APPENDIX B

DETAILED DOCUMENT REVIEW FINDINGS

Third-Party Verification Final Audit Report
First Audit

Noble Energy, Inc.
1625 Broadway, Suite 2200
Denver, CO 80202

November 5, 2018

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ALOYSIUS GUTTERSEN T4N-R64W-S34**

Consent Decree Tank System Number: **482**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
ALOYSIUS GUTTERSON T4N-R64W-S34 L01_FINAL PACKET	pdf	7/21/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
ALOYSIUS GUTTERSON T4N-R64W-S34 L01_SIGNED EVAL	pdf	7/17/2015	Engineering Evaluation
STEM Engineering Evaluation_Guttersen D03-27	xlsm	4/28/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_ALOYSIUS GUTTERSEN T4N-R64W-S34 L01	xlsm	7/28/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
ALOYSIUS GUTTERSON T4N-R64W-S34 L01_FINAL PACKET	pdf	7/21/2015	Work Request
ALOYSIUS GUTTERSON T4N-R64W-S34 L01 WORK REQUEST	pdf	5/11/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
ALOYSIUS GUTTERSON T4N-R64W-S34 L01_FIELD VER	pdf	7/15/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
ALOYSIUS GUTTERSON T4N-R64W-S34 L01 IR VERIFICATION	pdf	7/15/2015	IR Camera Verification Sheet
ALOYSIUS GUTTERSON T4N-R64W-S34 L01 _0068_NORMAL	mp4	7/15/2015	IR Camera Video
ALOYSIUS GUTTERSON T4N-R64W-S34 L01 _0069_DUMP	mp4	7/15/2015	IR Camera Video
ALOYSIUS GUTTERSON T4N-R64W-S34 L01 _0070_POST	mp4	7/15/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
ALOYSIUS GUTTERSON T4N-R64W-S34 L01_SIGNED EVAL	pdf	7/17/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ALOYSIUS GUTTERSEN T4N-R64W-S34**

Consent Decree Tank System Number: **482**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**4**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**2" & 1"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**			
Man. Capacity (MSCFD)	**109.272**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**13,224**	**13,226**	**0%**
Calculated Burner Capacity (scfh	**3,615**	**4,553**	
Headspace Surge Capacity (scfh)	**21,069**	**21,069**	
Total VCS Capacity (scfh)	**24,684**	**25,622**	
VCS Capacity minus PPIVF (scfh)	**11,460**	**12,396**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	4/20/2016 & 11/8/2016 & 3/31/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	4/21/2016 & 11/21/2016

SLR

LOD ID: **ALOYSIUS GUTTERSEN T4N-R64W-S34**

Consent Decree Tank System Number: **482**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor	**0.77**							
Valve Coefficent (gpm/psi) (	**21.25**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**2409**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**271.7**							
Working Flow (Mscfd)[h,i]	**23**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor								
Valve Coefficent (gpm/psi) (								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**23**	**0**

Flow Rate Summary	**Flow Rate (scfh)**	
	SLR	**Noble**
Oil Tank Flash Rate	**11,321**	**11,321**
Oil Tank Working Rate	**955**	**952**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**951**	**951**
Total	**13,226**	**13,224**

LOD ID: **ALOYSIUS GUTTERSEN T4N-R64W-S34**

Consent Decree Tank System Number: **482**

Audit Notes

No date is given on the work order, but the pdf was created on 5-11-2015

A hand written note to add a Comm 48" burner is listed on pg 2 ALOYSIUS GUTTERSON T4N-R64W-S34 L01_FINAL PACKET.pdf version of the Work Request. A Cimmaron 48HV burner is listed as controlling the tanks in ALOYSIUS GUTTERSON T4N-R64W-S34 L01_SIGNED EVAL.pdf. The use of a Cimmaron 48HV as the tank control is a conservative approach.

ALOYSIUS GUTTERSON T4N-R64W-S34 L01_FINAL PACKET.pdf , pages 3 & 6 on the Field Datasheet indicates a total of seven (7) oil tanks on site. ALOYSIUS GUTTERSON T4N-R64W-S34 L01_SIGNED EVAL.pdf and ALOYSIUS GUTTERSON T4N-R64W-S34 L01_FIELD VER.pdf indicate only four (4) oil tanks onsite. The IR evaluation videos focus on four (4) tanks, but an additional three (3) tanks can be seen behind those prominent in the video files. Possible co-located well site. Using only four (4) tanks is a conservative approach.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **AlOYSIUS T4N-R64W-S34 L02**

Consent Decree Tank System Number: **516**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
ALOYSIUS T4N-R64W-S34 L02_Final Packet	PDF	7/9/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
ALOYSIUS T4N-R64W-S34 L02_SIGNED EVAL	PDF	7/21/2015	Engineering Evaluation
STEM Engineering Evaluation_rev1 ALOYSIUS T4N-R64W-S34 L02	xslx	7/28/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
ALOYSIUS T4N-R64W-S34 L02_WORK REQUEST	PDF	5/18/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
ALOYSIUS T4N-R64W-S34 L02_WALKDOWN	PDF	6/29/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
ALOYSIUS T4N-R64W-S34 L02 IR VERIFICATION	PDF	7/2/2015	IR Camera Verification Sheet
ALOYSIUS T4N-R64W-S34 L02_0026_NORMAL	mp4	7/2/2015	IR Camera Video
ALOYSIUS T4N-R64W-S34 L02_0027_DUMP	mp4	7/2/2015	IR Camera Video
ALOYSIUS T4N-R64W-S34 L02_0028_POST	mp4	7/2/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
ALOYSIUS T4N-R64W-S34 L02_SIGNED EVAL	pdf	7/16/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **AlOYSIUS T4N-R64W-S34 L02**

Consent Decree Tank System Number: **516**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**2**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**4**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**60**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**			
Man. Capacity (MSCFD)	**140**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**3,682**	**3,683**	**0%**
Calculated Burner Capacity (scfh	**2,951**	**5,833**	
Headspace Surge Capacity (scfh)	**2,339**	**2,339**	
Total VCS Capacity (scfh)	**5,290**	**8,172**	
VCS Capacity minus PPIVF (scfh)	**1,608**	**4,490**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Doug Bopray /Tom Kussard
Audit Document Review Date:	4/7/2016 & 11/7/2016 & 3/31/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	4/12/2016 & 11/16/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **AlOYSIUS T4N-R64W-S34 L02**

Consent Decree Tank System Number: **516**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.61**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.72**							
Gas/Oil Ratio (scf/bbl)	**96.4**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor	**0.94**							
Valve Coefficent (gpm/psi) (	**5.72**							
Critical Pressure (psia)[b]	**530**							
Vapor Pressure (psia)[c]	**73**							
Critical pressure ratio (F_F) [d]	**0.86**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**727**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**70.1**							
Working Flow (Mscfd)[h,i]	**7**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor								
Valve Coefficent (gpm/psi) (								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**11**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**2,919**	**2,919**
Oil Tank Working Rate	**288**	**287**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**475**	**475**
Total	**3,683**	**3,681**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **AlOYSIUS T4N-R64W-S34 L02**

Consent Decree Tank System Number: **516**

Audit Notes

- Valve size (1") with a 1/2" trim was verified in document ALOYSIUS T4N-R64W-S34 L02_Final Packet.pfd

-Facility walkdown checklist did indicate whether all items on work request were completed. Completion of work critical to Audit was verified with Job Sheets and emails in Final Packet.

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original ALOYSIUS T4N-R64W-S34 - STEM Engineering Evaluation Check.xlsm and was changed to 12 oz/in^2 in the modified STEM Engineering Evaluation_rev1 ALOYSIUS T4N-R64W-S34 L02.xlsm file.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ARCHIBALD BREHON HEMPLEEDWARD RAWITCH SHABLE S20 T4N-R65W-S20 L01**

Consent Decree Tank System Number: **2108**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
ARCHIBALD BREHON HEMPLEEDWARD RAWITCH SHABLE S20 T4N-R65W-S20 L01_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
ARCHIBALD BREHON HEMPLEEDWARD RAWITCH SHABLE S20 T4N-R65W-S20 L01_SIGNED EVAL	pdf	8/10/2015	Engineering Evaluation
STEM Eng Eval_rev1 ARCHIBALD T4NR65WS20 L01	xlsm	9/22/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
ARCHIBALD BREHON HEMPLEEDWARD RAWITCH SHABLE S20 T4N-R65W-S20 L01 WORK REQUEST	pdf	6/18/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
ARCHIBALD BREHON HEMPLEEDWARD RAWITCH SHABLE S20 T4N-R65W-S20 L01 WALKDOWN	pdf	7/23/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
ARCHIBALD BREHON HEMPLEEDWARD RAWITCH SHABLE S20 T4N-R65W-S20 L01 IR VERIFICATION	pdf	7/22/2015	IR Camera Verification Sheet
ARCHIBALD BREHON HEMPLEEWARD RAWITCH SHABLE S20 T4N-R65W-S20 L01_0176_NORMAL	mp4	7/22/2015	IR Camera Video
ARCHIBALD BREHON HEMPLEEWARD RAWITCH SHABLE S20 T4N-R65W-S20 L01_0177_DUMP	mp4	7/22/2015	IR Camera Video
ARCHIBALD BREHON HEMPLEEWARD RAWITCH SHABLE S20 T4N-R65W-S20 L01_0178_POST	mp4	7/22/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
ARCHIBALD BREHON HEMPLEEDWARD RAWITCH SHABLE S20 T4N-R65W-S20 L01_SIGNED EVAL	pdf	8/10/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ARCHIBALD BREHON HEMPLEEDWARD RAWITCH SHABLE S20 T4N-R65W-S20 L01**

Consent Decree Tank System Number: **2108**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**			
Man. Capacity (MSCFD)	**140**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,746**	**4,747**	**0%**
Calculated Burner Capacity (scfh	**2,980**	**5,833**	
Headspace Surge Capacity (scfh)	**4,907**	**4,918**	
Total VCS Capacity (scfh)	**7,887**	**10,751**	
VCS Capacity minus PPIVF (scfh)	**3,141**	**6,004**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	3/10/2016 & 11/7/2016 & 3/31/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	3/11/2016 & 11/21/2016

LOD ID: **ARCHIBALD BREHON HEMPLEEDWARD RAWITCH SHABLE S20 T4N-R65W-S20 L01**

Consent Decree Tank System Number: **2108**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**17**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**3,720**	**3,720**
Oil Tank Working Rate	**314**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**713**	**713**
Total	**4,747**	**4,746**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ARCHIBALD BREHON HEMPLEEDWARD RAWITCH SHABLE S20 T4N-R65W-S20 L01**

Consent Decree Tank System Number: **2108**

Audit Notes

-Walkdown pdf does not confirm that all items on work request have been completed. Critical work request items were confirmed with Job Sheets and Emails in final packet

-Poor Quality scan of STEM Calculations page in Final Packet. Unsure if # Production Cycles Per Day is 6.5 or 65. SLR assumed 65.

"VOC Design Tank Pressure" was originally 10 oz/in^2 and the VOC line from the tanks to the knockout was 3" in the original ARCHIBALD BREHON - STEM Engineering Evaluation Check.xlsm. These were changed to 11 oz/in^2 and 4" in the modified STEM Eng Eval_rev1 ARCHIBALD BREHON HEMP T4NR65WS20 L01.xlsm file. SLR cannot confirm the line size between the tanks and knockout was changed to 4".

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ARISTOCRAT T3N-R65W-S11 L01**

Consent Decree Tank System Number: **373**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
ARISTOCRAT T3N-R65W-S11 L01_FINAL PACKET	pdf	5/6/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
ARISTOCRAT T3N-R65W-S11 LO1_SIGNED EVAL	pdf	6/29/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_rev1 ARISTOCRAT T3N-R65W-S11 L01	xlsm	9/23/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
ARISTOCRAT T3N-R65W-S11 L01 WORK REQUEST	pdf	5/19/2015	Work Request Form

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
ARISTOCRAT T3N-R65W-S11 L01 WALKDOWN	pdf	6/16/2015	Final Facility Walkdown Form

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
ARISTOCRAT T3N-R65W-S11 L01_0262_NORMAL	mp4	6/17/2015	IR Video of site during normal operation
ARISTOCRAT T3N-R65W-S11 L01_0263_DUMP	mp4	6/17/2015	IR Video of site during separator dump event
ARISTOCRAT T3N-R65W-S11 L01_0264_POST	mp4	6/17/2015	IR Video of site post dump event
ARISTOCRAT T3N-R65W-S11 L01 IR VERIFICATION	pdf	6/16/2015	IR Camera Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
ARISTOCRAT T3N-R65W-S11 LO1_SIGNED EVAL	pdf	6/29/2015	Signed Engineering Design Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ARISTOCRAT T3N-R65W-S11 L01**

Consent Decree Tank System Number: **373**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**7**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	
Water Tank Capacity (bbl):	
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**2" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**			
Man. Capacity (MSCFD)	**140**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**5,697**	**5,877**	**3%**
Calculated Burner Capacity (scfh	**2,871**	**5,833**	
Headspace Surge Capacity (scfh)	**10,022**	**10,533**	
Total VCS Capacity (scfh)	**12,893**	**16,366**	
VCS Capacity minus PPIVF (scfh)	**7,196**	**10,489**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Jaclyn Fitzgerald/Tom Kussard
Audit Document Review Date:	3/30/2016 & 11/8/2016 & 3/31/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	4/1/2016 & 11/21/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ARISTOCRAT T3N-R65W-S11 L01**

Consent Decree Tank System Number: **373**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**							
Valve Coefficent (gpm/psi) (C_v)	**7.20**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**827**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**93.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	
scfh vapor/tank[i]	**238**	
Mscfd	**40**	

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**3,885**	**3,720**
Oil Tank Working Rate	**328**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**1,664**	**1,664**
Total	**5,877**	**5,697**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ARISTOCRAT T3N-R65W-S11 L01**

Consent Decree Tank System Number: **373**

Audit Notes

-The IR Verification form is dated 6/16/2015 while the IR .mp4 video files are dated 6/17/2015

-Oil dump valve size on LP Surge (i.e. Heater Treater) was not confirmed in initial walkdown. SLR assumed the largest valve (2") with the confirmed trim size (1/2"). Noble utilized a 1" valve with 1/2" trim in it's final signed evaluation.

-Walkdown checklist did not indicate if all items on work request were completed. SLR confirmed completion of audit critical items on work request with Job Sheets and Emails in Final Packet.

-"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original Aristocrat T3N-R65W-S11 L01 STEM Engineering Evaluation Check.xlsm and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1 ARISTOCRAT T3N-R65W-S11 L01.xlsm file.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **AVA ST T4N-R64W-S36 L03**

Consent Decree Tank System Number: **970**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
AVA ST T4N-R64W-S36 L03 FINAL PACKET	pdf	5/19/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
AVA ST T4N-R64W-S36 L03_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation
STEM Engineering Evaluation_State Ava State	xlsm	4/29/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_AVA ST T4N-R64W S36 L03	xlsm	9/23/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
AVA ST T4N-R64W-S36 L03 WORK REQUEST	pdf	5/11/2015	Work Request
AVA ST T4N-R64W-S36 L03 FINAL PACKET	pdf	5/19/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
AVA ST T4N-R64W-S36 L03 FINAL WALKDOWN VERIFICATION FORM_2	pdf	6/8/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
AVA ST T4N-R64W-S36 L03 IR VERIFICATION	pdf	6/8/2015	IR Camera Verification Sheet
AVA ST T4N-R64W-S36 L03_0234_NORMAL	mp4	6/8/2015	IR Camera Video
AVA ST T4N-R64W-S36 L03_0235_DUMP	mp4	6/8/2015	IR Camera Video
AVA ST T4N-R64W-S36 L03_0236_POST	mp4	6/8/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
AVA ST T4N-R64W-S36 L03_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **AVA ST T4N-R64W-S36 L03**

Consent Decree Tank System Number: **970**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**2**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**TEC 4-CS (48" Tornado**	**Cimarron 48 HV**		
Man. Capacity (MSCFD)	**110.4**	**109.272**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**7,796**	**4,509**	**42%**
Calculated Burner Capacity (scfh	**6,956**	**9,153**	
Headspace Surge Capacity (scfh)	**4,713**	**4,713**	
Total VCS Capacity (scfh)	**11,669**	**13,866**	
VCS Capacity minus PPIVF (scfh)	**3,873**	**9,357**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	4/20/2016 & 11/8/2016 & 4/3/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	8/4/2016 & 11/21/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **AVA ST T4N-R64W-S36 L03**

Consent Decree Tank System Number: **970**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor	**0.94**							
Valve Coefficent (gpm/psi) (	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor								
Valve Coefficent (gpm/psi) (								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**11**	**0**

Flow Rate Summary	**Flow Rate (scfh)**	
	SLR	**Noble**
Oil Tank Flash Rate	**3,720**	**6,753**
Oil Tank Working Rate	**314**	**568**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**475**	**475**
Total	**4,509**	**7,796**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **AVA ST T4N-R64W-S36 L03**

Consent Decree Tank System Number: **970**

Audit Notes

Noble used a 2" dump valve with 3/4" trim in their "STEM Engineering Evaluation_rev1_AVA ST T4N-R64W-S36 L03.xlsm" calcbook. SLR was able to confirm a 1" dump valve with 1/2" trim based on the "AVA ST T4N-R64W-S36 L03 WORK REQUEST.pdf" and confirmation via the walkdown on pg 3 of the "AVA ST T4N-R64W-S36 L03 FINAL PACKET.pdf". Therefore SLR used a 1" valve with 1/2" trim in the calcs.

A 7/13/2016 letter from Bill Obermann, Noble, to Kenny Malmquist, SLR International, verified the completion of the LP separator 70 psi shut-in automation.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original AVA ST T4N-R64W-S36 - STEM Engineering Evaluation Check.xlsm. These were changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1_AVA ST T4N-R64W-S36 L03.xlsm file.

UPDATE: Noble confirmed accuracy of existing Engineering Evaluation. Evaluation specifies a maximum allowable oil dump trim of ¾". Field QAQC documents current oil dump trim of ½", which is less than ¾". Field QAQC markup (Attachment R) confirms the existing oil dump trim.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BECCA GUTTERSEN T3N-R64W-S3 L01**

Consent Decree Tank System Number: **485**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
BECCA GUTTERSEN T3N-R64W-S3 L01_FINAL PACKET	pdf	6/30/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
BECCA GUTTERSEN T3N-R64W-S3 L01 WORK REQUEST	pdf	5/28/2015	Work Request
BECCA GUTTERSEN T3N-R64W-S3 L01_SIGNED EVAL	pdf	6/30/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_rev1_BECCA GUTTERSEN T3N-R64W-S3 L01	xlsm	7/28/2016	Revised Engineering Design Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
BECCA GUTTERSEN T3N-R64W-S3 L01 WALKDOWN	pdf	6/10/2015	Facility Walkdown
BECCA GUTTERSEN T3N-R64W-S3 L01_FINAL PACKET	pdf	6/30/2015	Final Facility Packet

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
BECCA GUTTERSEN T3N-R64W-S3 L01 WALKDOWN	pdf	6/10/2015	Tank System Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
BECCA GUTTERSEN T3N-R64W-S3 L01_0249_NORMAL	mp4	6/10/2015	IR Inspection Video during normal operations
BECCA GUTTERSEN T3N-R64W-S3 L01_0250_DUMP	mp4	6/10/2015	IR Inspection Video during dump event
BECCA GUTTERSEN T3N-R64W-S3 L01_0251_POST	mp4	6/10/2015	IR Inspection Video after dump event
BECCA GUTTERSEN T3N-R64W-S3 L01 IR VERIFICATION	pdf	6/10/2015	IR Inspection Form

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
BECCA GUTTERSEN T3N-R64W-S3 L01_SIGNED EVAL	pdf	6/30/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BECCA GUTTERSEN T3N-R64W-S3 L01**

Consent Decree Tank System Number: **485**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**TEC 4-CS (48" Tornado)**			
Man. Capacity (MSCFD)	**110.4**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,746**	**4,747**	**0%**
Calculated Burner Capacity (scfh	**4,055**	**4,600**	
Headspace Surge Capacity (scfh)	**3,616**	**3,616**	
Total VCS Capacity (scfh)	**7,671**	**8,216**	
VCS Capacity minus PPIVF (scfh)	**2,925**	**3,469**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	3/16/2015 & 12/2/2016 & 3/31/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	3/18/2016 & 12/15/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BECCA GUTTERSEN T3N-R64W-S3 L01**

Consent Decree Tank System Number: **485**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**17**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**3,720**	**3,720**
Oil Tank Working Rate	**314**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**713**	**713**
Total	**4,747**	**4,746**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BECCA GUTTERSEN T3N-R64W-S3 L01**

Consent Decree Tank System Number: **485**

Audit Notes

-Field notes job sheet indicate a 1" valve with 1" trim and 1/4" orfice (FINAL PACKET p. 22) on the LP separator, Noble's use of 1/2" trim in their engineering evalation is conservative. SLR used a 1/2" trim for the audit calculations.

-The Noble calculated burner capacity is greater than the publicly available manufacturers' specifications. (SIGNED EVAL p.3)

-"VOC Design Tank Pressure" was 10 oz/in^2 in the original BECCA GUTTERSEN T3N-R64W-S3 L01_SIGNED EVAL.pdf and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1_BECCA GUTTERSEN T3N-R64W-S3 L01.xlsm file.

Nobles original BECCA GUTTERSEN - STEM Engineering Evaluation Check.xlsm work book shows a design pressure of 250 psi while Nobles updated STEM Engineering Evaluation_rev1_BECCA GUTTERSEN T3N-R64W-S3 L01.xlsm workbook shows a design pressure of 300 psi.

UPDATE: After reviewing SLR's Draft Report, Noble contacted Tornado to confirm that its burners can handle capacities beyond the published specification or 10 oz/in2. Tornado confirmed that the published burner curve can be hydraulically extrapolated beyond 10 oz/in2. Moreover, Tornado noted the stated capacity is based on heat release (86.4 MSCFD at 2,300 BTU/scf). Noble's typical flash gas is lighter in composition (1,800 BTU/scf) such that the Tornado burner would be capable of handling up to 110.4 MSCFD at the published heat release limit. The Tornado specification sheet notes the maximum flow is dependent on heating value of the gas, consistent with Noble's conversation.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BERNHARDT HULL T4N-R67W-S1 L01**

Consent Decree Tank System Number: **47**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
BERNHARDT HULL T4N-R67W-S1 L01_FINAL PACKET	pdf	various	Facility Final Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
BERNHARDT HULL T4N-R67W-S1 L01_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_rev1_BERNHARDT HULL T4N-R67W-S1 L01	xlsm	9/23/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
BERNHARDT HULL T4N-R67W-S1 L01 WORK ORDER	pdf	NOT DATED	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
BERNHARDT HULL T4N-R67W-S1 L01 WALDOWN	pdf	4/30/2015	Tank System Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
BERNHARDT HULL T4N-R67W-S1 L01_2239_normal	mp4	5/11/2015	IR Inspection Video
BERNHARDT HULL T4N-R67W-S1 L01_2240_dump	mp4	5/11/2015	IR Inspection Video
BERNHARDT HULL T4N-R67W-S1 L01_2241_post	mp4	5/11/2015	IR Inspection Video
BERNHARDT HULL T4N-R67W-S1 L01_SIGNEDVERIFICATION	pdf	5/11/2015	IR Camera Inspection Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
BERNHARDT HULL T4N-R67W-S1 L01_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BERNHARDT HULL T4N-R67W-S1 L01**

Consent Decree Tank System Number: **47**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity (bbl):	**315**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**80**	**80**	**80**					
Dump Valve Size & Trim Size (in)	**2" & 1/4"**	**2" & 1/4"**	**2" & 1/4"**					

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**COMM 200 48"**	**Cimarron 48**		
Man. Capacity (MSCFD)	**157**	**30**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,522**	**5,259**	**16%**
Calculated Burner Capacity (scfh)	**5,573**	**7,792**	
Headspace Surge Capacity (scfh)	**0**	**0**	
Total VCS Capacity (scfh)	**5,573**	**7,792**	
VCS Capacity minus PPIVF (scfh)	**1,051**	**2,532**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	3/31/2016 & 11/8/2016 & 3/31/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	4/3/2016 & 11/21/2016

LOD ID: **BERNHARDT HULL T4N-R67W-S1 L01**

Consent Decree Tank System Number: **47**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.92**	**0.92**	**0.92**					
Z2	**-0.86**	**-0.86**	**-0.86**					
Z3	**0.98**	**0.98**	**0.98**					
Z	**1.03**	**1.03**	**1.03**					
Gas/Oil Ratio (scf/bbl)	**130.1**	**130.1**	**130.1**					

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.55**	**0.55**	**0.55**					
Valve Coefficent (gpm/psi) (C_v)	**2.96**	**2.96**	**2.96**					
Critical Pressure (psia)[b]	**548**	**548**	**548**					
Vapor Pressure (psia)[c]	**93**	**93**	**93**					
Critical pressure ratio (F_F) [d]	**0.84**	**0.84**	**0.84**					
Choked Flow?[e]	**Yes**	**Yes**	**Yes**					
Peak Flow (bopd)[f,g]	**258**	**258**	**258**					

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**33.6**	**33.6**	**33.6**					
Working Flow (Mscfd)[h,i]	**2**	**2**	**2**					

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**315**	**0**
scfh vapor/tank[i]	**250**	**0**
Mscfd	**18**	**0**

Flow Rate Summary	**Flow Rate (scfh)**	
	SLR	**Noble**
Oil Tank Flash Rate	**4,203**	**3,513**
Oil Tank Working Rate	**307**	**295**
Water Tank Flash Rate	**0**	
Water Tank Working Rate	**0**	
Tank Breathing Rate	**749**	**713**
Total	**5,259**	**4,521**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BERNHARDT HULL T4N-R67W-S1 L01**

Consent Decree Tank System Number: **47**

Audit Notes

- Signed eval shows an LP operating pressure at 70 psig (FINAL PACKET p. 19). Work request (FINAL PACKET p. 5) and provided field documentation report pressure set at 80 psig (FINAL PACKET p. 23). Assumed 80 psig for these calculations.

- Noble used 300 bbl in the BERNHARDT HULL T4N-R67W-S1 L01_SIGNED EVAL.pdf. The confirmed capacity of the tanks is 315 bbl (FINAL PACKET p. 10). Noble did not claim any headspace surge capacity in their analysis. The discrepancy in tank size does not affect VCS capacity and only affects breathing losses included in PPIVFR.

-This facility has uncontrolled actual VOC emissions greater than 50 tpy. Therefore an IR inspections is required.

UPDATE: Noble confirmed accuracy of existing Engineering Evaluation. Automation standard practice sets shut-in pressure no higher than 70 psig.

UPDATE: Noble agrees that Engineering Evaluation was incorrect due to data entry error (315 bbl tanks misrepresented as 300 bbl in evaluation). An updated Engineering Evaluation was generated and a revised COCR submitted with Noble's Semi-Annual Report (6th) (January 29, 2018).

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **Bernhardt Schneider ST T5N-R67W-S36 L01**

Consent Decree Tank System Number: **46**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
Bernhardt Schneiders ST T5N-R67W-S36 L01_FINAL PACKET	pdf	7/6/2015	Final Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
Bernhardt Schneiders ST T5N-R67W-S36 L01_SIGNED EVAL	pdf	6/29/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_rev1 BERNHARDT SCHNEIDER ST T5N-R67W-S36 L01	xlsm	7/28/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
Bernhardt Schneiders ST T5N-R67W-S36 L01_FINAL PACKET	pdf	7/6/2015	Final Packet with initial work request
Bernhardt Schneiders ST T5N-R67W-S36 L01_WORK REQUEST	pdf	9/28/2015	work request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
Bernhardt Schneiders ST T5N-R67W-S36 L01 WALKDOWN	pdf	7/6/2015	facility walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
Bernhardt Schneiders ST T5N-R67W-S36 L01_0175_NORMAL	mp4		IR Video of site during normal operation
Bernhardt Schneiders ST T5N-R67W-S36 L01_0176_DUMP	mp4		IR Video of site during separator dump event
Bernhardt Schneiders ST T5N-R67W-S36 L01_0177_POST	mp4		IR Video of site post dump event
Bernhardt Schneiders ST T5N-R67W-S36 L01 IR VERIFICATION	pdf	5/27/2015	IR Camera Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
Bernhardt Schneiders ST T5N-R67W-S36 L01_SIGNED EVAL	pdf	6/29/2015	Signed Engineering Design Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **Bernhardt Schneider ST T5N-R67W-S36 L01**

Consent Decree Tank System Number: **46**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**2**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**80**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**COMM 200 48"**			
Man. Capacity (MSCFD)	**157**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,688**	**5,441**	**16%**
Calculated Burner Capacity (scfh)	**5,082**	**6,542**	
Headspace Surge Capacity (scfh)	**2,297**	**2,052**	
Total VCS Capacity (scfh)	**7,379**	**8,594**	
VCS Capacity minus PPIVF (scfh)	**2,691**	**3,152**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	3/9/2016 & 11/8/2016 & 3/31/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	3/17/2016 & 11/21/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **Bernhardt Schneider ST T5N-R67W-S36 L01**

Consent Decree Tank System Number: **46**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.92**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**1.03**							
Gas/Oil Ratio (scf/bbl)	**130.1**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**548**							
Vapor Pressure (psia)[c]	**93**							
Critical pressure ratio (F_F) [d]	**0.84**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**854**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**111.1**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**11**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**4,628**	**3,885**
Oil Tank Working Rate	**338**	**327**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**475**	**475**
Total	**5,441**	**4,687**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **Bernhardt Schneider ST T5N-R67W-S36 L01**

Consent Decree Tank System Number: **46**

Audit Notes

-Two separate work orders were created. One was dated 5/4/2015 and one dated 9/28/2015.

-There was a signed walkdown completed on 5/27/2015 to confirm the work from the 5/4/2015 workorder was completed. No walkdown form was found confirming the work from the 9/28/2015 work request was completed.

-There is no walkdown form confirming the oil dump valve shut in pressure on the LP separator was set to 70 psig (request made in the 9/28/2015 workorder). Therefore a maximum operating pressure for the LP separator of 80 psig (requested in the 5/4/2015 workorder and confirmed in the 5/27/2015 walkdown) was used in the calculations in this sheet.

UPDATE: Noble confirmed accuracy of existing Engineering Evaluation. Automation standard practice sets shut-in pressure no higher than 70 psig.

UPDATE: Noble agrees that Engineering Evaluation was incorrect due to data entry error (315 bbl tanks misrepresented as 300 bbl in evaluation). An updated Engineering Evaluation was generated and a revised COCR submitted with Noble's Semi-Annual Report (6th) (January 29, 2018).

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BERNHARDT VETTER T4N-R67W-S1 L01**

Consent Decree Tank System Number: **2331**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
BERNHARDT VETTER T4N-R67W-S1 L01_SIGNED EVAL	pdf	5/27/2015	Engineering Evaluation

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
BERNHARDT VETTER T4N-R67W-S1 L01 DESIGN PACKET	pdf	9/17/2015	Design Packet
BERNHARDT VETTER T4N-R67W-S1 L01_SIGNED EVAL	pdf	5/27/2015	Engineering Evaluation
STEM Engineering Evaluation_rev1 BERNHARDT VETTER T4N-R67W-S1 L01	xlsm	9/26/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
BERNHARDT VETTER T4N-R67W-S1 L01 WALKDOWN	pdf	4/30/2015	Walkdown Checklist
0181 - Bernhardt_Vetter STEM Work Request	pdf	12/30/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
BERNHARDT VETTER T4N-R67W-S1 L01 WALKDOWN	pdf	4/30/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
BERNHARDT VETTER T4N-R67W-S1 L01_SIGNEDVERIFICATION	pdf	5/11/2015	IR Camera Verification Sheet
BERNHARDT VETTER T4N-R67W-S1 L01_2236_normal	mp4	5/11/2015	IR Camera Video
BERNHARDT VETTER T4N-R67W-S1 L01_2237_dump	mp4	5/11/2015	IR Camera Video
BERNHARDT VETTER T4N-R67W-S1 L01_2238_post	mp4	5/11/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
BERNHARDT VETTER T4N-R67W-S1 L01_SIGNED EVAL	pdf	5/27/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BERNHARDT VETTER T4N-R67W-S1 L01**

Consent Decree Tank System Number: **2331**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**6**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**3**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**65**	**65**						
Dump Valve Size & Trim Size (in)	**2" & 1/2"**	**2" & 1/2"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**COMM 200 48"**	**COMM 200 48"**		
Man. Capacity (MSCFD)	**157**	**157**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**8,961**	**8,963**	**0%**
Calculated Burner Capacity (scfh)	**8,157**	**13,083**	
Headspace Surge Capacity (scfh)	**4,675**	**2,766**	
Total VCS Capacity (scfh)	**12,832**	**15,849**	
VCS Capacity minus PPIVF (scfh)	**3,871**	**6,887**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	5/8/2016 & 11/8/2016 & 3/31/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	5/16/2016 & 11/21/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BERNHARDT VETTER T4N-R67W-S1 L01**

Consent Decree Tank System Number: **2331**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.69**	**0.69**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**0.81**	**0.81**						
Gas/Oil Ratio (scf/bbl)	**104.5**	**104.5**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**	**0.78**						
Valve Coefficent (gpm/psi) (C_v)	**7.20**	**7.20**						
Critical Pressure (psia)[b]	**535**	**535**						
Vapor Pressure (psia)[c]	**78**	**78**						
Critical pressure ratio (F_F) [d]	**0.85**	**0.85**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**794**	**794**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**82.9**	**82.9**						
Working Flow (Mscfd)[h,i]	**8**	**8**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**34**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**6,907**	**6,907**
Oil Tank Working Rate	**629**	**627**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**1,426**	**1,426**
Total	**8,963**	**8,960**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BERNHARDT VETTER T4N-R67W-S1 L01**

Consent Decree Tank System Number: **2331**

Audit Notes

- Field datasheets (FINAL PACKET p. 12) do not list combustor details beyond a drawing that indicates there were two combustors connected to the tank VOC line at that time. A job sheet (FINAL PACKET p. 25) indicates two COMM burners were added to the tank VOC line. The engineering evaluation indicates there are three burners connected to the tank VOC line. Review of the IR camera video would indicate there are only two burners on the tank VOC line and one on the HLP separators.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

UPDATE: Noble confirmed accuracy of existing Engineering Evaluation. Per Appendix B of Draft Report, Noble considers a burner capacity of 8,209 scfh, whereas SLR considered a burner capacity of 13,083 scfh.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **Booth T5N-R67W-S25 L03**

Consent Decree Tank System Number: **45**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
BOOTH T5N-R67w-s25 L03_FINAL PACKET	pdf	7/9/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
BOOTH T5N-R67w-s25 l03_SIGNED EVAL	pdf	7/16/2015	
STEM Engineering Evaluation_rev1_BOOTH T5N-R67W-S25 L03	xlsm	7/28/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
BOOTH T5N-R67w-s25 L03_FINAL PACKET	pdf	7/9/2015	

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
BOOTH T5N-R67w-s25 L03 WALKDOWN	pdf	7/7/2015	

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
BOOTH T5N-R67w-s25 L03_0045_NORMAL	mp4	7/7/2015	
BOOTH T5N-R67w-s25 L03_0046_DUMP	mp4	7/7/2015	
BOOTH T5N-R67w-s25 L03_0047_POST	mp4	7/7/2015	
BOOTH T5N-R67w-s25 L03 IR VERIFICATION	pdf	7/7/2015	

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
BOOTH T5N-R67w-s25 L03_FINAL PACKET	pdf	7/9/2015	

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **Booth T5N-R67W-S25 L03**

Consent Decree Tank System Number: **45**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**4**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**			
Man. Capacity (MSCFD)	**109.272**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,984**	**4,985**	**0%**
Calculated Burner Capacity (scfh)	**3,740**	**4,553**	
Headspace Surge Capacity (scfh)	**5,513**	**5,513**	
Total VCS Capacity (scfh)	**9,253**	**10,066**	
VCS Capacity minus PPIVF (scfh)	**4,269**	**5,081**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	3/11/2016 & 11/8/2016 & 4/3/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	3/17/2016 & 11/21/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **Booth T5N-R67W-S25 L03**

Consent Decree Tank System Number: **45**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**23**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**3,720**	**3,720**
Oil Tank Working Rate	**314**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**951**	**951**
Total	**4,985**	**4,984**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **Booth T5N-R67W-S25 L03**

Consent Decree Tank System Number: **45**

Audit Notes

-Final Walkdown did not indicate if all items on the work request were completed. Completion of critical items related to this audit were confirmed using Job Sheets and Emails in the FINAL PACKET.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **Booth USX T7N R65W S35 L01**

Consent Decree Tank System Number: **1936**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
BOOTH USX T7N-R65W-S35 L01_FINAL PACKET	pdf	7/6/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
BOOTH USX T7N-R65W-S35 L01_SIGNED EVAL	pdf	6/26/2015	
STEM Engineering Evaluation_rev1_BOOTH USX T7N-R65W-S35 L01.xlsm	xlsm	9/23/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
BOOTH USX T7N-R65W-S35 L01_FINAL PACKET	pdf	7/6/2015	
BOOTH USX T7N-R65W-S35 L01 WORK REQUEST	pdf	5/14/2015	

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
BOOTH USX T7N-R65W-S35 L01_WALKDOWN	pdf	6/3/2015	

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
BOOTH USX T7N-R65W-S35-L01_0213_NORMAL	mp4	6/3/2015	
BOOTH USX T7N-R65W-S35-L01_0216_DUMP	mp4	6/3/2015	
BOOTH USX T7N-R65W-S35-L01_0217_POST	mp4	6/3/2015	
BOOTH USX T7N-R65W-S35 L01_IR VERIFICATION	pdf	6/3/2015	

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
BOOTH USX T7N-R65W-S35 L01_SIGNED EVAL	pdf	6/26/2015	

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **Booth USX T7N R65W S35 L01**

Consent Decree Tank System Number: **1936**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**5**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**80**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**TEC 4-CS (48" Tornado**	**TEC 4-CS (48" Tornado**		
Man. Capacity (MSCFD)	**110.4**	**110.4**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**13,461**	**6,154**	**54%**
Calculated Burner Capacity (scfh	**6,639**	**9,200**	
Headspace Surge Capacity (scfh)	**24,992**	**24,992**	
Total VCS Capacity (scfh)	**31,631**	**34,192**	
VCS Capacity minus PPIVF (scfh)	**18,170**	**28,038**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	4/20/2016 & 11/8/2016 & 1/30/2017 & 4/3/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	4/22/2016 & 11/21/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **Booth USX T7N R65W S35 L01**

Consent Decree Tank System Number: **1936**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.92**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**1.03**							
Gas/Oil Ratio (scf/bbl)	**130.1**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**548**							
Vapor Pressure (psia)[c]	**93**							
Critical pressure ratio (F_F) [d]	**0.84**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**854**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**111.1**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**29**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**4,628**	**11,321**
Oil Tank Working Rate	**338**	**952**
Water Tank Flash Rate	**0**	
Water Tank Working Rate	**0**	
Tank Breathing Rate	**1,189**	**1,189**
Total	**6,154**	**13,462**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **Booth USX T7N R65W S35 L01**

Consent Decree Tank System Number: **1936**

Audit Notes

-Avg. Time per cycle given in the final packet PDF is difficult to discern. Assumed it was 31 minutes.

-Trim on dump valve in SIGNED EVAL is 1", but a 1/2" trim is specified on the work order. The confirmed valve size on the LP separator is 1" with a 1/2" trim based on the FINAL PACKET and, WORK REQUEST and WALKDOWN and was used in this evaluation. Noble's use of a larger valve trim results in a higher PPIVFR.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BORESEN DETIENNE T5N-R67W-S12 L01**

Consent Decree Tank System Number: **2264**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
BORESEN DETIENNE T5N-R67W-S12 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation
BORESEN DETIENNE T5N-R67W-S12 L01_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
BORESEN DETIENNE T5N-R67W-S12 L01 WORK REQUEST	pdf	5/11/2015	Work Request
STEM Engineering Evaluation_Borsene Detienne	xlsm	5/21/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_BORESEN DETIENNE T5N-R67W-S12 L01	xlsm	7/28/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
BORESEN DETIENNE T5N-R67W-S12 L01 WORK REQUEST	pdf	5/11/2015	Work Request
Noble 3rd Party Audi Wave 12 Update Info Request_20170117	pdf	1/17/2017	Information Request Response

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
BORESEN DETIENNE T5N-R67W-S12 L01 WALKDOWN	pdf	4/24/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
BORESEN DETIENNE T5N-R67W-S12 L01_signedverification	pdf	5/11/2015	IR Camera Verification Sheet
BORESEN DETIENNE T5N-R67W-S12 L01_2222_normal	mp4	5/11/2015	IR Camera Video
BORESEN DETIENNE T5N-R67W-S12 L01_2223_dump	mp4	5/11/2015	IR Camera Video
BORESEN DETIENNE T5N-R67W-S12 L01_2224_post	mp4	5/11/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
BORESEN DETIENNE T5N-R67W-S12 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BORESEN DETIENNE T5N-R67W-S12 L01**

Consent Decree Tank System Number: **2264**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**2**
Oil Tank Capacity (bbl):	**315**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**2" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**TEC 4-CS (48" Tornado**	**Cimarron 48 HV**		
Man. Capacity (MSCFD)	**110.4**	**109.272**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,688**	**4,712**	**1%**
Calculated Burner Capacity (scfh	**6,956**	**9,153**	
Headspace Surge Capacity (scfh)	**1,186**	**1,381**	
Total VCS Capacity (scfh)	**8,142**	**10,534**	
VCS Capacity minus PPIVF (scfh)	**3,454**	**5,822**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	4/11/2015 & 11/8/2016 & 4/3/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	4/12/2016 & 11/21/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BORESEN DETIENNE T5N-R67W-S12 L01**

Consent Decree Tank System Number: **2264**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**							
Valve Coefficent (gpm/psi) (C_v)	**7.20**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**827**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**93.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**315**	**0**
scfh vapor/tank[i]	**250**	**0**
Mscfd	**12**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**3,885**	**3,885**
Oil Tank Working Rate	**328**	**327**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**499**	**475**
Total	**4,712**	**4,688**

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BORESEN DETIENNE T5N-R67W-S12 L01**

Consent Decree Tank System Number: **2264**

Audit Notes

- BORESEN DETIENNE T5N-R67W-S12 L01_SIGNED EVAL.pdf indicates oil tank sizes are 300 bbl. BORESEN DETIENNE T5N-R67W-S12 L01_FINAL PACKET.pdf field observation notes indicate oil tank sizes are 315 bbl. The headspace surge capacity did not change as a result of the difference in tank size.

- BORESEN DETIENNE T5N-R67W-S12 L01_SIGNED EVAL.pdf indicates uses a Leed 48" Gen 1 # 7 and Cimarron 48HV tank burners. BORESEN DETIENNE T5N-R67W-S12 L01_FINAL PACKET.pdf job sheet indicate a Cimarron 48HV and 48" Tornado unit are installed. A 48" Tornado was used in the audit evaluation. A 48" Tornado has a smaller capacity than a Leed 48" Gen 1 # 7 tank burner.

- BORESEN DETIENNE T5N-R67W-S12 L01_2223_dump.mp4 may possibly have emissions from the tank stand pipe. Footage 0:00:15 to 0:00:22 and 0:01:02 to end of video.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

- Revised evaluation uses a maximum LP separator opreating pressure of 70 psig compared to the original evaluation that used 80 psig. 80 psig was confirmed as the operating pressure via the work request and walkdown. Noble provided confirmation that the operating pressure was actually 70 psig in a response to an infomation request on 1/17/2017.

UPDATE: Noble agrees that Engineering Evaluation was incorrect due to data entry error (315 bbl tanks misrepresented as 300 bbl in evaluation). An updated Engineering Evaluation was generated and a revised COCR submitted with Noble's Semi-Annual Report (6th) (January 29, 2018).

UPDATE: After reviewing SLR's Draft Report, Noble contacted Tornado to confirm that its burners can handle capacities beyond the published specification or 10 oz/in2. Tornado confirmed that the published burner curve can be hydraulically extrapolated beyond 10 oz/in2. Moreover, Tornado noted the stated capacity is based on heat release (86.4 MSCFD at 2,300 BTU/scf). Noble's typical flash gas is lighter in composition (1,800 BTU/scf) such that the Tornado burner would be capable of handling up to 110.4 MSCFD at the published heat release limit. The Tornado specification sheet notes the maximum flow is dependent on heating value of the gas, consistent with Noble's conversation.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BOULTER JOHNSON ERICKSON HBR T4N-R64W-S10 L01**

Consent Decree Tank System Number: **249**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
BOULTER JOHNSON ERICKSON HBR T4N-R64W-S10 L01_FINAL PACKET	pdf	7/6/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
BOULTER JOHNSON ERICKSON HBR T4N-R64W-S10 L01_SIGNED EVAL	pdf	6/29/2015	Engineering Evaluation
STEM Engineering Eval_rev1_BOULTER JOHNSON ERICKSON HBR T4N-R64W-S10 L01	xlsm	7/28/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
BOULTER JOHNSON ERICKSON HBR T4N-R64W-S10 L01 WORK REQUEST	pdf	5/20/2015	Work Request
BOULTER JOHNSON ERICKSON HBR T4N-R64W-S10 L01_FINAL PACKET	pdf	7/6/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
BOULTER JOHNSON ERICKSON HBR T4N-R64W-S10 L01 WALKDOWN	pdf	6/18/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
BOULTER JOHNSON ERICKSON HBR T4N-R64W-S10 L01_0274_NORMAL	.mp4	6/18/2015	IR Camera Video
BOULTER JOHNSON ERICKSON HBR T4N-R64W-S10 L01_0274_NORMAL	.mp4	6/18/2015	IR Camera Video
BOULTER JOHNSON ERICKSON HBR T4N-R64W-S10 L01_0275_POST	.mp4	6/18/2015	IR Camera Video
BOULTER JOHNSON ERICKSON HBR T4N-R64W-S10 L01_IR VERIFICATION	pdf	6/18/2015	IR Camera Verification Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
BOULTER JOHNSON ERICKSON HBR T4N-R64W-S10 L01_SIGNED EVAL	pdf	6/29/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BOULTER JOHNSON ERICKSON HBR T4N-R64W-S10 L01**

Consent Decree Tank System Number: **249**

☑ Yes ☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes ☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**4**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**4"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**			
Man. Capacity (MSCFD)	**140**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,984**	**4,985**	**0%**
Calculated Burner Capacity (scfh)	**2,946**	**5,833**	
Headspace Surge Capacity (scfh)	**6,799**	**6,847**	
Total VCS Capacity (scfh)	**9,745**	**12,680**	
VCS Capacity minus PPIVF (scfh)	**4,761**	**7,696**	

☑ Yes ☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes ☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes ☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes ☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	3/14/2016 & 11/8/2016 & 4/3/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	3/18/2016 & 11/21/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BOULTER JOHNSON ERICKSON HBR T4N-R64W-S10 L01**

Consent Decree Tank System Number: **249**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**23**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**3,720**	**3,720**
Oil Tank Working Rate	**314**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**951**	**951**
Total	**4,985**	**4,984**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BOULTER JOHNSON ERICKSON HBR T4N-R64W-S10 L01**

Consent Decree Tank System Number: **249**

Audit Notes

-Average daily production is on pg 17 of the final packet was difficult to discern. Assumed to be 13 bopd.
-Average time per cycle is on pg 17 of the final packet was difficult to discern. Assumed to be 8.1 mins

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BROWN BICKLNG T6N-R65W-S3 L01**

Consent Decree Tank System Number: **74**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
BROWN BICKLING T6S-R65W-S3 L01_FINAL PACKET	pdf	4/28/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
BROWN BICKLING T6S-R65W-S3 L01_SIGNED EVAL	pdf	5/21/2015	Engineering Evaluation
STEM Engineering Evaluation_Bickling Brown	xlsm	4/28/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_BROWN BICKLING T6N-R65W-S3 L01	xlsm	7/28/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
BROWN BICKLING T6S-R65W-S3 L01 WORK REQUEST	pdf	5/11/2015	Work Request
BROWN BICKLING T6S-R65W-S3 L01_FINAL PACKET	pdf	4/28/2015	Work Request
Noble 3rd Party Audi Wave 12 Update Info Request_20170117	pdf	1/17/2017	Information Request Response

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
BROWN BICKLING T6S-R65W-S3 L01 WALKDOWN	pdf	4/28/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
BROWN BICKLING T6S-R65W-S3 L01_SIGNEDVERFICATION	pdf	5/5/2015	IR Camera Verification Sheet
BROWN BICKLING T6S-R65W-S3 L01_2248_NORMAL	mp4	5/5/2015	IR Camera Video
BROWN BICKLING T6S-R65W-S3 L01_2249_DUMP	mp4	5/5/2015	IR Camera Video
BROWN BICKLING T6S-R65W-S3 L01_2251_POST	mp4	5/5/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
BROWN BICKLING T6S-R65W-S3 L01_SIGNED EVAL	pdf	5/21/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BROWN BICKLNG T6N-R65W-S3 L01**

Consent Decree Tank System Number: **74**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**5**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**2**
# VOC Lines to Burner:	**2**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**2" & 1"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**		
Man. Capacity (MSCFD)	**140**	**140**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**13,461**	**13,464**	**0%**
Calculated Burner Capacity (scfh)	**5,834**	**11,667**	
Headspace Surge Capacity (scfh)	**26,801**	**26,801**	
Total VCS Capacity (scfh)	**32,635**	**38,468**	
VCS Capacity minus PPIVF (scfh)	**19,174**	**25,004**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	4/20/2016 & 11/8/2016 & 4/3/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	4/21/2016 & 11/21/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BROWN BICKLNG T6N-R65W-S3 L01**

Consent Decree Tank System Number: **74**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**							
Valve Coefficent (gpm/psi) (C_v)	**21.25**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**2409**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**271.7**							
Working Flow (Mscfd)[h,i]	**23**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**29**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**11,321**	**11,321**
Oil Tank Working Rate	**955**	**952**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**1,189**	**1,189**
Total	**13,464**	**13,462**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BROWN BICKLNG T6N-R65W-S3 L01**

Consent Decree Tank System Number: **74**

Audit Notes

Per BROWN BICKLING T6S-R65W-S3 L01_FINAL PACKET.pdf, VRT is installed onsite but is not operational.

The IR Camera videos pan through all five (5) tanks in an average of 20 seconds. Videos do not contain significant amounts of recordings to evaluate whether there are potential leaks from the tank thief hatches, valves, etc.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

"Max Operating Pressure" was originally 85psi in the original STEM Engineering Evaluation_Bickling Brown.xlsm and was changed to 70 psi in the modified STEM Engineering Evaluation_rev1_BROWN BICKLING T6N-R65W-S3 L01.xlsm file. Noble provided documentation that the pressure in the field was initially set at at a maximum 70 psi. Therefore SLR used 70 psi in their calculations.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BUTTERBALL DECHANT TURK BLUE T3N-R64W-S19 L01**

Consent Decree Tank System Number: **402**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
BUTTERBALL DECHANT TURK BLUE T3N-R64W-S19 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation
BUTTERBALL DECHANT TURK BLUE T3N-R64W-S19 L01_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
BUTTERBALL DECHANT TURK BLUE T3N-R64W-S19 L01_FINAL PACKET	pdf	No Date	Work Request
BUTTERBALL DECHANT TURK BLUE T3N-R64W-S19 L01 REWORK PACKET	pdf	6/23/2015	Rework Request
STEM Engineering Evaluation_Butterball Dechant Turk Blue	xlsm	4/28/2015	Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
BUTTERBALL DECHANT TURK BLUE T3N-R64W-S19 L01 WALKDOWN	pdf	4/30/2015	Walkdown Checklist
BUTTERBALL DECHANT TURK BLUE T3N-R64W-S19 L01 REWORK PACKET	pdf	6/23/2015	Rework Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
BUTTERBALL DECHANT TURK BLUE T3N-R64W-S19 L01 WALKDOWN	pdf	4/30/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
BUTTERBALL DECHANT TURK BLUE T3N-R64W-S19 L01 IR VERIFICATION	pdf	5/18/2015	IR Camera Verification Sheet
BUTTERBALL DECHANT TURK BLUE T3N-R64W-S19 L01_0711_normal	mp4	5/18/2015	IR Camera Video
BUTTERBALL DECHANT TURK BLUE T3N-R64W-S19 L01_0712_dump1, 2, 3, 4, 5	mp4	5/18/2015	IR Camera Video
BUTTERBALL DECHANT TURK BLUE T3N-R64W-S19 L01_0717_post	mp4	5/18/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
BUTTERBALL DECHANT TURK BLUE T3N-R64W-S19 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BUTTERBALL DECHANT TURK BLUE T3N-R64W-S19 L01**

Consent Decree Tank System Number: **402**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**6**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**2**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**2" & 1"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**		
Man. Capacity (MSCFD)	**109.272**	**109.272**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**13,699**	**13,702**	**0%**
Calculated Burner Capacity (scfh	**6,285**	**9,106**	
Headspace Surge Capacity (scfh)	**28,955**	**28,955**	
Total VCS Capacity (scfh)	**35,240**	**38,061**	
VCS Capacity minus PPIVF (scfh)	**21,541**	**24,359**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	5/8/2016 & 11/8/2016 & 4/5/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	5/16/2016 & 11/21/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BUTTERBALL DECHANT TURK BLUE T3N-R64W-S19 L01**

Consent Decree Tank System Number: **402**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**							
Valve Coefficent (gpm/psi) (C_v)	**21.25**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**2409**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**271.7**							
Working Flow (Mscfd)[h,i]	**23**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**34**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**11,321**	**11,321**
Oil Tank Working Rate	**955**	**952**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**1,426**	**1,426**
Total	**13,702**	**13,699**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BUTTERBALL DECHANT TURK BLUE T3N-R64W-S19 L01**

Consent Decree Tank System Number: **402**

Audit Notes

- Initial work request (FINAL PACKET p. 5) Indicates that a 3/4" dump valve trim was originally intended, however documentation indicates that a 1" trim remained in place. Final Signed Evaluation used a 1" dump valve trim (SIGNED EVAL).

- Walkdown checklist (FINAL PACKET p. 3) indicates that there are five thief hatches and PRV's each, while remaining provided documentation indicates that there are six production storage tanks. Based on other documentation SLR used 6 tanks in calculations.

- IR Verification videographer indicates observed visible emissions from thief hatch during dump events (IR VERIFICATION). FLIR video footage of dump event captures indicated emissions (DUMP1, 2, 3, 4, 5)

-Tank Battery is greater than 50 tpy VOC and as such will have an IR Camera Inspection.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BUTTERBALL THOMPSON LDS T3N-R64W-S1 L01**

Consent Decree Tank System Number: **385**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
BUTTERBALL THOMPSON LDS T3N-R64W-S1 L01_FINAL PACKET	pdf	7/6/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
BUTTERBALL THOMPSON LDS T3N-R64W-S1 L01_SIGNED EVAL	pdf	6/26/2015	Engineering Evaluation
BUTTERBALL THOMPSON LDS T3N-R64W-S1 L01_FINAL PACKET	pdf	7/6/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_BUTTERBALL THOMPSN LDS T3N-R64W-S1 L01	xlsm	9/27/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
BUTTERBALL THOMPSON LDS T3N-R64W-S1 L01 WORK REQUEST	pdf	5/19/2015	Work Request
BUTTERBALL THOMPSON LDS T3N-R64W-S1 L01_FINAL PACKET	pdf	7/6/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
BUTTERBALL THOMPSON LDS T3N-R64W-S1 L01 WALKDOWN	pdf	6/17/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
BUTTERBALL THOMPSON LDS T3N-R64W-S1 L01_0259_NORMAL	mp4	6/17/2015	IR Camera Video
BUTTERBALL THOMPSON LDS T3N-R64W-S1 L01_0260_NORMAL	mp4	6/17/2015	IR Camera Video
BUTTERBALL THOMPSON LDS T3N-R64W-S1 L01_0261_POST	mp4	6/17/2015	IR Camera Video
BUTTERBALL THOMPSON LDS T3N-R64W-S1 L01_IR VERIFICATION	pdf	6/17/2015	IR Camera Verification Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
BUTTERBALL THOMPSON LDS T3N-R64W-S1 L01_SIGNED EVAL	pdf	6/26/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BUTTERBALL THOMPSON LDS T3N-R64W-S1 L01**

Consent Decree Tank System Number: **385**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**5**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**3"**
# VOC Lines to KO:	**2**
# VOC Lines to Burner:	**2**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**			
Man. Capacity (MSCFD)	**140**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**5,222**	**5,222**	**0%**
Calculated Burner Capacity (scfh	**2,980**	**5,833**	
Headspace Surge Capacity (scfh)	**7,632**	**7,632**	
Total VCS Capacity (scfh)	**10,612**	**13,465**	
VCS Capacity minus PPIVF (scfh)	**5,390**	**8,243**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	3/11/2016 & 11/8/2016 & 4/5/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	3/18/2016 & 11/21/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BUTTERBALL THOMPSON LDS T3N-R64W-S1 L01**

Consent Decree Tank System Number: **385**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**29**	**0**

Flow Rate Summary	**Flow Rate (scfh)**	
	SLR	**Noble**
Oil Tank Flash Rate	**3,720**	**3,720**
Oil Tank Working Rate	**314**	**313**
Water Tank Flash Rate	**0**	
Water Tank Working Rate	**0**	
Tank Breathing Rate	**1,189**	**1,189**
Total	**5,222**	**5,222**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **BUTTERBALL THOMPSON LDS T3N-R64W-S1 L01**

Consent Decree Tank System Number: **385**

Audit Notes

-The average daily production given on pg 14 of the final packet is difficult to discern. Assumed to be 16 bopd.

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original BUTTERBALL THOMPSON-LDS T3N-R64W-S1 - STEM Engineering Evaluation Check.xlsm and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1_BUTTERBALL THOMPSN LDS T3N-R64W-S1 L01.xlsm file.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CANNON T3N-R65W-S35 L01**

Consent Decree Tank System Number: **415**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
CANNON T3N-R65W-S35 L01_FINAL PACKET	pdf	7/6/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
CANNON T3N-R65W-S35 L01_SIGNED EVAL	pdf	6/29/2015	Signed Engineering Evaluation
STEM Engineering Evaluation_CANNON T3N-R65W-S35 L01	xlsm	6/29/2015	STEM Engineering Evaluation Spreadsheet

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
CANNON T3N-R65W-S35 L01_FINAL PACKET	pdf	7/6/2015	Final Facility Packet
CANNON T3N-R65W-S35 L01 WORK REQUEST	pdf	5/18/2015	Work Request Form

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
CANNON T3N-R65W-S35 L01 WALKDOWN	pdf	6/16/2015	Final Facility Walkdown Form

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
CANNON T3N-R65W-S35 L01_0268_NORMAL	mp4	6/18/2015	Video of IR inspection during normal operations
CANNON T3N-R65W-S35 L01_0269_DUMP	mp4	6/18/2015	Video of IR inspection during dump event
CANNON T3N-R65W-S35 L01_0270_POST	mp4	6/18/2015	Video of IR inspection post dump event
CANNON T3N-R65W-S35 L01 IR VERIFICATION	pdf	6/18/2015	IR Inspection Form

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
CANNON T3N-R65W-S35 L01_SIGNED EVAL	pdf	6/29/2015	Signed Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CANNON T3N-R65W-S35 L01**

Consent Decree Tank System Number: **415**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**6**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**2" & 1"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**		
Man. Capacity (MSCFD)	**140**	**140**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**11,945**	**13,702**	**15%**
Calculated Burner Capacity (scfh	**5,197**	**11,667**	
Headspace Surge Capacity (scfh)	**33,303**	**33,303**	
Total VCS Capacity (scfh)	**38,500**	**44,970**	
VCS Capacity minus PPIVF (scfh)	**26,555**	**31,268**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	4/20/2016 & 4/5/2017
Audit Document Review Verified by:	James Van Horne
Audit Document Verification Date:	4/22/2016 & 5/25/2017

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CANNON T3N-R65W-S35 L01**

Consent Decree Tank System Number: **415**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)[j]	**0.77**							
Valve Coefficent (gpm/psi) (C_v)	**21.25**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**2409**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**271.7**							
Working Flow (Mscfd)[h,i]	**23**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**34**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**11,321**	**11,321**
Oil Tank Working Rate	**955**	**952**
Water Tank Flash Rate	**0**	
Water Tank Working Rate	**0**	
Tank Breathing Rate	**1,426**	**1,426**
Total	**13,702**	**13,699**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CANNON T3N-R65W-S35 L01**

Consent Decree Tank System Number: **415**

Audit Notes

-Work request pdf (under the tanks section) states there are 5 production tanks on location. All other documentation shows 6 production tanks on location.

-Within the first 5 seconds of the video CANNON T3N-R65W-S35 L01_0269_DUMP.mp4 there appears to be vapors visible across the bottom of the video. Source of the vapor is unknown.

-Site was selected for IR inspection due to visible emissions in IR camera video duirng dump event.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CARLSON T5N-R65W-S4 L01**

Consent Decree Tank System Number: **1437**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
CARLSON T5N-R65W-S4 L01_FINAL PACKET	pdf	1/7/2016	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
CARLSON T5N-R65W-S4 L01_SIGNED EVAL	pdf	1/7/2016	Engineering Evaluation
CARLSON T5N-R65W-S4 L01_STEM Engineering Evaluation	xlsm	1/6/2016	Tank VOC Analysis
CARLSON T5N-R65W-S4 L01 - Tank System Audit Checklist	xlsm	5/16/2017	Revised Tank VOC Analysis
CARLSON T5N-R65W-S4 L01_SIGNED EVAL (1)	pdf	5/17/2017	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
CARLSON T5N-R65W-S4 L01_WORK REQUEST	pdf	10/14/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
CARLSON T5N-R65W-S4 L01_WALKDOWN	pdf	1/6/2016	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
CARLSON T5N-R65W-S4 L01_0088_NORMAL	mp4	1/6/2016	IR Camera Video
CARLSON T5N-R65W-S4 L01_0089_DUMP	mp4	1/6/2016	IR Camera Video
CARLSON T5N-R65W-S4 L01_0090_POST	mp4	1/6/2016	IR Camera Video
CARLSON T5N-R65W-S4 L01_IR VERIFICATION	pdf	1/6/2016	IR Camera Verification Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
CARLSON T5N-R65W-S4 L01_SIGNED EVAL	pdf	1/7/2016	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CARLSON T5N-R65W-S4 L01**

Consent Decree Tank System Number: **1437**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**1**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**4**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**60**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**TEC 4-CS (48" Tornado**			
Man. Capacity (MSCFD)	**110.4**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**3,587**	**3,445**	**4%**
Calculated Burner Capacity (scfh	**3,768**	**4,600**	
Headspace Surge Capacity (scfh)	**646**	**535**	
Total VCS Capacity (scfh)	**4,414**	**5,135**	
VCS Capacity minus PPIVF (scfh)	**827**	**1,690**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	12/1/2016
Audit Document Review Verified by:	Angela M. Oberlander & James Van Horne
Audit Document Verification Date:	12/5/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CARLSON T5N-R65W-S4 L01**

Consent Decree Tank System Number: **1437**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.61**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.72**							
Gas/Oil Ratio (scf/bbl)	**96.4**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**530**							
Vapor Pressure (psia)[c]	**73**							
Critical pressure ratio (F_F) [d]	**0.86**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**727**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**70.1**							
Working Flow (Mscfd)[h,i]	**7**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**6**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**2,919**	**3,049**
Oil Tank Working Rate	**288**	**300**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**238**	**238**
Total	**3,445**	**3,587**

LOD ID: **CARLSON T5N-R65W-S4 L01**

Consent Decree Tank System Number: **1437**

Audit Notes

-Noble used a 2" valve with a 1/2" trim in their final signed evaluation. The confirmed valve size is 1" based on the information provided on the Field Datasheet(page 14 of the final packet). SLR still considers the modeling guideline to be followed because the use of 2" valve overestimated PPIVFR.

UPDATE: After reviewing SLR's Draft Report, Noble contacted Tornado to confirm that its burners can handle capacities beyond the published specification or 10 oz/in2. Tornado confirmed that the published burner curve can be hydraulically extrapolated beyond 10 oz/in2. Moreover, Tornado noted the stated capacity is based on heat release (86.4 MSCFD at 2,300 BTU/scf). Noble's typical flash gas is lighter in composition (1,800 BTU/scf) such that the Tornado burner would be capable of handling up to 110.4 MSCFD at the published heat release limit. The Tornado specification sheet notes the maximum flow is dependent on heating value of the gas, consistent with Noble's conversation.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CARMIN USX T4N-R63W-S5 L01**

Consent Decree Tank System Number: **502**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
CARMEN USX T4N-R63W-S5 L01_FINAL PACKET	pdf	7/6/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
CARMEN USX T4N-R63W-S5 L01_SIGNED EVAL	pdf	6/26/2015	Engineering Evaluation
STEM Engineering Evaluation_CARMIN USX T4N-R63W-S5 L01	xlsm	4/28/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_CARMIN USX T4N-R63W-S5 L01.xlsm	xlsm	9/29/2016	Revised Tank VOC Analysis
Evaluation_rev1_CARMIN USX T4N-R63W-S5 L01.xlsm	xlsm	1/17/2017	Revised Tank VOC Analysis 2

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
CARMEN USX T4N-R63W-S5 L01_WORK REQUEST	pdf	5/14/2015	Work Request
CARMEN USX T4N-R63W-S5 L01_FINAL PACKET	pdf	7/6/2015	Work Request
Noble 3rd Party Audit Wave 12 Update Info Request_20170117	pdf	1/17/2017	Information Request Response

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
CARMEN USX T4N-R63W-S5 L01 WALKDOWN	pdf	6/10/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
CARMEN USX T4N-R63W-S5 L01 IR VERIFICATION	pdf	6/10/2015	IR Camera Verification Sheet
CARMEN USX T4N-R63W-S5 L01_0246 NORMAL	mp4	6/10/2015	IR Camera Video
CARMEN USX T4N-R63W-S5 L01_0247 DUMP	mp4	6/10/2015	IR Camera Video
CARMEN USX T4N-R63W-S5 L01_0248 NORMAL	mp4	6/10/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
CARMEN USX T4N-R63W-S5 L01_SIGNED EVAL	pdf	6/26/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CARMIN USX T4N-R63W-S5 L01**

Consent Decree Tank System Number: **502**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**		
Man. Capacity (MSCFD)	**140**	**140**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,746**	**4,747**	**0%**
Calculated Burner Capacity (scfh	**5,384**	**11,667**	
Headspace Surge Capacity (scfh)	**3,372**	**3,372**	
Total VCS Capacity (scfh)	**8,756**	**15,039**	
VCS Capacity minus PPIVF (scfh)	**4,010**	**10,292**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	4/20/2016 & 11/8/2016 & 1/30/2017 & 4/5/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	4/28/2016 & 11/21/2016

LOD ID: **CARMIN USX T4N-R63W-S5 L01**
Consent Decree Tank System Number: **502**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**17**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**3,720**	**3,720**
Oil Tank Working Rate	**314**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**713**	**713**
Total	**4,747**	**4,746**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CARMIN USX T4N-R63W-S5 L01**

Consent Decree Tank System Number: **502**

Audit Notes

Three (3) oil tanks were present in the original STEM Engineering Evaluation_CARMIN USX T4N-R63W-S5 L01.xlsm file and was changed to two (2) oil tanks in the modified STEM Engineering Evaluation_rev1_CARMIN USX T4N-R63W-S5 L01.xlsm file. The "max operating pressure" was 80 psi in the original STEM Engineering Evaluation_CARMIN USX T4N-R63W-S5 L01.xlsm file and was changed to 70 psi in the modified STEM Engineering Evaluation_rev1_CARMIN USX T4N-R63W-S5 L01.xlsm file. Noble provided documentation showing there are three (3) oil tanks onsite, and the pressure was originally set at 70 psi therefore SLR used those values in the calcs.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CASEY BLUE GUTTERSEN USX T3N-R64W-S21 L01**

Consent Decree Tank System Number: **549**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
CASEY BLUE GUTTERSEN USX T3N-R64W-S21 L01_FINAL PACKET	pdf	NOT DATED	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
CASEY BLUE GUTTERSEN USX T3N-R64W-S21 L01_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_Guttersen USX, Casey Blue	xlsm	4/28/2015	Engineering Design Evaluation Model
STEM Eng Eval_rev1_CASEY BLUE GUTTERSEN USX T3N-R64W-S21 L01	xlsm	7/28/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
0142 - Guttersen Casey Blue Work Request	pdf	NOT DATED	Work Request
CASEY BLUE GUTTERSEN USX T3N-R64W-S21 L01_COMPLETED REWORK	pdf	8/28/2015	Rework Request
Noble 3rd Party Audi Wave 12 Update Info Request_20170117	pdf	1/17/2017	Information Request Response

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
CASEY BLUE GUTTERSEN USX T3N-R64W-S21 L01 WALKDOWN	pdf	4/30/2015	Tank System Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
CASEY BLUE GUTTERSEN USX T3N-R64W-S21 L01_2313_normal	mp4	5/8/2015	IR Inspection Video
CASEY BLUE GUTTERSEN USX T3N-R64W-S21 L01_2314_dump	mp4	5/8/2015	IR Inspection Video
CASEY BLUE GUTTERSEN USX T3N-R64W-S21 L01_2315_post	mp4	5/8/2015	IR Inspection Video
CASEY BLUE GUTTERSEN USX T3N-R64W-S21 L01_SIGNEDVERIFICATIONS	pdf	5/8/2015	IR Camera Verification Documentation and Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
CASEY BLUE GUTTERSEN USX T3N-R64W-S21 L01_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CASEY BLUE GUTTERSEN USX T3N-R64W-S21 L01**

Consent Decree Tank System Number: **549**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**7**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**3**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**	**70**						
Dump Valve Size & Trim Size (in)	**1" & 1/2"**	**1" & 1/2"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**Cimarron 48 HV**	**Cimarron 48 HV**	
Man. Capacity (MSCFD)	**140**	**109.272**	**109.272**	

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**9,730**	**9,732**	**0%**
Calculated Burner Capacity (scfh	**7,318**	**14,939**	
Headspace Surge Capacity (scfh)	**11,153**	**11,153**	
Total VCS Capacity (scfh)	**18,471**	**26,092**	
VCS Capacity minus PPIVF (scfh)	**8,741**	**16,361**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	5/8/2016 & 12/2/2016 & 1/30/2017 & 4/5/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	5/9/2016 & 12/15/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CASEY BLUE GUTTERSEN USX T3N-R64W-S21 L01**

Consent Decree Tank System Number: **549**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**	**0.77**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**0.89**	**0.89**						
Gas/Oil Ratio (scf/bbl)	**112.8**	**112.8**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**	**0.94**						
Valve Coefficent (gpm/psi) (C_v)	**5.72**	**5.72**						
Critical Pressure (psia)[b]	**539**	**539**						
Vapor Pressure (psia)[c]	**83**	**83**						
Critical pressure ratio (F_F) [d]	**0.85**	**0.85**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**792**	**792**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**	**89.3**						
Working Flow (Mscfd)[h,i]	**8**	**8**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**40**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**7,440**	**7,440**
Oil Tank Working Rate	**627**	**626**
Water Tank Flash Rate	**0**	
Water Tank Working Rate	**0**	
Tank Breathing Rate	**1,664**	**1,664**
Total	**9,732**	**9,730**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CASEY BLUE GUTTERSEN USX T3N-R64W-S21 L01**

Consent Decree Tank System Number: **549**

Audit Notes

-Rework request dated August 28, 2015 (FINAL PACKET p. 25) indicates that automatic and pneumatic PSHH should be set to 70 psi. All other provided documentation including Signed Eval (FINAL PACKET p. 19) refers to 75 psi. No provided field documentation indicates that the operating pressure was changed to 70 psi so 75 psi operating pressure was used in this evaluation.

-The facility has actual uncontrolled VOC emissions greater than 50 tpy. Therefore an IR inspection is required. "Max Operating Pressure" was 75 psi in the original STEM Engineering Evaluation_Guttersen USX, Casey Blue.xlsm and was changed to 70 psi in the modified STEM Eng Eval_rev1_CASEY BLUE GUTTERSEN USX T3N-R64W-S21 L01.xlsm file. Noble provided documentation that the pressure in the field was initially set at at a maximum 70 psi, therefore SLR use that value in the calcs.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CASTOR T9N-R59W-S35 L01**

Consent Decree Tank System Number: **2069**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
CASTOR T9N-R59W-S35 l01_FINAL PACKET	pdf	7/14/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
CASTOR T9N-R59W-S35 l01_SIGNED EVAL	pdf	7/15/2015	Signed Engineering Evaluation
STEM Engineering Evaluation_CASTOR T9N-R59W-S35 L01	xlsm	7/14/2015	Noble Engineering Design Model
STEM Engineering Evaluation_rev1_CASTOR T9N-R59W-S35 L01	xlsm	10/10/2016	Revised Engineering Evaluation
Attachment B - STEM Engineering Evaluation_rev1_CASTOR T9N-R59W-S35 L01.xlsm	xlsm	1/17/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
CASTOR T9N-R59W-S35 l01_FINAL PACKET	pdf	7/14/2015	Final Facility Packet
CASTOR T9N-R59W-S35 l01 WORK REQUEST	pdf	5/18/2015	Work Request
Noble 3rd Party Audit Wave 12 Update Info Request_20170117	pdf	1/17/2017	Noble Info Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
CASTOR T9N-R59W-S35 l01 WALKDOWN	pdf	7/9/2015	Walkdown Verification Sheet

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
CASTOR T9N-R59W-S35 l01_0056_NORMAL	mp4	7/13/2015	IR Camera Video during Normal Operations
CASTOR T9N-R59W-S35 l01_0057_DUMP	mp4	7/13/2015	IR Camera Video during Dump Event
CASTOR T9N-R59W-S35 l01_0058_POST	mp4	7/13/2015	IR Camera Video Following Dump Event
CASTOR T9N-R59W-S35 l01 IR VERIFICATION	pdf	7/13/2015	IR Camera Verification Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
CASTOR T9N-R59W-S35 l01_SIGNED EVAL	pdf	7/15/2015	Signed Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CASTOR T9N-R59W-S35 L01**

Consent Decree Tank System Number: **2069**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**5**
Oil Tank Capacity:	**300**
# of Water Tanks:	**1**
Water Tank Capacity:	**300**
VOC Line Size:	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**55**							
Dump Valve Size & Trim Size (in)	**2" & 1"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**							
Dump Valve Size & Trim Size (in)	**2" & 3/4"**							

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**			
Man. Capacity (MSCFD)	**140**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**12,760**	**12,762**	**0%**
Calculated Burner Capacity (scfh	**2,893**	**5,833**	
Headspace Surge Capacity (scfh)	**25,417**	**25,417**	
Total VCS Capacity (scfh)	**28,310**	**31,250**	
VCS Capacity minus PPIVF (scfh)	**15,550**	**18,489**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	4/20/2016 & 11/8/2016 & 4/5/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	4/28/2016 & 11/21/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CASTOR T9N-R59W-S35 L01**

Consent Decree Tank System Number: **2069**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.51**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.62**							
Gas/Oil Ratio (scf/bbl)	**88.4**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**							
Valve Coefficent (gpm/psi) (C_v)	**21.25**							
Critical Pressure (psia)[b]	**526**							
Vapor Pressure (psia)[c]	**68**							
Critical pressure ratio (F_F) [d]	**0.86**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**2111**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**186.7**							
Working Flow (Mscfd)[h,i]	**20**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.80**							
Valve Coefficent (gpm/psi) (C_v)	**12.20**							
Critical Pressure (psia)[j]	**3200**							
Vapor Pressure (psia)[k]	**1**							
Critical pressure ratio (F_F)[d]	**0.96**							
Choked Flow?[e]	**Yes**							
Peak Flow (bwpd)[f,g]	**6789**							

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**27**							
Working Flow (Mscfd)[l]	**38**							

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**29**	**6**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**7,779**	**7,779**
Oil Tank Working Rate	**836**	**834**
Water Tank Flash Rate	**1,131**	**1,131**
Water Tank Working Rate	**1,588**	**1,588**
Tank Breathing Rate	**1,426**	**1,426**
Total	**12,762**	**12,758**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CASTOR T9N-R59W-S35 L01**

Consent Decree Tank System Number: **2069**

Audit Notes

-Based on understanding of site design water may be dumped to the tank from both the high pressure separator and low pressure separator. There was no indication of method to prevent both separators from dumping water at the same time. Therefore a water dump from the low pressure separator was added to SLR analysis.

-It was assumed the low pressure separator water dump had the same cycle time and production rate inorder to calculate headspace surge capacity.

-Walkdown Verfication sheet did not indicate that all modification in work request were completed. Job sheets and emails provided in final packet was used to verify all work was completed.

Five (5) oil tank are shown in the original STEM Engineering Evaluation_CASTOR T9N-R59W-S35 L01.xlsm file and four (4) oil tanks are shown in the modified STEM Engineering Evaluation_rev1_CASTOR T9N-R59W-S35 L01.xlsm file.

One (1) water tank is shown in the original STEM Engineering Evaluation_CASTOR T9N-R59W-S35 L01.xlsm file and no water tanks are shown in the modified STEM Engineering Evaluation_rev1_CASTOR T9N-R59W-S35 L01.xlsm file.

The Max Operating Pressure on the water dumps to tanks was 500 psig in the original STEM Engineering Evaluation_CASTOR T9N-R59W-S35 L01.xlsm file but modified to 400 psig in the modified STEM Engineering Evaluation_rev1_CASTOR T9N-R59W-S35 L01.xlsm file. Noble provided documentation showing 5 oil and 1 water tank onsite, along with the max operating pressure of 400 psi there SLR used these values in the calcs.

Design pressure in the original CASTOR T9N-R59W-S35 L01 - STEM Evaluation Check.xlsm workbook for the oil dumps is 300 psi. The pressure was then changed in the modified Attachment B - STEM Engineering Evaluation_rev1_CASTOR T9N-R59W-S35 L01.xlsm workbook is 500 psi.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CECIL COOPER T6N-R64W-S23 L01**

Consent Decree Tank System Number: **286**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
CECIL COOPER T6N-R64W-S23 L01_ FINAL PACKET	pdf	7/6/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
CECIL COOPER T6N-R64W-S23 L01_ SIGNED EVAL	pdf	7/8/2015	Signed Engineering Evaluation
STEM Engineering Evaluation_rev1_CECIL COOPER T6N-R64W-S23 L01	xlsm	7/28/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
CECIL COOPER T6N-R64W-S23 L01_ FINAL PACKET	pdf	7/6/2015	Final Facility Packet
CECIL COOPER T6N-R64W-S23 L01 WORK REQUEST	pdf	5/18/2015	Work Request
CECIL COOPER T6N-R64W-S23 L01 REWORK REQUEST	pdf	10/1/2015	Rework Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
CECIL COOPER T6N-R64W-S23 L01 WALKDOWN	pdf	6/22/2015	Final Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
CECIL COOPER T6N-R64W-S23 L01_0284_NORMAL	mp4	6/22/2015	IR Camera Video during Normal Operations
CECIL COOPER T6N-R64W-S23 L01_0285_DUMP	mp4	6/22/2015	IR Camera Video during Dump Event
CECIL COOPER T6N-R64W-S23 L01_0286_POST	mp4	6/22/2015	IR Camera Video following Dump Event
CECIL COOPER T6N-R64W-S23 L01 IR VERIFICATION	pdf	6/22/2015	IR Camera Verification Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
CECIL COOPER T6N-R64W-S23 L01_ SIGNED EVAL	pdf	7/8/2015	Signed Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CECIL COOPER T6N-R64W-S23 L01**

Consent Decree Tank System Number: **286**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**1**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 3/8"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**			
Man. Capacity (MSCFD)	**140**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**2,436**	**2,436**	**0%**
Calculated Burner Capacity (scfh	**2,939**	**5,833**	
Headspace Surge Capacity (scfh)	**179**	**179**	
Total VCS Capacity (scfh)	**3,118**	**6,012**	
VCS Capacity minus PPIVF (scfh)	**682**	**3,576**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	3/16/2016 & 11/8/2016 & 4/5/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	3/18/2016 & 11/21/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CECIL COOPER T6N-R64W-S23 L01**

Consent Decree Tank System Number: **286**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.91**							
Valve Coefficent (gpm/psi) (C_v)	**3.22**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**431**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**48.7**							
Working Flow (Mscfd)[h,i]	**4**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**6**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**2,027**	**2,027**
Oil Tank Working Rate	**171**	**171**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**238**	**238**
Total	**2,436**	**2,436**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CECIL COOPER T6N-R64W-S23 L01**

Consent Decree Tank System Number: **286**

Audit Notes

-The work in the Rework Request pdf was never verified. IR camera inspection was completed before the Rework Request was issued. Rework requests do not relate to any of the inputs into engineering evaluation.

-Walkdown does not indicate that all work was completed. Verification of completion of work from first work request dated 5/18/2015 was done via job sheets and email in final packet.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CECIL FARMS T6N-R66W-S6 L02**

Consent Decree Tank System Number: **2365**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
CECIL FARMS T6N-R66W-S6 L02_FINAL PACKET	pdf	4/25/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
CECIL FARMS T6N-R66W-S6 L02_SIGNED EVAL	pdf	5/21/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_Cecil Farms	xlsm	4/15/2015	STEM Engineering Design Evaluation Model
STEM Engineering Evaluation_rev1_CECIL FARMS T6N-R66W-S6 L02.xlsm	xlsm	2/24/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
CECIL FARMS T6N-R66W-S6 L02 WORK REQUEST	pdf	unknown	Work Request
CECIL FARMS T6N-R66W-S6 L02_FINAL PACKET	pdf	4/25/2015	Final Facility Packet

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
CECIL FARMS T6N-R66W-S6 L02 WALKDOWN	pdf	4/25/2015	Final Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
CECIL FARMS T6N-R66W-S6 L02_SIGNED VERIFICATION	pdf	5/5/2015	IR Camera Verification Documentation Field Data Sheet
CECIL FARMS T6N-R66W-S6 L02_2256-NORMAL	mp4	5/5/2015	IR Camera Video during Normal Operations
CECIL FARMS T6N-R66W-S6 L02_2257-DUMP	mp4	5/5/2015	IR Camera Video during Dump Event
CECIL FARMS T6N-R66W-S6 L02_2258-POST	mp4	5/5/2015	IR Camera Video following Dump Event

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
CECIL FARMS T6N-R66W-S6 L02_SIGNED EVAL	pdf	5/21/2015	Signed Engineering Design Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CECIL FARMS T6N-R66W-S6 L02**

Consent Decree Tank System Number: **2365**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**5**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**2**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**4**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**						
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**				
Dump Valve Size & Trim Size (in)	**2" & 1/4"**	**2" & 1/4"**	**2" & 1/4"**	**2" & 1/4"**				

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**COMM 200 48"**		
Man. Capacity (MSCFD)	**140**	**157**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**21,166**	**22,131**	**5%**
Calculated Burner Capacity (scfh	**7,951**	**12,375**	
Headspace Surge Capacity (scfh)	**39,518**	**35,525**	
Total VCS Capacity (scfh)	**47,469**	**47,900**	
VCS Capacity minus PPIVF (scfh)	**26,303**	**25,769**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/5/2016 & 11/8/2016
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	5/10/2016 & 11/21/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CECIL FARMS T6N-R66W-S6 L02**

Consent Decree Tank System Number: **2365**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**-0.90**	**-0.90**						
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)[j]	**0.77**	**0.77**						
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**						
Critical Pressure (psia)[b]	**833**	**833**						
Vapor Pressure (psia)[c]	**407**	**407**						
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**6905**	**6905**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**158.2**	**158.2**						
Working Flow (Mscfd)[h,i]	**66**	**66**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.55**	**0.55**	**0.55**	**0.55**				
Valve Coefficent (gpm/psi) (C_v)	**2.96**	**2.96**	**2.96**	**2.96**				
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**	**3200**				
Vapor Pressure (psia)[k]	**1**	**1**	**1**	**1**				
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**	**0.96**				
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**				
Peak Flow (bwpd)[f,g]	**1132**	**1132**	**1132**	**1132**				

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**5**	**5**	**5**	**5**				
Working Flow (Mscfd)[l]	**6**	**6**	**6**	**6**				

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**29**	**11**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**13,179**	**13,179**
Oil Tank Working Rate	**5,473**	**5,459**
Water Tank Flash Rate	**755**	**755**
Water Tank Working Rate	**1,060**	**1,060**
Tank Breathing Rate	**1,664**	**713**
Total	**22,131**	**21,166**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CECIL FARMS T6N-R66W-S6 L02**

Consent Decree Tank System Number: **2365**

Audit Notes

-Pg 10 of final packet pdf shows six (6) oil stock tanks. The signed eval pdf shows 5 total oil tanks and 2 water tanks. IR camera video shows 8 tanks on site. The final evaluation of a banked configuration with 2 oil and 1 water tank yielded the most conservative result, therefore this is what SLR used in the calcs.

-The facilty has the uncontrolled actual VOC emissions greater than 50 tpy. Therefore and IR inspection is required.
Tanks are in a banked configuration. Noble calculations do not account for breathing from non-producing bank. All tanks were included in the audit spreadsheet to accommodate a banked configuration for breathing losses. One bank has 2 oil tanks and 1 water tank and the second bank has 3 oil tanks and 1 water tank.

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original CECIL FARMS T6N-R66W-S6 L02 - STEM Engineering Evaluation Check.xlsm and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1_CECIL FARMS T6N-R66W-S6 L02.xlsm file.

The VOC line size was 3" in the original CECIL FARMS T6N-R66W-S6 L02 - STEM Engineering Evaluation Check.xlsm and was changed to a 4" in the modified STEM Engineering Evaluation_rev1_CECIL FARMS T6N-R66W-S6 L02.xlsm file. Field notes in final packet indicate the line is 4" in diameter.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CHANDLER ST GUTTERSEN T3N-R64W-S15 L01**

Consent Decree Tank System Number: **544**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
CHANDLER ST GUTTERSEN T3N-R64W-S15 L01_FINAL PACKET	pdf	5/20/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
CHANDLER ST GUTTERSEN T3N-R64W-S15 L01_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_Chandler St, Cally Blue	xlsm	4/30/2015	STEM Engineering Design Model
STEM Engineering Evaluation_rev1_CHANDLER ST GUTTERSEN T3N-R64W-S15 L01	xlsm	11/9/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
CHANDLER ST GUTTERSEN T3N-R64W-S15 L01_FINAL PACKET	pdf	5/20/2015	Final Facility Packet including Work Request
CHANDLER ST GUTTERSEN T3N-R64W-S15 L01_FINAL PACKET	pdf	7/13/2015	Final Facility Packet including Rework Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
CHANDLER ST GUTTERSEN T3N-R64W-S15 L01_FIELD VER	pdf	4/30/2015	Tank System Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
CHANDLER ST GUTTERSEN T3N-R64W-S15 L01_2323_normal	mp4	5/13/2015	IR Inspection Video
CHANDLER ST GUTTERSEN T3N-R64W-S15 L01_2324_dump	mp4	5/13/2015	IR Inspection Video
CHANDLER ST GUTTERSEN T3N-R64W-S15 L01_2325_post	mp4	5/13/2015	IR Inspection Video
CHANDLER ST GUTTERSEN T3N-R64W-S15 L01_SIGNEDVERIFICATION	pdf	5/13/2015	IR Camera Verification Documentation and Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
CHANDLER ST GUTTERSEN T3N-R64W-S15 L01_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Design Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CHANDLER ST GUTTERSEN T3N-R64W-S15 L01**

Consent Decree Tank System Number: **544**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**8**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**2**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**						
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**					
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**					

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**	**LEED 48" Gen 1 #7**	
Man. Capacity (MSCFD)	**109.272**	**109.272**	**140**	

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**33,505**	**34,708**	**4%**
Calculated Burner Capacity (scfh	**7,913**	**14,939**	
Headspace Surge Capacity (scfh)	**73,740**	**73,740**	
Total VCS Capacity (scfh)	**81,653**	**88,679**	
VCS Capacity minus PPIVF (scfh)	**48,148**	**53,971**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	5/10/2016 & 11/9/2016 & 4/5/2017
Audit Document Review Verified by:	James Van Horne
Audit Document Verification Date:	5/18/2016 & 5/12/2017

SLR

LOD ID: **CHANDLER ST GUTTERSEN T3N-R64W-S15 L01**

Consent Decree Tank System Number: **544**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**-0.90**	**-0.90**						
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**						
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**						
Critical Pressure (psia)[b]	**833**	**833**						
Vapor Pressure (psia)[c]	**407**	**407**						
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**6905**	**6905**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**158.2**	**158.2**						
Working Flow (Mscfd)[h,i]	**66**	**66**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**					
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**					
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**					
Vapor Pressure (psia)[k]	**1**	**1**	**1**					
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**					
Choked Flow?[e]	**Yes**	**Yes**	**Yes**					
Peak Flow (bwpd)[f,g]	**11381**	**11381**	**11381**					

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**46**	**46**	**46**					
Working Flow (Mscfd)[l]	**64**	**64**	**64**					

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**46**	**11**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**13,179**	**13,179**
Oil Tank Working Rate	**5,473**	**5,459**
Water Tank Flash Rate	**5,691**	**5,690**
Water Tank Working Rate	**7,988**	**7,987**
Tank Breathing Rate	**2,377**	**1,189**
Total	**34,708**	**33,505**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **CHANDLER ST GUTTERSEN T3N-R64W-S15 L01**

Consent Decree Tank System Number: **544**

Audit Notes

- Field datasheets dated March 6, 2015 (FINAL PACKET p. 5) indicate that there is no VRT on site. Subsequent documentation makes references to a VRT and a VRT is visible in FLIR video footage (2323_NORMAL 0:22).
- The Field Datasheet system sketch (FIELD PACKET p. 3) shows separator 5, fed by Guttersen D22-27, feeding a low pressure separator. Provided STEM calculations (FINAL PACKET p. 13) show the D22-27 stream comingled with Chandler State D23-79HN and dumping from a single low pressure separator. The same Field Datasheet also shows this separator dumping water to a pit while provided STEM calculations show the D22-27 water dumping to a water tank. No provided documentation shows this change in configuration taking place. As the more conservative approach, SLR assumes that the D22-27 water stream is dumping both oil and water directly to tanks connected the same VOC header. The revised analysis provided by noble includes a high pressure water dump from the 22-27 separator

-The facility has 2 banks of tanks each with 4 oil and 1 water tank. Noble did not include breathing losses from both banks. SLR included all tanks in its analysis to account for breathing from all tanks.
-"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original CHANDLER ST GUTTERSEN T3N-R64W-S15 L01 - STEM Engineering Evaluation Check.xlsm and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1_CHANDLER ST GUTTERSEN T3N-R64W-S15 L01.xlsm file.

-Max Operating Pressure was originally 300 psi in the original CHANDLER ST GUTTERSEN T3N-R64W-S15 L01 - STEM Engineering Evaluation Check.xlsm and was changed to 400 psi in the modified STEM Engineering Evaluation_rev1_CHANDLER ST GUTTERSEN T3N-R64W-S15 L01.xlsm file. 400 psi was used in the original Signed Eval pdf, there SLR is using this value in the calcs.

-The facility has actual uncontrolled VOC emissions greater than 50 tpy. Therefore an IR camera inspection is required.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **Checketts Jerke T4N-R65W-S15 L01**

Consent Decree Tank System Number: **2158**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
CHECKETTS JERKE T4N-R65W-S15 L01 DESIGN PACKET	pdf	No Date	Design Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
CHECKETTS JERKE T4N-R65W-S15 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation
STEM Engineering Evaluation_rev1_CHECKETTS JERKE T4N-R65W-S15 L01	xlsm	9/27/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
CHECKETTS JERKE T4N-R65W-S15 L01 WORK REQUEST	pdf	5/11/2015	Work Request
Noble 3rd Party Audit Wave 12 Update Info Request_20170117	pdf	1/17/2017	Noble Info Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
CHECKETTS JERKE T4N-R65W-S15 L01 WALKDOWN	pdf	4/30/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
CHECKETTS JERKE T4N-R65W-S15 L01 IR VERIFICATION	pdf	5/18/2016	IR Camera Verification Sheet
CHECKETTS JERKE T4N-R65W-S15 L01_0733_normal	mp4	5/18/2016	IR Camera Video
CHECKETTS JERKE T4N-R65W-S15 L01_0734_dump	mp4	5/18/2016	IR Camera Video
CHECKETTS JERKE T4N-R65W-S15 L01_0735_post	mp4	5/18/2016	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
CHECKETTS JERKE T4N-R65W-S15 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **Checketts Jerke T4N-R65W-S15 L01**

Consent Decree Tank System Number: **2158**

☐ Yes ☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes ☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**4**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**	**70**						
Dump Valve Size & Trim Size (in)	**2" & 1/2"**	**2" & 1/2"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**COMM 200 48"**		
Man. Capacity (MSCFD)	**140**	**79.2**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**9,376**	**9,377**	**0%**
Calculated Burner Capacity (scfh	**6,755**	**9,133**	
Surge Capacity (scfh)	**7,917**	**7,917**	
Total VCS Capacity (scfh)	**14,672**	**17,050**	
VCS Capacity minus PPIVF (scfh)	**5,296**	**7,673**	

☑ Yes ☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes ☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes ☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes ☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	James Van Horne/Tom Kussard
Audit Document Review Date:	2/24/2016 & 11/9/2016 & 1/31/2017 & 4/5/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	2/25/2016 & 11/22/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **Checketts Jerke T4N-R65W-S15 L01**

Consent Decree Tank System Number: **2158**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**	**0.77**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**0.89**	**0.89**						
Gas/Oil Ratio (scf/bbl)	**112.8**	**112.8**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor	**0.78**	**0.78**						
Valve Coefficent (gpm/psi) (	**7.20**	**7.20**						
Critical Pressure (psia)[b]	**539**	**539**						
Vapor Pressure (psia)[c]	**83**	**83**						
Critical pressure ratio (F_F) [d]	**0.85**	**0.85**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**827**	**827**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**93.3**	**93.3**						
Working Flow (Mscfd)[h,i]	**8**	**8**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor								
Valve Coefficent (gpm/psi) (								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**23**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**7,771**	**7,771**
Oil Tank Working Rate	**655**	**654**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**951**	**951**
Total	**9,377**	**9,376**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **Checketts Jerke T4N-R65W-S15 L01**

Consent Decree Tank System Number: **2158**

Audit Notes

-No field notes were availble to confirm the valve size. SLR used the largest valve size (2") associated with the confirmed 1/2" trim.

-Video shows that one of the 4 tanks appears to be taller than the other 3 and therefore larger but documentation states that all tanks are 300 bbl capacity. Using Noble's STEM Engineering Evaluation the amount of additional surge capacity was larger than the amount of additional breathing losses due to a larger tank. SLR determined both the modeling guideline and engineering design standard to be applied correctly.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

The "Max Operating Pressure" was 80 psi in the original CHECKETTS JERKE T4N-R65W-S15 L01_SIGNED EVAL.pdf and was changed to 70 psi the modified STEM Engineering Evaluation_rev1_CHECKETTS JERKE T4N-R65W-S15 L01.xlsm file. Noble info request provided data proving that the current onsite pressure is 70 psi therefore SLR used this value in the calcs.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **COUGAR BAKER FRITZLER T5N-R64W-S2 L01**

Consent Decree Tank System Number: **300**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
COUGAR BAKER FRITZLER T5N-R64W-S2 L01_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Design Evaluation
COUGAR BAKER FRITZLER T5N-R64W-S2 L01_FINAL PACKET	pdf	7/27/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
COUGAR BAKER FRITZLER T5N-R64W-S2 L01_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_Cougar Baker	xlsm	4/28/2015	STEM Engineering Design Model
STEM Engineering Evaluation_rev1_COUGAR BAKER FRITZLER T5N-R64W-S2 L01	xlsm	7/28/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
COUGAR BAKER FRITZLER T5N-R64W-S2 L01 WORK REQUEST	xlsx	NOT DATED	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
COUGAR BAKER FRITZLER T5N-R64W-S2 L01 WALKDOWN	pdf	4/28/2015	Tank System Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
COUGAR BAKER FRITZLER T5N-R64W-S2 L01_2334_normal	mp4	5/11/2015	IR Inspection Video
COUGAR BAKER FRITZLER T5N-R64W-S2 L01__2335_dump	mp4	5/11/2015	IR Inspection Video
COUGAR BAKER FRITZLER T5N-R64W-S2 L01__2336_post	mp4	5/11/2015	IR Inspection Video
COUGAR BAKER FRITZLER T5N-R64W-S2 L01 IR VERIFICATION	pdf	5/11/2015	IR Camera Verification Documentation and Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
COUGAR BAKER FRITZLER T5N-R64W-S2 L01_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **COUGAR BAKER FRITZLER T5N-R64W-S2 L01**

Consent Decree Tank System Number: **300**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**9**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**3**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**2**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**				
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**1" & 1/2"**				

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**				
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**1" & 1/2"**				

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	
Man. Capacity (MSCFD)	**140**	**140**	**140**	

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**58,367**	**49,072**	**16%**
Calculated Burner Capacity (scfh	**7,728**	**17,500**	
Headspace Surge Capacity (scfh)	**157,743**	**135,794**	
Total VCS Capacity (scfh)	**165,471**	**153,294**	
VCS Capacity minus PPIVF (scfh)	**107,104**	**104,222**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	5/8/2016 & 11/9/2016 & 4/5/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	5/10/2016 & 11/22/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **COUGAR BAKER FRITZLER T5N-R64W-S2 L01**

Consent Decree Tank System Number: **300**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**	**-1.02**	**-1.02**				
Z2	**-0.86**	**-0.86**	**-0.86**	**-0.86**				
Z3	**0.98**	**0.98**	**0.98**	**0.98**				
Z	**-0.90**	**-0.90**	**-0.90**	**-0.90**				
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**	**22.9**	**22.9**				

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**	**0.94**				
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**	**5.72**				
Critical Pressure (psia)[b]	**833**	**833**	**833**	**833**				
Vapor Pressure (psia)[c]	**407**	**407**	**407**	**407**				
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**	**0.76**	**0.76**				
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**				
Peak Flow (bopd)[f,g]	**6905**	**6905**	**6905**	**2269**				

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**158.2**	**158.2**	**158.2**	**52.0**				
Working Flow (Mscfd)[h,i]	**66**	**66**	**66**	**22**				

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**	**0.94**				
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**	**5.72**				
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**	**3200**				
Vapor Pressure (psia)[k]	**1**	**1**	**1**	**1**				
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**	**0.96**				
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**				
Peak Flow (bwpd)[f,g]	**11381**	**11381**	**11381**	**3740**				

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**46**	**46**	**46**	**15**				
Working Flow (Mscfd)[l]	**64**	**64**	**64**	**21**				

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**51**	**17**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**21,935**	**26,359**
Oil Tank Working Rate	**9,108**	**10,918**
Water Tank Flash Rate	**6,314**	**7,587**
Water Tank Working Rate	**8,863**	**10,650**
Tank Breathing Rate	**2,853**	**2,853**
Total	**49,072**	**58,367**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **COUGAR BAKER FRITZLER T5N-R64W-S2 L01**

Consent Decree Tank System Number: **300**

Audit Notes

- Provided STEM calculations (SIGNED EVAL p. 2) list the HP separator associated with the B2-5 and B2-19 wells as having a dump valve with a 1" trim . Field Datasheets (FINAL PACKET p. 8), dated March 9, 2015, indicate that the separator has a 1" valve with 1/2" trim. No provided documentation indicates that the valves were changed. SLR assumes that the valve for that separator is a 1" valve with a 1/2" trim. Since the confirmed valve size is smaller than the size used in Noble's calculations SLR still deems the modeling guideline to have been applied correctly.

-The facility has uncontrolled actual VOC emissions greater than 50 tpy. Therefore an IR inspection is required. "VOC Design Tank Pressure" was originally 10 oz/in^2 in the original COUGAR BAKER FRITZLER T5N-R64W-S2 L01 - STEM Engineering Evaluation Check.xlsm and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1_COUGAR BAKER FRITZLER T5N-R64W-S2 L01.xlsm file.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT 2E RANCH T3N-R64W-57 L01**

Consent Decree Tank System Number: **389**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
DECHANT 2E RANCH T3N-R64W-S7 L01_FINAL PACKET	pdf	7/6/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
DECHANT 2E RANCH T3N-R64W-S7 L01_SIGNED EVAL	pdf	6/29/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_rev1_DECHANT 2E RANCH T3N-R64W-S7 L01	xlsm	4/15/2015	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
DECHANT 2E RANCH T3N-R64W-S7 L01 WORK REQUEST	pdf	5/5/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
DECHANT 2E RANCH T3N-R64W-S7 L01 WALKDOWN	pdf	6/1/2015	Final Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
DECHANT 2E RANCH T3N-R64W-S7 L01_0194_NORMAL	mp4	6/1/2015	IR Camera Video During Normal Operations
DECHANT 2E RANCH T3N-R64W-S7 L01_0195_DUMP	mp4	6/1/2015	IR Camera Video During Dump Event
DECHANT 2E RANCH T3N-R64W-S7 L01_0196_POST	mp4	6/1/2015	IR Camera Video Following Dump Event
DECHANT 2E RANCH T3N-R64W-S7 L01 IR VERIFICATION	pdf	6/1/2015	IR Camera Verification Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
DECHANT 2E RANCH T3N-R64W-S7 L01_SIGNED EVAL	pdf	6/29/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT 2E RANCH T3N-R64W-57 L01**

Consent Decree Tank System Number: **389**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**4"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**COMM 200 48"**			
Man. Capacity (MSCFD)	**157**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,746**	**4,747**	**0%**
Calculated Burner Capacity (scfh	**5,069**	**6,542**	
Headspace Surge Capacity (scfh)	**1,738**	**1,738**	
Total VCS Capacity (scfh)	**6,807**	**8,280**	
VCS Capacity minus PPIVF (scfh)	**2,061**	**3,533**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	3/16/2016 & 11/9/2016 & 4/6/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	3/22/2016 & 11/22/2016

LOD ID: **DECHANT 2E RANCH T3N-R64W-57 L01**

Consent Decree Tank System Number: **389**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**17**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**3,720**	**3,720**
Oil Tank Working Rate	**314**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**713**	**713**
Total	**4,747**	**4,746**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT 2E RANCH T3N-R64W-57 L01**

Consent Decree Tank System Number: **389**

Audit Notes

The Original DECHANT 2E RANCH T3N-R64W-S7 - STEM Engineering Evaluation Check.xlsm workbook shows a VOC design tank pressure of 10 oz/in^2 and the modified STEM Engineering Evaluation_rev1_DECHANT 2E RANCH T3N-R64W-S7 L01.xlsm workbook shows a VOC design tank pressure of 13 oz/in^2.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT CORBIN RIVA T3N-R64W-S30 L01**

Consent Decree Tank System Number: **437**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
DECHANT CORBIN RIVA T3N-R64W-S30 L01_FINAL PACKET	pdf	4/30/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
DECHANT CORBIN RIVA T3N-R64W-S30 L01_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_Dechant Riva White	xlsm	4/29/2015	STEM Engineering Design Evaluation Model
STEM Engineering Evaluation_rev1_DECHANT CORBIN RIVA T3N-R64W-S30 L01	xlsm	9/20/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
DECHANT CORBIN RIVA T3N-R64W-S30 L01 COMPLETED REWORK	pdf	8/17/2015	Rework Request
DECHANT CORBIN RIVA T3N-R64W-S30 L01 WORK REQUEST	pdf	NOT DATED	Work Request
DECHANT CORBIN RIVA T3N-R64W-S30 L01_FINAL PACKET	pdf	4/30/2015	Final Facility Packet

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
DECHANT CORBIN RIVA T3N-R64W-S30 L01 WALKDOWN	pdf	4/30/2015	Facility Walkdown
DECHANT CORBIN RIVA T3N-R64W-S30 L01 COMPLETED REWORK	pdf	8/17/2015	Rework Verification

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
DECHANT CORBIN RIVA T3N-R64W-S30 L01 OR VERIFICATION	pdf	5/21/2015	IR Camera Verification Documentation Field Data Sheet
DECHANT CORBIN RIVA T3N-R64W-S30 L01_0752_DUMP	mp4	5/21/2015	IR Camera Video During Dump Event
DECHANT CORBIN RIVA T3N-R64W-S30 L01_0753_POST	mp4	5/21/2015	IR Camera Video Following Dump Event
DECHANT CORBIN RIVA T3N-R64W-S30 L01_0752_NORMAL	mp4	5/21/2015	IR Camera Video During Normal Operations

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
DECHANT CORBIN RIVA T3N-R64W-S30 L01_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Design Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT CORBIN RIVA T3N-R64W-S30 L01**

Consent Decree Tank System Number: **437**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**8**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3"**
# VOC Lines to KO:	**2**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**2" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**TEC 4-CS (48" Tornado**		
Man. Capacity (MSCFD)	**140**	**110.4**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**8,272**	**6,115**	**26%**
Calculated Burner Capacity (scfh	**6,638**	**10,433**	
Headspace Surge Capacity (scfh)	**8,459**	**4,508**	
Total VCS Capacity (scfh)	**15,097**	**14,941**	
VCS Capacity minus PPIVF (scfh)	**6,825**	**8,826**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/5/5016 & 11/9/2016
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	5/11/2016 & 11/22/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT CORBIN RIVA T3N-R64W-S30 L01**

Consent Decree Tank System Number: **437**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**							
Valve Coefficent (gpm/psi) (C_v)	**7.20**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**827**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**93.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**46**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**3,885**	**6,753**
Oil Tank Working Rate	**328**	**568**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**1,902**	**951**
Total	**6,115**	**8,272**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT CORBIN RIVA T3N-R64W-S30 L01**

Consent Decree Tank System Number: **437**

Audit Notes

-According to the Walkdown PDF, the tanks are banked . Two (2) banks total, each bank with four (4) tanks. According to the Signed Eval pdf the tanks are not banked. Evaluation conducted as if the tanks are banked. 8 Tanks were entered into the calculation sheet to account for breathing from all tanks.

-First work request (Pg 5 of the final packet) requests to reduce oil dump valve trim to 1/2" and was confirmed to be completed. Signed evaluation uses oil dump valve trims of 3/4". 1/2" valve trims were used in SLR's calculations. SLR still considers the modeling guideline applied correctly because Noble installed a smaller trim size than used in their calculations.

-Visible VOC's in DECHANT CORBIN RIVA T3N-R64W-S30 L01_0752_DUMP.mp4 This was noted on the IR verification with a note stating "Noble Personnel cleaned and resealed TH gasket, emissions no longer detected."

-The IR video clips are taken from a stationary position, making it difficult to aee the pressure relief devices from the tanks furthest from the camera.

-The facility has uncontrolled actual emissions greater than 50 tpy. Therefore an IR camera inspection is required.
"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original STEM Engineering Evaluation_Dechant Riva White.xlsm and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1_DECHANT CORBIN RIVA T3N-R64W-S30 L01.xlsm file.

UPDATE: Noble agrees that Engineering Evaluation was incorrect. Updated Engineering Evaluation submitted with Noble's Semi-Annual Report (5th) (July 28, 2017).

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT MOSER T3N-R65W-S26 L01**

Consent Decree Tank System Number: **394**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
DECHANT MOSER T3N-R65W-S26 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation
DECHANT MOSER T3N-R65W-S26 L01_FINAL PACKET	pdf	NOT DATED	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
179 - Dechant Moser Work Request	pdf	NOT DATED	Work Request
STEM Engineering Evaluation_Dechant Moser	xlsm	5/21/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_DECHANT MOSER T3N-R65W-S26 L01	xlsm	9/27/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
179 - Dechant Moser Work Request	pdf	NOT DATED	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
DECHANT MOSER T3N-R65W-S26 L01 WALKDOWN	pdf	4/30/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
DECHANT MOSER T3N-R65W-S26 L01 IR VERIFICATION	pdf	5/18/2015	IR Camera Verification Sheet
DECHANT MOSER T3N-R65W-S26 L01_0727_normal	mp4	5/18/2015	IR Camera Video
DECHANT MOSER T3N-R65W-S26 L01_0728_dump	mp4	5/18/2015	IR Camera Video
DECHANT MOSER T3N-R65W-S26 L01_0729_post	mp4	5/18/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
DECHANT MOSER T3N-R65W-S26 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT MOSER T3N-R65W-S26 L01**

Consent Decree Tank System Number: **394**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**6**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**2" & 3/4"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**	**LEED 48" Gen 1 #7**	
Man. Capacity (MSCFD)	**109.272**	**109.272**	**140**	

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**8,747**	**8,748**	**0%**
Calculated Burner Capacity (scfh)	**7,501**	**14,939**	
Headspace Surge Capacity (scfh)	**10,346**	**10,346**	
Total VCS Capacity (scfh)	**17,847**	**25,285**	
VCS Capacity minus PPIVF (scfh)	**9,100**	**16,537**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	5/8/2016 & 11/9/2016 & 4/20/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	5/19/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT MOSER T3N-R65W-S26 L01**

Consent Decree Tank System Number: **394**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.80**							
Valve Coefficent (gpm/psi) (C_v)	**12.20**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**1437**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**162.1**							
Working Flow (Mscfd)[h,i]	**14**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**34**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**6,753**	**6,753**
Oil Tank Working Rate	**569**	**568**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**1,426**	**1,426**
Total	**8,748**	**8,747**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT MOSER T3N-R65W-S26 L01**

Consent Decree Tank System Number: **394**

Audit Notes

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original STEM Engineering Evaluation_Dechant Moser.xlsm and was changed to 12 oz/in^2 in the modified STEM Engineering Evaluation_rev1_DECHANT MOSER T3N-R65W-S26 L01.xlsm file.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT ST T3N-R65W-S36 L01**

Consent Decree Tank System Number: **2213**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
DECHANT ST T3N-R65W-S36 L01_FINAL PACKET	pdf	7/24/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
DECHANT ST T3N-R65W-S36 L01_SIGNED EVAL	pdf	5/26/2015	Signed Engineering Design Evaluation (1/2)
DECHANT ST T3N-R65W-S36 L01_SIGNED EVAL	pdf	5/26/2016	Signed Engineering Design Evaluation (2/2)
STEM Engineering Evaluation_Dechant St 1-36_Oil	xlsm	4/28/2015	Oil Tank VCS STEM Engineering Evaluation
STEM Engineering Evaluation_rev1_DECHANT ST T3N-R65W-S36 L01_Oil.xlsm	xlsm	7/28/2016	Revised Oil Tank VCS STEM Engineering Evaluation
STEM Engineering Evaluation_rev1_DECHANT ST T3N-R65W-S36 L01_Water.xlsm	xlsm	7/28/2016	Revised Water Tank VCS STEM Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
DECHANT ST T3N-R65W-S36 L01 WORK REQUEST	xlsx	NOT DATED	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
DECHANT ST T3N-R65W-S36 L01 WALKDOWN	pdf	4/24/2015	Tank System Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
DECHANT ST T3N-R65W-S36 L01_2290_normal	mp4	5/11/2015	IR Camera Video During Normal Operations
DECHANT ST T3N-R65W-S36 L01_2291_dump	mp4	5/11/2015	IR Camera Video During Dump Event
DECHANT ST T3N-R65W-S36 L01_2292_post	mp4	5/11/2015	IR Camera Video Following Dump Event
DECHANT ST T3N-R65W-S36 L01_SIGNEDVERIFICATION	pdf	5/11/2015	IR Camera Verification Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
DECHANT ST T3N-R65W-S36 L01_SIGNED EVAL	pdf	5/26/2015	Signed Engineering Design Evaluation (1/2)
DECHANT ST T3N-R65W-S36 L01_SIGNED EVAL	pdf	5/26/2016	Signed Engineering Design Evaluation (2/2)

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT ST T3N-R65W-S36 L01**

Consent Decree Tank System Number: **2213**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**6**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**125**	**125**	**125**	**125**	**125**	**125**		
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**		

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): **12**

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**		
Man. Capacity (MSCFD)	**109.272**	**109.272**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**28,699**	**28,719**	**0%**
Calculated Burner Capacity (scfh	**7,799**	**9,106**	
Headspace Surge Capacity (scfh)	**41,867**	**41,400**	
Total VCS Capacity (scfh)	**49,666**	**50,506**	
VCS Capacity minus PPIVF (scfh)	**20,967**	**21,787**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	5/11/2016 & 11/9/2016 & 4/20/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	5/31/2016 & 11/22/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT ST T3N-R65W-S36 L01**

Consent Decree Tank System Number: **2213**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**	**-1.02**	**-1.02**	**-1.02**	**-1.02**		
Z2	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**		
Z3	**0.98**	**0.98**	**0.98**	**0.98**	**0.98**	**0.98**		
Z	**-0.90**	**-0.90**	**-0.90**	**-0.90**	**-0.90**	**-0.90**		
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**	**22.9**	**22.9**	**22.9**	**22.9**		

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**		
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**	**21.25**	**21.25**	**21.25**		
Critical Pressure (psia)[b]	**588**	**588**	**588**	**588**	**588**	**588**		
Vapor Pressure (psia)[c]	**138**	**138**	**138**	**138**	**138**	**138**		
Critical pressure ratio (F_F) [d]	**0.82**	**0.82**	**0.82**	**0.82**	**0.82**	**0.82**		
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**		
Peak Flow (bopd)[f,g]	**3368**	**3368**	**3368**	**3368**	**3368**	**3368**		

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**77.1**	**77.1**	**77.1**	**77.1**	**77.1**	**77.1**		
Working Flow (Mscfd)[h,i]	**32**	**32**	**32**	**32**	**32**	**32**		

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**34**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**19,285**	**19,285**
Oil Tank Working Rate	**8,008**	**7,988**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**1,426**	**1,426**
Total	**28,719**	**28,699**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT ST T3N-R65W-S36 L01**

Consent Decree Tank System Number: **2213**

Audit Notes

- Field Datasheet system sketch (FINAL PACKET p. 7) shows water tanks and oil tanks with separate headers except that the one combustor that the water header feeds is also fed one of the three combustors fed by the oil header. As a conservative approach, SLR ran calculations assuming that the oil header used none of the shared combustor capacity and the water header used all of the shared burner capacity.

-This facility has actual uncontrolled VOC emissions greater than 50 tpy. Therefore an IR inspection is required. "VOC Design Tank Pressure" was originally 11 oz/in^2 in the original STEM Engineering Evaluation_Dechant St 1-36_Oil.xlsm and was changed to 12 oz/in^2 in the modified STEM Engineering Evaluation_rev1_DECHANT ST T3N-R65W-S36 L01_Oil.xlsm file.

UPDATE: Noble confirmed accuracy of existing Engineering Evaluation. Per Appendix B of Draft Report, Noble considers a burner capacity of 7,860 scfh, whereas SLR considered a burner capacity of 9,106 scfh.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT T2N-R64W-S19 L01**

Consent Decree Tank System Number: **438**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
DECHANT T2N-R64W-S19 L01_FINAL PACKET	pdf	NOT DATED	Final Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
DECHANT T2N-R64W-S19 L01_SIGNED EVAL	pdf	5/26/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_Dechant 2 well HZ	xlsm	5/22/2015	Engineering Evalualtion
STEM Engineering Evaluation_rev1_DECHANT T2N-R64W-S19 L01	xlsm	9/20/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
DECHANT T2N-R64W-S19 L01_FINAL PACKET	pdf	NOT DATED	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
DECHANT T2N-R64W-S19 L01 WALKDOWN	pdf	4/30/2015	Tank System Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
DECHANT T2N-R64W-S19 L01_2298_normal			IR Inspection Video
DECHANT T2N-R64W-S19 L01_2299_dump			IR Inspection Video
DECHANT T2N-R64W-S19 L01_2300_post			IR Inspection Video
DECHANT T2N-R64W-S19 L01_SIGNEDVERIFICATION	pdf	5/7/2015	IR Camera Verification Documentation and Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
DECHANT T2N-R64W-S19 L01_SIGNED EVAL	pdf	5/26/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT T2N-R64W-S19 L01**

Consent Decree Tank System Number: **438**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**6**	**2**
Oil Tank Capacity (bbl):	**300**	**400**
# of Water Tanks:	**0**	
Water Tank Capacity (bbl):	**0**	
VOC Line Size (in):	**3**	
# VOC Lines to KO:	**1**	
# VOC Lines to Burner:	**1**	

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**	**70**						
Dump Valve Size & Trim Size (in)	**2" & 3/4"**	**2" & 3/4"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**COMM 200 48"**		
Man. Capacity (MSCFD)	**140**	**157**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**16,543**	**16,704**	**1%**
Calculated Burner Capacity (scfh)	**6,258**	**12,375**	
Headspace Surge Capacity (scfh)	**41,483**	**47,801**	
Total VCS Capacity (scfh)	**47,741**	**60,176**	
VCS Capacity minus PPIVF (scfh)	**31,198**	**43,472**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	5/8/2016 & 11/9/2016 & 4/20/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	5/31/2016 & 11/22/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT T2N-R64W-S19 L01**

Consent Decree Tank System Number: **438**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**	**0.77**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**0.89**	**0.89**						
Gas/Oil Ratio (scf/bbl)	**112.8**	**112.8**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.80**	**0.80**						
Valve Coefficent (gpm/psi) (C_v)	**12.20**	**12.20**						
Critical Pressure (psia)[b]	**539**	**539**						
Vapor Pressure (psia)[c]	**83**	**83**						
Critical pressure ratio (F_F) [d]	**0.85**	**0.85**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**1437**	**1437**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**162.1**	**162.1**						
Working Flow (Mscfd)[h,i]	**14**	**14**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Oil Tanks	Water Tanks
scfh air/tank	**300**	**400**	**0**
scfh vapor/tank[i]	**238**	**317**	**0**
Mscfd	**34**	**15**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**13,505**	**13,505**
Oil Tank Working Rate	**1,139**	**1,136**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**2,060**	**1,902**
Total	**16,704**	**16,543**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT T2N-R64W-S19 L01**

Consent Decree Tank System Number: **438**

Audit Notes

- IR Camera Verification videographer indicates that VOC emissions were observed during the dump event. (SIGNEDVERIFICATION) Notes report that the leak source was determined to be Thief Hatch assembly adapter plate.

-There are 8 oil tanks on site (2 x 400 bbl and 6 x 300 bbl). Noble modeled with eight 300 bbl tanks. The tanks were entered separately onto the vapor headspace surge capacity check sheet to account for the various sizes (the 300 bbl tanks into the oil tank spaces and the 400 bbl tanks into the water tank spaces). The result is breathing losses and Headspace surge capacity were underestimated. Because the increase in surge capacity is larger than the increase in breathing losses SLR has determined that both the modeling guideline and engineering design standard were applied correctly.

-Work request states to install a second burner to control the tanks and the burner can bea Cimarron 48HV, Tornado 48 or COMM 48. Noble used a Cimarron 48HV in the final signed eval. A COMM 48 was installed which has a higher capacity than a Cimarron 48 HV and the engineering design standard was still determined to be applied correctly.

-This site has actual uncontrolled actual VOC emission greater than 50 tpy. Therefore an IR inspection is required.
The "Tank % Full" is 82% in the original STEM Engineering Evaluation_Dechant 2 well HZ.xlsm and was changed to 83% in the modified STEM Engineering Evaluation_rev1_DECHANT T2N-R64W-S19 L01.xlsm file. This minor change did not change the determination that the engineering design standard was applied correctly.

UPDATE: Noble agrees that Engineering Evaluation was incorrect due to data entry error ((2) 400 bbl + (6) 300 bbl tanks misrepresented as (8) 300 bbl in evaluation). An updated Engineering Evaluation was generated and a revised COCR submitted with Noble's Semi-Annual Report (6th) (January 29, 2018).

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT T2N-R65W-S1 L01**

Consent Decree Tank System Number: **2357**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
DECHANT T2N-R65W-S1 L01_Final Packet	PDF	7/13/2016	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
DECHANT T2N-R65W-S1 L01_SIGNED EVAL	PDF	5/22/2015	Engineering Evaluation
STEM Design Guide_Dechant 37N EW HZ_Oil_Base	xlsm	4/17/2015	Tank VOC Analysis
STEM Design Guide_Dechant 37N EW HZ_Water_Base	xlsm	4/17/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_DECHANT T2N-R65W-S1 L01_Oil.xlsm	xlsm	9/20/2016	Revised Tank VOC Analysis (Oil)
STEM Engineering Evaluation_rev1_DECHANT T2N-R65W-S1 L01_Water.xlsm	xlsm	9/20/2016	Revised Tank VOC Analysis (Water)
Attachment A - STEM Engineering Evaluation_rev1_DECHANT T2N-R65W-S1 L01.xlsm	xlsm	6/28/2017	Revised Tank VOC Analysis w/ TLO

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
0067 - Dechant 37N-EW1HZ Work Request	PDF	No Date	Work Request
DECHANT T2N-R65W-S1 L01_Final Packet	PDF	7/13/2016	Work Request
Noble 3rd Party Audit Wave 12 Update Info Request_20170117	pdf	1/17/2017	Noble Info Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
DECHANT T2N-R65W-S1 L01 WALKDOWN	PDF	4/30/2016	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
DECHANT T2N-R65W-S1 L01_SIGNEDVERIFICATION	PDF	5/11/2015	IR Camera Verification Sheet
DECHANT T2N-R65W-S1 L01_2293_normal	MP4	5/11/2015	IR Camera Video
DECHANT T2N-R65W-S1 L01_2295_dump	MP4	5/11/2015	IR Camera Video
DECHANT T2N-R65W-S1 L01_2297_post	MP4	5/11/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
DECHANT T2N-R65W-S1 L01_SIGNED EVAL	PDF	5/22/2015	Signed Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT T2N-R65W-S1 L01**

Consent Decree Tank System Number: **2357**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**2**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	
Water Tank Capacity (bbl):	
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**125**	**125**	**125**					
Dump Valve Size & Trim Size (in)	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**					

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

Truck Loadout Vapor Collection Installed? ☑ Yes ☐ No

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**Cimarron 48 HV**		
Man. Capacity (MSCFD)	**140**	**109.272**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**7,683**	**8,637**	**12%**
Calculated Burner Capacity (scfh	**6,149**	**10,386**	
Headspace Surge Capacity (scfh)	**3,556**	**3,556**	
Total VCS Capacity (scfh)	**9,705**	**13,942**	
VCS Capacity minus PPIVF (scfh)	**2,022**	**5,305**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Angela M. Oberlander
Audit Document Review Date:	7/3/2018
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	7/3/2018

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT T2N-R65W-S1 L01**

Consent Decree Tank System Number: **2357**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**	**-1.02**					
Z2	**-0.86**	**-0.86**	**-0.86**					
Z3	**0.98**	**0.98**	**0.98**					
Z	**-0.90**	**-0.90**	**-0.90**					
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**	**22.9**					

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**	**0.78**	**0.78**					
Valve Coefficent (gpm/psi) (C_v)	**7.20**	**7.20**	**7.20**					
Critical Pressure (psia)[b]	**588**	**588**	**588**					
Vapor Pressure (psia)[c]	**138**	**138**	**138**					
Critical pressure ratio (F_F) [d]	**0.82**	**0.82**	**0.82**					
Choked Flow?[e]	**Yes**	**Yes**	**Yes**					
Peak Flow (bopd)[f,g]	**1156**	**1156**	**1156**					

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**26.5**	**26.5**	**26.5**					
Working Flow (Mscfd)[h,i]	**11**	**11**	**11**					

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	
scfh vapor/tank[i]	**238**	
Mscfd	**34**	

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**3,310**	**3,310**
Oil Tank Working Rate	**1,374**	**1,371**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**1,426**	**475**
Truck Vent Capture Rate	**2,527**	**2,527**
Total	**8,637**	**7,683**

LOD ID: **DECHANT T2N-R65W-S1 L01**

Consent Decree Tank System Number: **2357**

Audit Notes

-Facility walkdown checklist (DECHANT T2N-R65W-S1 L01 WALKDOWN.pdf) indicates there are two oil production tanks in one bank, four in another for a total of six oil production tanks. The pre-evaluation documentation (DECHANT T2N-R65W-S1 L01_Final Packet.pdf) indicates there are three in one bank, four in the other, for a total of seven oil production tanks. The engineering evaluation(DECHANT T2N-R65W-S1 L01_SIGNED EVAL.pdf) indicates the tanks are not in a banked configuration, but there are seven total oil production tanks. It was assumed the walkdown information is correct and that there are six oil production tanks total. It was assumed the tanks are in a banked configuration of one bank of two, and one bank of four for the audit. Noble corrected the evaluation to account for the surge capacity from only 2 tanks in "STEM Engineering Evaluation_rev1_DECHANT T2N-R65W-S1 L01_Oil.xlsm provided on 10/28/2016.

-6 oil tanks and were included in SLR calculations to account for breathing from all tanks. Headspace surge capacity was calculated based on a the bank of 2 oil production tanks.

-Rework requests to "Add camlock and cap fittings to truck vent capture line." It is unclear as to whether the load out capture ties into the VCS. As a conservative approach SLR included truck vent capture line flow rate based on the information provided by Noble on 4/20/2017.

-Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

UPDATE: Noble revised its PPIVFR determinations to include TLO vapors. Noble completed Engineering Evaluations and submitted a revised COCR with its Semi-Annual Reports (5th) (July 28, 2017) and (6th) (January 29, 2018). Noble provided revised Engineering Evaluation to SLR on May 10, 2018.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide

UPDATE: Noble agrees that Engineering Evaluation was incorrect. Updated Engineering Evaluation was generated and submitted with Noble's Semi-Annual Report (6th) (January 29, 2018).

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT T3N-R64W-S31**

Consent Decree Tank System Number: **424**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
DECHANT T3N-R64W-S31 L01_FINAL PACKET	pdf	5/22/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
DECHANT T3N-R64W-S31 L01_SIGNED EVAL	pdf	7/9/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_rev1_DECHANT T3N-R64W-S31 L01	xlsm	7/28/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
DECHANT T3N-R64W-S31 L01 WORK REQUEST	pdf	5/12/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
DECHANT T3N-R64W-S31 L01 WALKDOWN	pdf	6/4/2015	Tank System Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
DECHANT T3N-R64W-S31 L01_0225_NORMAL	mp4	6/4/2016	IR Inspection Video During Normal Operations
DECHANT T3N-R64W-S31 L01_0226_DUMP	mp4	6/4/2015	IR Inspection Video During Dump Event
DECHANT T3N-R64W-S31 L01_0227_POST	mp4	6/4/2015	IR Inspection Video Following Dump Event
DECHANT T3N-R64W-S31 L01 IR VERIFICATION	pdf	6/4/2015	IR Camera Verification Documentation and Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
DECHANT T3N-R64W-S31 L01_SIGNED EVAL	pdf	7/9/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT T3N-R64W-S31**

Consent Decree Tank System Number: **424**

☐ Yes ☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes ☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**4**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**80**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**COMM 200 48"**			
Man. Capacity (MSCFD)	**157**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,984**	**5,917**	**19%**
Calculated Burner Capacity (scfh	**4,854**	**6,542**	
Headspace Surge Capacity (scfh)	**6,793**	**7,133**	
Total VCS Capacity (scfh)	**11,647**	**13,675**	
VCS Capacity minus PPIVF (scfh)	**6,663**	**7,758**	

☑ Yes ☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes ☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes ☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes ☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	4/11/2016 & 11/17/2016
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	4/13/2016 & 11/28/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT T3N-R64W-S31**

Consent Decree Tank System Number: **424**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.92**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**1.03**							
Gas/Oil Ratio (scf/bbl)	**130.1**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor	**0.94**							
Valve Coefficent (gpm/psi) (	**5.72**							
Critical Pressure (psia)[b]	**548**							
Vapor Pressure (psia)[c]	**93**							
Critical pressure ratio (F_F) [d]	**0.84**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**854**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**111.1**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor								
Valve Coefficent (gpm/psi) (								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**23**	**0**

Flow Rate Summary	**Flow Rate (scfh)**	
	SLR	**Noble**
Oil Tank Flash Rate	**4,628**	**3,720**
Oil Tank Working Rate	**338**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**951**	**951**
Total	**5,917**	**4,984**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DECHANT T3N-R64W-S31**

Consent Decree Tank System Number: **424**

Audit Notes

-Signed eval calls for LP separator to be set at 70 psig max. Workorder calls for PSHH to be installed and set at 80 psig. (FINAL PACKET p. 9, SIGNED EVAL p. 1). Calcs were run using 80 psig to be conservative.

UPDATE: Noble confirmed accuracy of existing Engineering Evaluation. Automation standard practice sets shut-in pressure no higher than 70 psig.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DICKENS T5N-R65W-S32 L01**

Consent Decree Tank System Number: **269**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
DICKENS T5N-R65W-S32 L01_FINAL PACKET	pdf	6/10/2015	Facility Final Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
DICKENS T5N-R65W-S32 L01_SIGNED EVAL	pdf	6/29/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_rev1_DICKENS T5N-R65W-S32 L01	xlsm	7/28/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
DICKENS T5N-R65W-S32 L01 WORK REQUEST	pdf	5/11/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
DICKENS T5N-R65W-S32 L01 WALKDOWN	pdf	6/1/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
DICKENS T5N-R65W-S32 L01_0190_NORMAL	mp4	6/1/2015	IR Inspection Video During Normal Operations
DICKENS T5N-R65W-S32 L01_0191_DUMP	mp4	6/1/2015	IR Inspection Video During Dump Event
DICKENS T5N-R65W-S32 L01_0193_POST	mp4	6/1/2015	IR Inspection Video Following Dump Event
DICKENS T5N-R65W-S32 L01 IR VERIFICATION	pdf	6/1/2015	IR Camera Verification Documentation and Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
DICKENS T5N-R65W-S32 L01_SIGNED EVAL	pdf	6/29/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DICKENS T5N-R65W-S32 L01**

Consent Decree Tank System Number: **269**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**			
Man. Capacity (MSCFD)	**109.272**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,746**	**4,747**	**0%**
Calculated Burner Capacity (scfh	**3,763**	**4,553**	
Headspace Surge Capacity (scfh)	**3,315**	**3,315**	
Total VCS Capacity (scfh)	**7,078**	**7,868**	
VCS Capacity minus PPIVF (scfh)	**2,332**	**3,121**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	3/20/2016 & 11/10/2016 & 4/20/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	3/25/2016 & 11/28/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DICKENS T5N-R65W-S32 L01**

Consent Decree Tank System Number: **269**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**17**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**3,720**	**3,720**
Oil Tank Working Rate	**314**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**713**	**713**
Total	**4,747**	**4,746**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DICKENS T5N-R65W-S32 L01**

Consent Decree Tank System Number: **269**

Audit Notes

"VOC Design Tank Pressure" was originally 11 oz/in^2 in the original DICKENS T5N-R65W-S32 L01 - Tank System Audit Checklist Rev 1.xlsx and was changed to 12 oz/in^2 in the modified STEM Engineering Evaluation_rev1_DICKENS T5N-R65W-S32 L01.xlsm file.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DUKE T5N-R66W-S4 L01**

Consent Decree Tank System Number: **13**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
DUKE T5N-R66W-S4 L01_FINAL PACKET	pdf	7/24/2015	Signed Engineering Design Evaluation

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
DUKE T5N-R66W-S4 L01_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_Duke	xlsm	4/29/2015	Engineering Evaluation Worksheet
STEM Engineering Evaluation_rev1_DUKE T5N-R66W-S4 L01	xlsm	9/21/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
DUKE T5N-R66W-S4 L01 WORK REQUEST	xlsx	4/17/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
DUKE T5N-R66W-S4 L01 WALKDOWN	pdf	4/26/2015	Tank System Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
DUKE T5N-R66W-S4 L01_2225_normal	mp4	5/4/2015	IR Inspection Video During Normal Operations
DUKE T5N-R66W-S4 L01_2228_dump	mp4	5/4/2015	IR Inspection Video During Dump Event
DUKE T5N-R66W-S4 L01_2229_post	mp4	5/4/2015	IR Inspection Video Following Dump Event
DUKE T5N-R66W-S4 L01_signedverification	pdf	5/4/2015	IR Camera Verification Documentation and Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
DUKE T5N-R66W-S4 L01_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DUKE T5N-R66W-S4 L01**

Consent Decree Tank System Number: **13**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**4**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**65**	**65**						
Dump Valve Size & Trim Size (in)	**1" & 1/2"**	**1" & 1/2"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**TEC 4-CS (48" Tornado**	**COMM 200 48"**		
Man. Capacity (MSCFD)	**110.4**	**157**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**8,165**	**8,166**	**0%**
Calculated Burner Capacity (scfh)	**7,339**	**11,142**	
Headspace Surge Capacity (scfh)	**4,158**	**4,158**	
Total VCS Capacity (scfh)	**11,497**	**15,300**	
VCS Capacity minus PPIVF (scfh)	**3,332**	**7,133**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	5/8/2016 & 11/10/2016 & 4/20/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	6/1/2016 & 11/28/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DUKE T5N-R66W-S4 L01**

Consent Decree Tank System Number: **13**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.69**	**0.69**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**0.81**	**0.81**						
Gas/Oil Ratio (scf/bbl)	**104.5**	**104.5**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)[j]	**0.94**	**0.94**						
Valve Coefficent (gpm/psi) (C_v)	**5.72**	**5.72**						
Critical Pressure (psia)[b]	**535**	**535**						
Vapor Pressure (psia)[c]	**78**	**78**						
Critical pressure ratio (F_F) [d]	**0.85**	**0.85**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**760**	**760**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**79.4**	**79.4**						
Working Flow (Mscfd)[h,i]	**7**	**7**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**23**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**6,613**	**6,613**
Oil Tank Working Rate	**602**	**601**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**951**	**951**
Total	**8,166**	**8,165**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DUKE T5N-R66W-S4 L01**

Consent Decree Tank System Number: **13**

Audit Notes

- Walkdown checklist (FINAL PACKET p. 3) is dated but not signed.

-The facility has actual uncontrolled VOC emissions greater than 50 tpy. Therefore an IR inspection is required.

"VOC Design Tank Pressure" was originally 11 oz/in^2 in the originalSTEM Engineering Evaluation_Duke.xlsm and was changed to 12 oz/in^2 in the modified STEM Engineering Evaluation_rev1_DUKE T5N-R66W-S4 L01.xlsm file.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DYER T6N-R64W-S2 L01**

Consent Decree Tank System Number: **1630**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
DYER T6N-R64W-S2 L01_FINAL PACKET	pdf	12/14/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
DYER T6N-R64W-S2 L01_SIGNED EVAL	pdf	12/18/2015	Engineering Evaluation
DYER T6N-R64W-S2 L01_STEM Engineering Evaluation	xlsm	4/28/2015	Tank VOC Analysis
DYER T6N-R64W-S2 L01 - Tank System Audit Checklist	pdf	5/15/2017	Revised Engineering Evaluation
STEM Engineering Evaluation_rev1_DYER T6N-R64W-S2 L01	xlsm	5/16/2017	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
DYER T6N-R64W-S2 L01_WORK REQUEST	pdf	8/20/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
DYER T6N-R64W-S2 L01_WALKDOWN	pdf	12/9/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
DYER T6N-R64W-S2 L01_0495_NORMAL	mp4	12/9/2015	IR Camera Video
DYER T6N-R64W-S2 L01_0496_DUMP	mp4	12/9/2015	IR Camera Video
DYER T6N-R64W-S2 L01_0497_POST	mp4	12/9/2015	IR Camera Video
DYER T6N-R64W-S2 L01_IR VERIFICATION	pdf	12/9/2015	IR Camera Verification Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
DYER T6N-R64W-S2 L01_SIGNED EVAL	pdf	12/18/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DYER T6N-R64W-S2 L01**

Consent Decree Tank System Number: **1630**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**2**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**4**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**60**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**			
Man. Capacity (MSCFD)	**140**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**3,682**	**3,683**	**0%**
Calculated Burner Capacity (scfh	**2,957**	**5,833**	
Headspace Surge Capacity (scfh)	**2,178**	**2,268**	
Total VCS Capacity (scfh)	**5,135**	**8,101**	
VCS Capacity minus PPIVF (scfh)	**1,453**	**4,419**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	12/1/2016
Audit Document Review Verified by:	Angela M. Oberlander & James Van Horne
Audit Document Verification Date:	12/5/2016 & 6/27/2017

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DYER T6N-R64W-S2 L01**

Consent Decree Tank System Number: **1630**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.61**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.72**							
Gas/Oil Ratio (scf/bbl)	**96.4**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**530**							
Vapor Pressure (psia)[c]	**73**							
Critical pressure ratio (F_F) [d]	**0.86**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**727**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**70.1**							
Working Flow (Mscfd)[h,i]	**7**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**11**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**2,919**	**2,919**
Oil Tank Working Rate	**288**	**287**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**475**	**475**
Total	**3,683**	**3,682**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **DYER T6N-R64W-S2 L01**

Consent Decree Tank System Number: **1630**

Audit Notes

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **EACHUS FRUMAN RITCHEY T3N-R65W-S23 L01**

Consent Decree Tank System Number: **2297**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
EACHUS FRUMAN RITCHEY T3N-R65W-S23 L01_FINAL PACKET	pdf	6/10/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
EACHUS FRUMAN RITCHEY T3N-R65W-S23 L01_SIGNED EVAL	pdf	6/26/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_rev1_EACHUS FRUMAN RITCHEY T3N-R65W-S23 L01	xlsm	7/28/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
EACHUS FRUMAN RITCHEY T3N-R65W-S23 L01 WORK REQUEST	pdf	5/8/2015	Work Request
EACHUS FRUMAN RITCHEY T3N-R65W-S23 L01 REWORK REQUEST	pdf	10/1/2015	Rework Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
EACHUS FRUMAN RITCHEY T3N-R65W-S23 L01 WALKDOWN	pdf	6/9/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
EACHUS FRUMAN RITCHEY T3N-R65W-S23 L01_0240_NORMAL	mp4	6/9/2015	IR Inspection Video During Normal Operations
EACHUS FRUMAN RITCHEY T3N-R65W-S23 L01_0241_DUMP	mp4	6/9/2015	IR Inspection Video During Dump Event
EACHUS FRUMAN RITCHEY T3N-R65W-S23 L01_0242_POST	mp4	6/9/2015	IR Inspection Video Following Dump Event
EACHUS FRUMAN RITCHEY T3N-R65W-S23 L01 IR VERIFICATION	pdf	6/9/2015	IR Camera Verification Documentation and Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
EACHUS FRUMAN RITCHEY T3N-R65W-S23 L01_SIGNED EVAL	pdf	6/26/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **EACHUS FRUMAN RITCHEY T3N-R65W-S23 L01**

Consent Decree Tank System Number: **2297**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**COMM 200 48"**			
Man. Capacity (MSCFD)	**157**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,746**	**4,747**	**0%**
Calculated Burner Capacity (scfh	**4,906**	**6,542**	
Headspace Surge Capacity (scfh)	**5,287**	**5,287**	
Total VCS Capacity (scfh)	**10,193**	**11,829**	
VCS Capacity minus PPIVF (scfh)	**5,447**	**7,082**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	3/21/2016 & 11/10/2016 & 4/20/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	3/28/2016 & 11/26/2016

SLR

LOD ID: **EACHUS FRUMAN RITCHEY T3N-R65W-S23 L01**
Consent Decree Tank System Number: **2297**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**17**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**3,720**	**3,720**
Oil Tank Working Rate	**314**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**713**	**713**
Total	**4,747**	**4,746**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **EACHUS FRUMAN RITCHEY T3N-R65W-S23 L01**

Consent Decree Tank System Number: **2297**

Audit Notes

-An email from from an Automation Tech dated May 22, 2015 indicates that a pressure switch was installed and set to trip at 70 lbs. The work order requests that the LP separator PSHH be set to 80 psi. Rework request dated October 1, 2015 requests that PSHH be set to 70 psi. (REWORK REQUEST)

-An email from Automation Support dated May 26, 2015 indicates a stuck motor valve on Eachus 5-23. Automation QC tests still passed.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **EAGLE RELIANCE SENECA TAHOMA ECONODE T6N-R65W-S14 L01**

Consent Decree Tank System Number: **2342**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
EAGLE RELIANCE SENECA TAHOMA ECONODE T6N-R65W-S14 L01_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Design Evaluation 1/2
EAGLE RELIANCE SENECA TAHOMA ECONODE T6N-R65W-S14 L01_SIGNED EVAL	pdf	5/26/2015	Signed Engineering Design Evaluation 2/2
EAGLE RELIANCE SENECA TAHOMA ECONODE T6N-R65W-S14 L01 2016 Audit Document Request	pdf	4/29/2016	Combustor Configuration Clarification

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
STEM Engineering Evaluation_rev0_Eagle EcoNode_Oil	xlsx	4/15/2015	STEM Engineering Evaluation for Oil Tanks
STEM Engineering _rev1_EAGLE RELIANCE T6N-R65W-S14 L01_Oil	xlsx	9/20/2016	Revised Engineer Evaluation (Oil)
STEM Engineering _rev1_EAGLE RELIANCE T6N-R65W-S14 L01_Water	xlsx	9/20/2016	Revised Engineer Evaluation (Water)
Attachment C - STEM Eng Eval_rev1_EAGLE RELIANCE SENECA TAHOMA ECONODE _Oil.xlsm	xlsx	9/21/2016	Revised Engineer Evaluation (Oil) 2

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
EAGLE RELIANCE SENECA TAHOMA ECONODE T6N-R65W-S14 L01 WALKDOWN	pdf	4/23/2015	Tank System Walkdown Checklist
Noble 3rd Party Audit Wave 12 Update Info Request_20170117	pdf	1/17/2017	Noble Info Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
EAGLE RELIANCE SENECA TAHOMA ECONODE T6N-R65W-S14 L01 WALKDOWN	pdf	4/23/2015	Tank System Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
EAGLE RELIANCE SENECA TAHOMA ECONODE T6N-R65W-S14 L01_2268_normal	mp4	5/5/2015	IR Inspection Video
EAGLE RELIANCE SENECA TAHOMA ECONODE T6N-R65W-S14 L01_2270_dump	mp4	5/5/2015	IR Inspection Video
EAGLE RELIANCE SENECA TAHOMA ECONODE T6N-R65W-S14 L01_2271_post	mp4	5/5/2015	IR Inspection Video
EAGLE RELIANCE SENECA TAHOMA ECONODE T6N-R65W-S14 L01_SIGNEDVERIFICATION	pdf	5/5/2015	IR Camera Verification Documentation and Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
EAGLE RELIANCE SENECA TAHOMA ECONODE T6N-R65W-S14 L01_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Design Evaluation 1/2
EAGLE RELIANCE SENECA TAHOMA ECONODE T6N-R65W-S14 L01_SIGNED EVAL	pdf	5/26/2015	Signed Engineering Design Evaluation 2/2

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **EAGLE RELIANCE SENECA TAHOMA ECONODE T6N-R65W-S14 L01**

Consent Decree Tank System Number: **2342**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**18**
Oil Tank Capacity (bbl):	**500**
# of Water Tanks:	
Water Tank Capacity (bbl):	
VOC Line Size (in):	**4**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10	Vessel 11
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10	Vessel 11
Max Operating Pressure (psig)											
Dump Valve Size & Trim Size (in)											

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig) 12

	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	
Man. Capacity (MSCFD)	**140**	**140**	**140**	**140**	

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**106,077**	**109,718**	**3%**
Calculated Burner Capacity (scfh)	**7,866**	**23,333**	
Headspace Surge Capacity (scfh)	**364,996**	**364,996**	
Total VCS Capacity (scfh)	**372,862**	**388,329**	
VCS Capacity minus PPIVF (scfh)	**266,785**	**278,611**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	5/11/2016 & 11/10/2016 & 4/20/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	7/1/2016 & 11/28/2016

SLR

LOD ID: **EAGLE RELIANCE SENECA TAHOMA ECONODE T6N-R65W-S14 L01**

Consent Decree Tank System Number: **2342**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10	Vessel 11
Z1	-1.02	-1.02	-1.02	-1.02	-1.02	-1.02	-1.02	-1.02	-1.02	-1.02	-1.02
Z2	-0.86	-0.86	-0.86	-0.86	-0.86	-0.86	-0.86	-0.86	-0.86	-0.86	-0.86
Z3	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Z	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90
Gas/Oil Ratio (scf/bbl)	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10	Vessel 11
Valve Press Recovery Factor (C_f)	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77
Valve Coefficent (gpm/psi) (C_v)	21.25	21.25	21.25	21.25	21.25	21.25	21.25	21.25	21.25	21.25	21.25
Critical Pressure (psia)[b]	833	833	833	833	833	833	833	833	833	833	833
Vapor Pressure (psia)[c]	407	407	407	407	407	407	407	407	407	407	407
Critical pressure ratio (F_F) [d]	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Choked Flow?[e]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Peak Flow (bopd)[f,g]	6905	6905	6905	6905	6905	6905	6905	6905	6905	6905	6905

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10	Vessel 11
Flash Flow (Mscfd)	158.2	158.2	158.2	158.2	158.2	158.2	158.2	158.2	158.2	158.2	158.2
Working Flow (Mscfd)[h,i]	66	66	66	66	66	66	66	66	66	66	66

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10	Vessel 11
Valve Press Recovery Factor (C_f)											
Valve Coefficent (gpm/psi) (C_v)											
Critical Pressure (psia)[j]											
Vapor Pressure (psia)[k]											
Critical pressure ratio (F_F)[d]											
Choked Flow?[e]											
Peak Flow (bwpd)[f,g]											

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10	Vessel 11
Flash Flow (Mscfd)											
Working Flow (Mscfd)[l]											

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	500	
scfh vapor/tank[i]	396	
Mscfd	171	

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	72,487	72,487
Oil Tank Working Rate	30,099	30,024
Water Tank Flash Rate	0	0
Water Tank Working Rate	0	0
Tank Breathing Rate	7,132	3,566
Total	109,718	106,077

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **EAGLE RELIANCE SENECA TAHOMA ECONODE T6N-R65W-S14 L01**

Consent Decree Tank System Number: **2342**

Audit Notes

-Noble did not account for breathing loses from both tank banks. All 18 oil tanks were included in SLR's analysis to account for breathing losses from those tanks.
-The facility has uncontrolled actual emissions greater than 50 tpy and therefore an IR inspection is required.
"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original STEM Engineering Evaluation_rev0_Eagle EcoNode_Oil.xlsm and was changed to 12 oz/in^2 in the modified STEM Engineering _rev1_EAGLE RELIANCE T6N-R65W-S14 L01_Oil.xlsm file.

The modified STEM Engineering _rev1_EAGLE RELIANCE T6N-R65W-S14 L01_Oil.xlsm file indicates there are 19 - 500 bbl oil tanks on site (one bank of 9 tanks and one bank of 10 tanks). The orginal STEM Engineering Evaluation_rev0_Eagle EcoNode_Oil.xlsm indicated there were 18 - 500 bbl tanks on site (two banks, each with 9 tanks). Noble confirmed via a data request there are 18 tanks onsite.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **EHRLICH T4N-R67W-S23 L02 (OIL)**

Consent Decree Tank System Number: **170**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
EHRLICH T4N-R67W-S23 L02_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Evaluation
STEM Engineering Evaluation_Ehrlich PC O23_Oil	xlsm	5/22/2015	STEM Engineering Evaluation Spreadsheet for Oil Tanks
STEM Engineering Evaluation_rev1_EHRLICH T4N-R67W-S23 L02_Oil.xlsm	xlsm	7/28/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
EHRLICH T4N-R67W-S23 L02 DESIGN PACKET	pdf	7/13/2015	Oil Tank Work Request and Engineering Drawings
Noble 3rd Party Audit Wave 12 Update Info Request_20170117	pdf	1/17/2017	Noble Info Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
EHRLICH T4N-R67W-S23 L02 WALKDOWN	pdf	5/6/2015	Final Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
EHRLICH T4N-R67W-S23 L02 IR VERIFICATION	pdf	5/21/2015	IR Verification Field Form
EHRLICH T4N-R67W-S23 L02_0761_normal	mp4	5/21/2015	IR Camera Video during Normal Operations
EHRLICH T4N-R67W-S23 L02_0762_dump	mp4	5/21/2015	IR Camera Video during Dump Event
EHRLICH T4N-R67W-S23 L02_0761_post	mp4	5/21/2015	IR Camera Video after Dump Event

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
EHRLICH T4N-R67W-S23 L02_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **EHRLICH T4N-R67W-S23 L02 (OIL)**

Consent Decree Tank System Number: **170**

☐ Yes ☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes ☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**4**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**125**	**300**	**300**					
Dump Valve Size & Trim Size (in)	**1" & 1/2"**	**1" & 1/2"**	**1" & 1/2"**					

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**			
Man. Capacity (MSCFD)	**109.272**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**7,505**	**7,510**	**0%**
Calculated Burner Capacity (scfh	**3,740**	**4,553**	
Headspace Surge Capacity (scfh)	**36,462**	**36,462**	
Total VCS Capacity (scfh)	**40,202**	**41,015**	
VCS Capacity minus PPIVF (scfh)	**32,697**	**33,505**	

☑ Yes ☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes ☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ **Yes** ☐ **No**	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF)
☑ Yes ☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	7/20/2016 & 11/10/2016 & 1/31/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	8/5/2016 & 11/28/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **EHRLICH T4N-R67W-S23 L02 (OIL)**

Consent Decree Tank System Number: **170**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**	**-1.02**					
Z2	**-0.86**	**-0.86**	**-0.86**					
Z3	**0.98**	**0.98**	**0.98**					
Z	**-0.90**	**-0.90**	**-0.90**					
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**	**22.9**					

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor	**0.94**	**0.94**	**0.94**					
Valve Coefficent (gpm/psi) (	**5.72**	**5.72**	**5.72**					
Critical Pressure (psia)[b]	**588**	**744**	**744**					
Vapor Pressure (psia)[c]	**138**	**313**	**313**					
Critical pressure ratio (F_F) [d]	**0.82**	**0.78**	**0.78**					
Choked Flow?[e]	**Yes**	**Yes**	**Yes**					
Peak Flow (bopd)[f,g]	**1107**	**1875**	**1875**					

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**25.3**	**42.9**	**42.9**					
Working Flow (Mscfd)[h,i]	**11**	**18**	**18**					

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor								
Valve Coefficent (gpm/psi) (								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**23**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**4,635**	**4,635**
Oil Tank Working Rate	**1,924**	**1,920**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**951**	**951**
Total	**7,510**	**7,506**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **EHRLICH T4N-R67W-S23 L02 (OIL)**

Consent Decree Tank System Number: **170**

Audit Notes

-There is no documentation confirming the size or trim of the oil dump valves. Final Evaluation (EHRLICH T4N-R67W-S23 L02_SIGNED EVAL.pdf) was run with 1" valve trims and was changed to a 1" valve with 1/2" trim in the modified STEM Engineering Evaluation_rev1_EHRLICH T4N-R67W-S23 L02_Oil.xlsm file. Noble confirmed via a data request on 1/17/2017 that the dump valve sizes is a 1" valve with a 1/2" trim.

-The walkdown (EHRLICH T4N-R67W-S23 L02 WALKDOWN.pdf) is not signed or dated.

-Visible VOCs' can be seen on the EHRLICH T4N-R67W-23 L02_0763_post.mp4 video file at the 59 second mark. It is not clear where the VOC's are originating from.

-The facility has actual uncontrolled VOC emissions greater than 50 tpy. Therefore an IR inspection is required

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FEUERSTEIN T6N-R66W-S28 L01**

Consent Decree Tank System Number: **2051**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
FEUERSTEIN T6N-R66W-S28 L01_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
FEUERSTEIN T6N-R66W-S28 L01_SIGNED EVAL	pdf	5/21/2015	Engineering Evaluation
STEM Engineering Evaluation_Feuerstein	xlsm	4/15/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_FEUERSTEIN T6N-R66W-S28 L01	xlsm	N/A	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
FEUERSTEIN T6N-R66W-S28 L01	xlsx	4/1/2015	Work Request
FEUERSTEIN T6N-R66W-S28 L01_FINAL PACKET	pdf	No Date	Work Request
Noble 3rd Party Audit Wave 12 Update Info Request_20170117	pdf	1/17/2017	Noble Info Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
FEUERSTEIN T6N-R66W-S28 L01_WALKDOWN	pdf	4/24/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
FEUERSTEIN T6N-R66W-S28 L01_SIGNEDVERIFICATION		5/5/2015	IR Camera Verification Sheet
FEUERSTEIN T6N-R66W-S28 L01_2260_normal	mp4	5/5/2015	IR Camera Video
FEUERSTEIN T6N-R66W-S28 L01_2261_dump1	mp4	5/5/2015	IR Camera Video
FEUERSTEIN T6N-R66W-S28 L01_2262_dump2	mp4	5/5/2015	IR Camera Video
FEUERSTEIN T6N-R66W-S28 L01_2263_post	mp4	5/5/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
FEUERSTEIN T6N-R66W-S28 L01_SIGNED EVAL	pdf	5/21/2015	Signed Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FEUERSTEIN T6N-R66W-S28 L01**

Consent Decree Tank System Number: **2051**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**9**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**3**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**					
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**					

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**	**400**	**400**		
Dump Valve Size & Trim Size (in)	**2" & 1/4"**	**2" & 1/4"**	**2" & 1/4"**	**2" & 1/4"**	**2" & 1/4"**	**2" & 1/4"**		

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**LEED 48" Gen 1 #7**		
Man. Capacity (MSCFD)	**109.272**	**140**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**32,106**	**33,553**	**5%**
Calculated Burner Capacity (scfh	**6,046**	**10,386**	
Headspace Surge Capacity (scfh)	**80,090**	**80,090**	
Total VCS Capacity (scfh)	**86,136**	**90,476**	
VCS Capacity minus PPIVF (scfh)	**54,030**	**56,923**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	7/20/2016 & 11/10/2016 & 2/2/2017 & 4/26/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	8/4/2016 & 11/28/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FEUERSTEIN T6N-R66W-S28 L01**

Consent Decree Tank System Number: **2051**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**	**-1.02**					
Z2	**-0.86**	**-0.86**	**-0.86**					
Z3	**0.98**	**0.98**	**0.98**					
Z	**-0.90**	**-0.90**	**-0.90**					
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**	**22.9**					

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**					
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**					
Critical Pressure (psia)[b]	**833**	**833**	**833**					
Vapor Pressure (psia)[c]	**407**	**407**	**407**					
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**	**0.76**					
Choked Flow?[e]	**Yes**	**Yes**	**Yes**					
Peak Flow (bopd)[f,g]	**6905**	**6905**	**6905**					

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**158.2**	**158.2**	**158.2**					
Working Flow (Mscfd)[h,i]	**66**	**66**	**66**					

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.55**	**0.55**	**0.55**	**0.55**	**0.55**	**0.55**		
Valve Coefficent (gpm/psi) (C_v)	**2.96**	**2.96**	**2.96**	**2.96**	**2.96**	**2.96**		
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**		
Vapor Pressure (psia)[k]	**1**	**1**	**1**	**1**	**1**	**1**		
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**		
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**		
Peak Flow (bwpd)[f,g]	**1132**	**1132**	**1132**	**1132**	**1132**	**1132**		

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**5**	**5**	**5**	**5**	**5**	**5**		
Working Flow (Mscfd)[l]	**6**	**6**	**6**	**6**	**6**	**6**		

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**51**	**17**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**19,769**	**19,769**
Oil Tank Working Rate	**8,209**	**8,188**
Water Tank Flash Rate	**1,132**	**1,132**
Water Tank Working Rate	**1,590**	**1,589**
Tank Breathing Rate	**2,853**	**1,426**
Total	**33,553**	**32,104**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FEUERSTEIN T6N-R66W-S28 L01**

Consent Decree Tank System Number: **2051**

Audit Notes

IR Camera videos do not clearly show all tanks.

Noble did not account for breathing losses from all tanks. SLR included all tanks in its calcualtions to account for breathing losses from all tanks. Headspace surge capacity from the bank with one with 3 oil tanks and 3 water tanks was used in SLRs calculations

SLR could not confirm the valve size for the water dump valves. A 1/4" trim size was designated in the work request (FEUERSTEIN T6N-R66W-S28 L01.xlsx). SLR used the largest valve, a 2" valve size, with a 1/4" trim in its calculation which matches what noble used.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original FEUERSTEIN T6N-R66W-S28 L01 6 Tanks - STEM Engineering Evaluation Check.xlsm and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1_FEUERSTEIN T6N-R66W-S28 L01.xlsm file.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FIVE M T6N-R65W-S28 L01**

Consent Decree Tank System Number: **2016**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
FIVE M T6N-R65W-S28 L01_FINAL PACKET	pdf	4/23/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
FIVE M T6N-R65W-S28 L01_SIGNED EVAL	pdf	5/21/2015	Engineering Evaluation
FIVE M T6N-R65W-S28 L01_FINAL PACKET	pdf	4/23/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_FIVE M T6N-R65W S28 L01	xslm	9/28/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
FIVE M T6N-R65W-S28 L01 WALKDOWN	pdf	4/23/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
FIVE M T6N-R65W-S28 L01_SIGNEDVERIFICATION	pdf	5/5/2015	IR Camera Verification Sheet
FIVE M T6N-R65W-S28 L01_2252_normal	mp4	5/5/2015	IR Camera Video
FIVE M T6N-R65W-S28 L01_2254_dump	mp4	5/5/2015	IR Camera Video
FIVE M T6N-R65W-S28 L01_2255_post	mp4	5/5/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
FIVE M T6N-R65W-S28 L01_SIGNED EVAL	pdf	5/21/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FIVE M T6N-R65W-S28 L01**

Consent Decree Tank System Number: **2016**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**4**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**2**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**						
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**				
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**				

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig) 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**			
Man. Capacity (MSCFD)	**109.272**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**38,302**	**38,316**	**0%**
Calculated Burner Capacity (scfh)	**3,740**	**4,553**	
Headspace Surge Capacity (scfh)	**89,293**	**89,293**	
Total VCS Capacity (scfh)	**93,033**	**93,846**	
VCS Capacity minus PPIVF (scfh)	**54,731**	**55,530**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/5/2016 & 11/11/2016
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	5/19/2016 & 11/28/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FIVE M T6N-R65W-S28 L01**

Consent Decree Tank System Number: **2016**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**-0.90**	**-0.90**						
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**						
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**						
Critical Pressure (psia)[b]	**833**	**833**						
Vapor Pressure (psia)[c]	**407**	**407**						
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**6905**	**6905**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**158.2**	**158.2**						
Working Flow (Mscfd)[h,i]	**66**	**66**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**	**0.77**				
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**	**21.25**				
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**	**3200**				
Vapor Pressure (psia)[k]	**1**	**1**	**1**	**1**				
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**	**0.96**				
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**				
Peak Flow (bwpd)[f,g]	**11381**	**11381**	**11381**	**11381**				

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**46**	**46**	**46**	**46**				
Working Flow (Mscfd)[l]	**64**	**64**	**64**	**64**				

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**23**	**11**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**13,179**	**13,179**
Oil Tank Working Rate	**5,473**	**5,459**
Water Tank Flash Rate	**7,588**	**7,587**
Water Tank Working Rate	**10,650**	**10,650**
Tank Breathing Rate	**1,426**	**1,426**
Total	**38,316**	**38,301**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FIVE M T6N-R65W-S28 L01**

Consent Decree Tank System Number: **2016**

Audit Notes

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.
"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original FIVE M T6N-R65W-S28 L01_SIGNED EVAL.pdf and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1_FIVE M T6N-R65W-S28 L01.xlsm file.

The water production in the originalFIVE M T6N-R65W-S28 L01_SIGNED EVAL.pdf is coming from two (2) separtor vessels (2 - LP) and was changed to four (4) separtor vessels (2- HP and 2- LP) in the modified STEM Engineering Evaluation_rev1_FIVE M T6N-R65W-S28 L01.xlsm file. SLR included these additional water sources in its evaluation.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FIVE M T6N-R65W-S28 L02**

Consent Decree Tank System Number: **68**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
FIVE M T6N-R65W-S28 L02_FINAL PACKET	pdf	4/29/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
FIVE M T6N-R65W-S28 L02_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Evaluation
STEM Engineering Evaluation_Five M E21	xlsm	4/30/2015	STEM Engineering Evaluation Model
STEM Engineering Evaluation_rev1_FIVE M T6N-R65W S28 L02	xlsm	11/11/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
FIVE M T6N-R65W-S28 L02 REWORK PACKET	pdf	9/22/2015	Rework Request
FIVE M T6N-R65W-S28 L02_FINAL PACKET	pdf	4/29/2015	Final Facility Packet

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
FIVE M T6N-R65W-S28 L02 WALKDOWN	pdf	4/29/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
FIVE M T6N-R65W-S28 L02 IR VERIFICATION	pdf	5/15/2015	IR Camera Verification Documentation Field Data Sheet
FIVE M T6N-R65W-S28 L02_0702_NORMAL	mp4	5/15/2015	IR Camera Video During Normal Operations
FIVE M T6N-R65W-S28 L02_0703_DUMP	mp4	5/15/2015	IR Camera Video During Dump Event
FIVE M T6N-R65W-S28 L02_0704_POST	mp4	5/15/2015	IR Camera Video Following Dump Event

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
FIVE M T6N-R65W-S28 L02_SIGNED EVAL	pdf	5/22/2015	Final Facility Packet

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FIVE M T6N-R65W-S28 L02**

Consent Decree Tank System Number: **68**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**4**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**2**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**						
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**						
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**						

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**		
Man. Capacity (MSCFD)	**109.272**	**109.272**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**29,183**	**29,197**	**0%**
Calculated Burner Capacity (scfh	**6,869**	**9,106**	
Headspace Surge Capacity (scfh)	**90,946**	**73,195**	
Total VCS Capacity (scfh)	**97,815**	**82,301**	
VCS Capacity minus PPIVF (scfh)	**68,632**	**53,104**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/5/2016 & 11/11/2016 & 4/26/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	5/31/2016 & 11/28/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FIVE M T6N-R65W-S28 L02**

Consent Decree Tank System Number: **68**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**-0.90**	**-0.90**						
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**						
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**						
Critical Pressure (psia)[b]	**833**	**833**						
Vapor Pressure (psia)[c]	**407**	**407**						
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**6905**	**6905**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**158.2**	**158.2**						
Working Flow (Mscfd)[h,i]	**66**	**66**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**						
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**						
Critical Pressure (psia)[j]	**3200**	**3200**						
Vapor Pressure (psia)[k]	**1**	**1**						
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bwpd)[f,g]	**11381**	**11381**						

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**46**	**46**						
Working Flow (Mscfd)[l]	**64**	**64**						

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**23**	**11**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**13,179**	**13,179**
Oil Tank Working Rate	**5,473**	**5,459**
Water Tank Flash Rate	**3,794**	**3,794**
Water Tank Working Rate	**5,325**	**5,325**
Tank Breathing Rate	**1,426**	**1,426**
Total	**29,197**	**29,183**

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FIVE M T6N-R65W-S28 L02**

Consent Decree Tank System Number: **68**

Audit Notes

-Field Datasheet and IR camera videos show a total of 10 tanks onsite. There is no indication in any of the documentation that some are out of service. Noble evaluated site with a single bank of 4 oil tanks and 2 water tanks. Final walkdown indicates 2 separate banks of tanks; One bank with 4 oil tanks and 1 water tank and one bank with 1 water tank. The configuation indicated on the final walkdown was used to evaluate this site. All tanks were listed so that breathing loss from all tanks were included.

-Cannot clearly see all thief hatches and PRV's in the IR videos.

-No documentation available showing the work in the rework packet (FIVE M T6N-R65W-S28 L02 Rework Packet.pdf) pdf was ever completed. The rework does not request changes to critical parameters (pressure, valve/stem size, vrt, etc.).

-Facility has actual uncontrolled VOC emissions greater than 50 tpy and therefore must have an IR inspection completed

UPDATE: Noble confirmed accuracy of existing Engineering Evaluation. TLO walkdown documentation (Attachment M) confirms that one bank of tanks had been removed from service at the time the facility retrofit was performed.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FIVE RIVERS T4N-R66W-S8 L01**

Consent Decree Tank System Number: **2372**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
FIVE RIVERS T4N-R66W-S8 L01_FINAL PACKET	pdf	4/24/2015	Facility Final Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
FIVE RIVERS T4N-R66W-S8 L01_SIGNED EVAL	pdf	5/21/2015	Signed Engineering Evaluation
STEM Engineering Evaluation_Five Rivers K07_Oil	xlsm	4/15/2015	Stem Engineering Evaluation for 4 oil tank configuration
R66W-S8 L01_Oil	xlsm	7/28/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
FIVE RIVERS T4N-R66W-S8 L01_FINAL PACKET	pdf	4/24/2015	Facility Final Packet

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
FIVE RIVERS T4N-R66W-S8 L01 WALKDOWN	pdf	4/24/2013	Final Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
FIVE RIVERS T4N-R66W-S8 L01 IR VERIFICATION	pdf	5/4/2015	IR Camera Verification Documentation Field Data Sheet
FIVE RIVERS T4N-R66W-S8 L01_2245_normal	mp4	5/4/2015	IR Camera Video During Normal Operations
FIVE RIVERS T4N-R66W-S8 L01_2246_dump	mp4	5/4/2015	IR Camera Video During Dump Event
FIVE RIVERS T4N-R66W-S8 L01_2247_post	mp4	5/4/2015	IR Camera Video Following Dump Event

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
FIVE RIVERS T4N-R66W-S8 L01_SIGNED EVAL	pdf	5/21/2015	Signed Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FIVE RIVERS T4N-R66W-S8 L01**

Consent Decree Tank System Number: **2372**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**10**
Oil Tank Capacity (bbl):	**500**
# of Water Tanks:	**2**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**4"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**				
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**				

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**				
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**				

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig) 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**		
Man. Capacity (MSCFD)	**109.272**	**109.272**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**38,862**	**59,504**	**53%**
Calculated Burner Capacity (scfh)	**7,478**	**9,106**	
Headspace Surge Capacity (scfh)	**82,999**	**51,211**	
Total VCS Capacity (scfh)	**90,477**	**60,317**	
VCS Capacity minus PPIVF (scfh)	**51,615**	**813**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/5/2016 & 11/11/2016 & 4/28/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	5/24/2016 & 11/28/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FIVE RIVERS T4N-R66W-S8 L01**

Consent Decree Tank System Number: **2372**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**	**-1.02**	**-1.02**				
Z2	**-0.86**	**-0.86**	**-0.86**	**-0.86**				
Z3	**0.98**	**0.98**	**0.98**	**0.98**				
Z	**-0.90**	**-0.90**	**-0.90**	**-0.90**				
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**	**22.9**	**22.9**				

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**	**0.77**				
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**	**21.25**				
Critical Pressure (psia)[b]	**833**	**833**	**833**	**833**				
Vapor Pressure (psia)[c]	**407**	**407**	**407**	**407**				
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**	**0.76**	**0.76**				
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**				
Peak Flow (bopd)[f,g]	**6905**	**6905**	**6905**	**6905**				

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**158.2**	**158.2**	**158.2**	**158.2**				
Working Flow (Mscfd)[h,i]	**66**	**66**	**66**	**66**				

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**	**0.77**				
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**	**21.25**				
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**	**3200**				
Vapor Pressure (psia)[k]	**1**	**1**	**1**	**1**				
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**	**0.96**				
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**				
Peak Flow (bwpd)[f,g]	**11381**	**11381**	**11381**	**11381**				

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**46**	**46**	**46**	**46**				
Working Flow (Mscfd)[l]	**64**	**64**	**64**	**64**				

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**500**	**0**
scfh vapor/tank[i]	**396**	**0**
Mscfd	**95**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**26,359**	**26,359**
Oil Tank Working Rate	**10,945**	**10,918**
Water Tank Flash Rate	**7,588**	**0**
Water Tank Working Rate	**10,650**	**0**
Tank Breathing Rate	**3,962**	**1,585**
Total	**59,504**	**38,862**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FIVE RIVERS T4N-R66W-S8 L01**

Consent Decree Tank System Number: **2372**

Audit Notes

-The walkdown pdf (FIVE RIVERS T4N-R66W-S8 L01 WALKDOWN.pdf) shows a banked tank configuration of two banks of 4 oil tanks and one bank of 2 oil and 2 water tanks. The signed eval pdf (FIVE RIVERS T4N-R66W-S8 L01_SIGNED EVAL.pdf) shows a banked tank configuration of two banks of 4 oil tanks and one bank of 2 water tanks. Pg 7 of the final packet pdf (FIVE RIVERS T4N-R66W-S8 L01_FINAL PACKET.pdf) shows ten (10) oil tanks and two (2) water tanks onsite, totaling twelve (12) tanks overall. The tank configuration indicated on the walkdown was used for SLR's analysis.

-None of the Noble Analyses include breathing emissions from the other tank banks. Breathing losses from all tanks were accounted for in SLR's analyses by including all of the tanks from all banks in its calculations.

-IR videos do not clearly show all tanks.

-This facility has uncontrolled actual VOC emissions greater than 50 tpy. Therefore an IR inspection is required.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

UPDATE: Noble agrees that Engineering Evaluation was incorrect in representing the correct quantity of tanks. Updated Engineering Evaluation submitted with Noble's Semi-Annual Report (5th) (July 28, 2017).

Update: Noble confirmed accuracy of existing Engineering Evaluation. Although there are multiple tank banks on this location, each bank has its own dedicated set of VOC combustors. Adding in breathing losses from parallel tank banks means that additional VOC capacity would be available. Initial site walkdown picture (Attachment P) documents the existing VOC system configuration.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FOOSE T6N-R64W-S18 L01**

Consent Decree Tank System Number: **2044**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
FOOSE T6N-R64W-S18 L01_FINAL PACKET	pdf	4/23/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
FOOSE T6N-R64W-S18 L01_SIGNED EVAL	pdf	5/21/2015	Engineering Evaluation
STEM Engineering Evaluation_Foose A18	xlsm	4/15/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_FOOSE T6N-R64W-S18 L01	xlsm	7/28/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
Noble 3rd Party Audit Wave 12 Update Info Request_20170117	pdf	1/17/2017	Noble Info Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
FOOSE T6N-R64W-S18 L01_WALKDOWN	pdf	4/23/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
FOOSE T6N-R64W-S18 L01_SIGNED VERIFICATION	pdf	5/6/2015	IR Camera Verification Sheet
FOOSE T6N-R64W-S18 L01_2273_normal	mp4	5/6/2015	IR Camera Video
FOOSE T6N-R64W-S18 L01_2274_dump	mp4	5/6/2015	IR Camera Video
FOOSE T6N-R64W-S18 L01_2276_post	mp4	5/6/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
FOOSE T6N-R64W-S18 L01_SIGNED EVAL	pdf	5/21/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FOOSE T6N-R64W-S18 L01**

Consent Decree Tank System Number: **2044**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**1**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**							
Dump Valve Size & Trim Size (in)	**2" & 1"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**						
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**						

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**			
Man. Capacity (MSCFD)	**140**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**19,389**	**19,396**	**0%**
Calculated Burner Capacity (scfh	**2,916**	**5,833**	
Headspace Surge Capacity (scfh)	**63,131**	**63,131**	
Total VCS Capacity (scfh)	**66,047**	**68,964**	
VCS Capacity minus PPIVF (scfh)	**46,658**	**49,568**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/5/2016 & 11/11/2016 & 1/31/2016 & 4/20/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	5/23/2016 &11/269/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FOOSE T6N-R64W-S18 L01**

Consent Decree Tank System Number: **2044**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**-0.90**							
Gas/Oil Ratio (scf/bbl)	**22.9**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**							
Valve Coefficent (gpm/psi) (C_v)	**21.25**							
Critical Pressure (psia)[b]	**833**							
Vapor Pressure (psia)[c]	**407**							
Critical pressure ratio (F_F) [d]	**0.76**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**6905**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**158.2**							
Working Flow (Mscfd)[h,i]	**66**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**						
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**						
Critical Pressure (psia)[j]	**3200**	**3200**						
Vapor Pressure (psia)[k]	**1**	**1**						
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bwpd)[f,g]	**11381**	**11381**						

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**46**	**46**						
Working Flow (Mscfd)[l]	**64**	**64**						

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**17**	**6**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**6,590**	**6,590**
Oil Tank Working Rate	**2,736**	**2,729**
Water Tank Flash Rate	**3,794**	**3,794**
Water Tank Working Rate	**5,325**	**5,325**
Tank Breathing Rate	**951**	**951**
Total	**19,396**	**19,389**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FOOSE T6N-R64W-S18 L01**

Consent Decree Tank System Number: **2044**

Audit Notes

-Four (4) oil tanks and one (1) water tank listed on pg. 8 of the final packet pdf (FOOSE T6N-R64W-S18 L01_FINAL PACKET.pdf), while only three (3) oil tanks and one (1) water tank are listed in the signed eval pdf (FOOSE T6N-R64W-S18 L01_SIGNED EVAL.pdf). Five (5) tanks total are shown in the IR videos. There is a note on pg. 8 of the final packet pdf showing oil tank 1 is not attached to the vent header. Therefore three (3) oil tanks and one (1) water tank onsite connected to the VCS is accurate.

-A VOC / emissions source can be seen at 0:28 seconds in the "FOOSE T6N-R64W-S18 L01_2273_normal. Mp4" video. This emissions source appears to be a heater or engine and not associated with the tanks or tank VCS.

-Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

Water dumps from one (1) separator vessel (LP) existed in the original STEM Engineering Evaluation_Foose A18.xlsm, now water dumps from two (2) separator vessels (LP & HP) are shown in the modified STEM Engineering Evaluation_rev1_FOOSE T6N-R64W-S18 L01.xlsm file. Noble provided info to SLR saying Initially, the original (Rev0) evaluation combined thewater production dump from two separate separators(1 HP and 1 LP) as a single water dump. The revised(Rev1) evaluation incorporated a second water dump to provide a dedicated water dump scenario for each separator.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FOSS T6N-R64W-S10 L01**

Consent Decree Tank System Number: **586**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
FOSS T6N-R64W-S10 L01_FINAL PACKET	pdf	12/16/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
FOSS T6N-R64W-S10 L01_SIGNED EVAL	pdf	1/18/2016	Engineering Evaluation
FOSS T6N-R64W-S10 L01_STEM Engineering Evaluation	xlsm	1/18/2016	Tank VOC Analysis
FOSS T6N-R64W-S10 L01_SIGNED EVAL (1)	pdf	5/16/2017	Revised Engineering Evaluation
STEM Engineering Evaluation_rev1_FOSS T6N-R64W-S10 L01	xlsm	5/16/2017	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
FOSS T6N-R64W-S10 L01_WORK REQUEST	pdf	9/1/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
FOSS T6N-R64W-S10 L01_WALKDOWN	pdf	12/10/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
FOSS T6N-R64W-S10 L01_0507_NORMAL	mp4	12/10/2015	IR Camera Video
FOSS T6N-R64W-S10 L01_0508_DUMP	mp4	12/10/2015	IR Camera Video
FOSS T6N-R64W-S10 L01_0509_POST	mp4	12/10/2015	IR Camera Video
FOSS T6N-R64W-S10 L01_IR VERIFICATION	pdf	12/10/2015	IR Camera Verification Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
FOSS T6N-R64W-S10 L01_SIGNED EVAL	pdf	1/18/2016	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FOSS T6N-R64W-S10 L01**

Consent Decree Tank System Number: **586**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**2**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 3/8"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**			
Man. Capacity (MSCFD)	**140**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**2,673**	**2,674**	**0%**
Calculated Burner Capacity (scfh	**4,960**	**5,833**	
Headspace Surge Capacity (scfh)	**217**	**217**	
Total VCS Capacity (scfh)	**5,177**	**6,050**	
VCS Capacity minus PPIVF (scfh)	**2,504**	**3,377**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	12/1/2016
Audit Document Review Verified by:	Angela M. Oberlander & James Van Horne
Audit Document Verification Date:	12/5/2016 & 6/27/2017

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FOSS T6N-R64W-S10 L01**

Consent Decree Tank System Number: **586**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.91**							
Valve Coefficent (gpm/psi) (C_v)	**3.22**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**431**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**48.7**							
Working Flow (Mscfd)[h,i]	**4**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**11**	**0**

Flow Rate Summary	**Flow Rate (scfh)**	
	SLR	**Noble**
Oil Tank Flash Rate	**2,027**	**2,027**
Oil Tank Working Rate	**171**	**171**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**475**	**475**
Total	**2,674**	**2,673**

LOD ID: **FOSS T6N-R64W-S10 L01**

Consent Decree Tank System Number: **586**

Audit Notes

-Noble decreased the diameter of the vapor collection line between the knockout drum and burners from 4" to 3". Replacement of 2" line to a 4" line was confirmed completed in the Job sheet in the final facility packet.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FRAN LUTZ T6N-R65W-S25 L01**

Consent Decree Tank System Number: **79**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
FRAN LUTZ T6N-R65W-S25 L01_SIGNED EVAL	pdf	6/29/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_rev1_FRAN LUTZ T6N-R65W-S25 L01	xlsm	9/21/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
FRAN LUTZ T6N-R65W-S25 L01 FINAL PACKET	pdf	5/18/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
FRAN LUTZ T6N-R65W-S25 L01 WALKDOWN	pdf	7/6/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
FRAN LUTZ T6N-R65W-S25 L01_0252_NORMAL	mp4	6/15/2015	IR Video of site during normal operation
FRAN LUTZ T6N-R65W-S25 L01_0253_DUMP	mp4	6/15/2015	IR Video of site during separator dump event
FRAN LUTZ T6N-R65W-S25 L01_0254_POST	mp4	6/15/2015	IR Video of site post dump event
MOSER T4N-R65W-S10 L02 IR VERIFICATION	pdf	6/18/2015	IR Camera Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
FRAN LUTZ T6N-R65W-S25 L01_SIGNED EVAL	pdf	6/29/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FRAN LUTZ T6N-R65W-S25 L01**

Consent Decree Tank System Number: **79**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**2" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**COMM 200 48"**			
Man. Capacity (MSCFD)	**157**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,746**	**4,926**	**4%**
Calculated Burner Capacity (scfh	**4,906**	**6,542**	
Surge Capacity (scfh)	**4,115**	**4,453**	
Total VCS Capacity (scfh)	**9,021**	**10,995**	
VCS Capacity minus PPIVF (scfh)	**4,275**	**6,068**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Angela M. Oberlander/Tom Kussard
Audit Document Review Date:	2/26/2016 & 11/11/2016 & 4/21/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	3/17/2016 & 11/29/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FRAN LUTZ T6N-R65W-S25 L01**

Consent Decree Tank System Number: **79**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**							
Valve Coefficent (gpm/psi) (C_v)	**7.20**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**827**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**93.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**17**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**3,885**	**3,720**
Oil Tank Working Rate	**328**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**713**	**713**
Total	**4,926**	**4,746**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FRAN LUTZ T6N-R65W-S25 L01**

Consent Decree Tank System Number: **79**

Audit Notes

-Field notes did not list valve size, only trim size. Noble used a 1" valve with 1/2 trim in the engineering evaluation. SLR used used the largest available valve (2") with 1/2" trim in our calculations.

-Walkdown did not verify all the modificaiton were completed. Critical modifications were verified to be completed. Job form in final packet indicates that changes to separators and burners were complete. Email from automation indicates that automation revisions were completed. Trim size on valves are correct as indicated on page 1 of the walkdown packet.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FRANKIE T4N-R65W-S4 L01**

Consent Decree Tank System Number: **2043**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
FRANKIE T4N-R65W-S4 L01_FINAL PACKET	pdf	4/17/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
FRANKIE T4N-R65W-S4 L01_SIGNED EVAL	pdf	5/21/2015	Engineering Evaluation
STEM Engineering Evaluation_Frankie Knaub	xlsm	4/28/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_FRANKIE T4N-R65W-S4 L01	xlsm	7/28/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
FRANKIE T4N-R65W-S4 L01 WORK REQUEST	xlsx	4/1/2015	Work Request
FRANKIE T4N-R65W-S4 L01_FINAL PACKET	pdf	4/17/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
FRANKIE T4N-R65W-S4 L01 WALKDOWN	pdf	5/6/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
FRANKIE T4N-R65W-S4 L01 IR VERIFICATION	pdf	5/14/2015	IR Camera Verification Sheet
FRANKIE T4N-R65W-S4 L01_0679_normal	mp4	5/14/2015	IR Camera Video
FRANKIE T4N-R65W-S4 L01_0680_dump	mp4	5/14/2015	IR Camera Video
FRANKIE T4N-R65W-S4 L01_0681_post	mp4	5/14/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
FRANKIE T4N-R65W-S4 L01_SIGNED EVAL	pdf	5/21/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FRANKIE T4N-R65W-S4 L01**

Consent Decree Tank System Number: **2043**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**9**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**4**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**				
Dump Valve Size & Trim Size (in)	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**				

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**				
Dump Valve Size & Trim Size (in)	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**				

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**COMM 200 48"**		
Man. Capacity (MSCFD)	**109.272**	**157**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**20,242**	**22,154**	**9%**
Calculated Burner Capacity (scfh	**7,416**	**11,095**	
Headspace Surge Capacity (scfh)	**26,848**	**26,848**	
Total VCS Capacity (scfh)	**34,264**	**37,943**	
VCS Capacity minus PPIVF (scfh)	**14,022**	**15,789**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/5/2016 & 11/11/2016 & 4/28/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	5/24/2016 & 11/29/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FRANKIE T4N-R65W-S4 L01**

Consent Decree Tank System Number: **2043**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**	**-1.02**	**-1.02**				
Z2	**-0.86**	**-0.86**	**-0.86**	**-0.86**				
Z3	**0.98**	**0.98**	**0.98**	**0.98**				
Z	**-0.90**	**-0.90**	**-0.90**	**-0.90**				
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**	**22.9**	**22.9**				

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**	**0.78**	**0.78**	**0.78**				
Valve Coefficent (gpm/psi) (C_v)	**7.20**	**7.20**	**7.20**	**7.20**				
Critical Pressure (psia)[b]	**833**	**833**	**833**	**833**				
Vapor Pressure (psia)[c]	**407**	**407**	**407**	**407**				
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**	**0.76**	**0.76**				
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**				
Peak Flow (bopd)[f,g]	**2370**	**2370**	**2370**	**2370**				

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**54.3**	**54.3**	**54.3**	**54.3**				
Working Flow (Mscfd)[h,i]	**23**	**23**	**23**	**23**				

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**	**0.78**	**0.78**	**0.78**				
Valve Coefficent (gpm/psi) (C_v)	**7.20**	**7.20**	**7.20**	**7.20**				
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**	**3200**				
Vapor Pressure (psia)[k]	**1**	**1**	**1**	**1**				
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**	**0.96**				
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**				
Peak Flow (bwpd)[f,g]	**3906**	**3906**	**3906**	**3906**				

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**16**	**16**	**16**	**16**				
Working Flow (Mscfd)[l]	**22**	**22**	**22**	**22**				

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**51**	**23**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**9,047**	**9,047**
Oil Tank Working Rate	**3,757**	**3,747**
Water Tank Flash Rate	**2,604**	**2,604**
Water Tank Working Rate	**3,655**	**3,655**
Tank Breathing Rate	**3,091**	**1,189**
Total	**22,154**	**20,242**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FRANKIE T4N-R65W-S4 L01**

Consent Decree Tank System Number: **2043**

Audit Notes

Walkdown sheet is undated and unsigned. Based in 4/17/2015 job sheet, it appears the valve trims were modified as required per the FRANKIE T4N-R65W-S4 L01 WORK REQUEST.xlsm work request.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

Noble did not account for breathing loses from both tank banks. SLR included all tanks in its calcualtions to account for for breathing losses from all tanks on site.

"VOC Design Tank Pressure" was originally 11 oz/in^2 in the original FRANKIE T4N-R65W-S4 L01- STEM Engineering Evaluation Check_AMO.xlsm and was changed to 12 oz/in^2 in the modified STEM Engineering Evaluation_rev1_FRANKIE T4N-R65W-S4 L01.xlsm file.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FRICO HAAS MATTHEW T3N-R65W-S15 L01**

Consent Decree Tank System Number: **430**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
FRICO HAAS MATTHEW T3N-R65W-S15 L01_SIGNED EVAL	pdf	6/26/2015	Engineering Evaluation

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
FRICO HAAS MATTHEW T3N-R65W-S15 L01 WORK REQUEST	pdf	5/18/2015	Work Request
STEM Engineering Evaluation_FRICO HAAS MATTHEW T3N-R65W-S15 L01	xlsm	6/24/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_FRICO HAAS MATTHEW T3N-R65W-S15 L01.xlsm	xlsm	9/21/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
FRICO HAAS MATTHEW T3N-R65W-S15 L01 WALKDOWN	pdf	6/9/2015	Walkdown Checklist

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
FRICO HAAS MATTHEW T3N-R65W-S15 L01 WALKDOWN	pdf	6/9/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
FRICO HAAS MATTHEW T3N-R65W-S15 L01 IR VERIFICATION	pdf	6/9/2015	IR Camera Verification Sheet
FRICO HAAS MATTHEW T3N-R65W-S15 L01_0237_NORMAL	mp4	6/9/2015	IR Camera Video
FRICO HAAS MATTHEW T3N-R65W-S15 L01_0238_DUMP	mp4	6/9/2015	IR Camera Video
FRICO HAAS MATTHEW T3N-R65W-S15 L01_0239_POST	mp4	6/9/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
FRICO HAAS MATTHEW T3N-R65W-S15 L01_SIGNED EVAL	pdf	6/26/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FRICO HAAS MATTHEW T3N-R65W-S15 L01**

Consent Decree Tank System Number: **430**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**2**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**2" & 1"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**COMM 200 48"**			
Man. Capacity (MSCFD)	**157**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**12,748**	**12,751**	**0%**
Calculated Burner Capacity (scfh	**4,961**	**6,542**	
Headspace Surge Capacity (scfh)	**13,957**	**13,957**	
Total VCS Capacity (scfh)	**18,918**	**20,499**	
VCS Capacity minus PPIVF (scfh)	**6,170**	**7,748**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	4/11/2016 & 11/11/2016 & 4/20/2016
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	4/12/2016 & 11/29/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FRICO HAAS MATTHEW T3N-R65W-S15 L01**

Consent Decree Tank System Number: **430**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**							
Valve Coefficent (gpm/psi) (C_v)	**21.25**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**2409**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**271.7**							
Working Flow (Mscfd)[h,i]	**23**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**11**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**11,321**	**11,321**
Oil Tank Working Rate	**955**	**952**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**475**	**475**
Total	**12,751**	**12,748**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FRICO HAAS MATTHEW T3N-R65W-S15 L01**

Consent Decree Tank System Number: **430**

Audit Notes

-Final walkdown sheet, item 1 has no indication as to whether workorder items have been completed. (FINAL PACKET p. 20). Design critical items were confirmed with Job Sheets, Emails and, walkdown checklist.

-FLIR video footage of tank nearest burner appears to have a leak beginng at 18 seconds into the DUMP event video (0238_DUMP 0:18) and beginning at 0:20 seconds into the POST video (0239_POST 0:20).
"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original STEM Engineering Evaluation_FRICO HAAS MATTHEW T3N-R65W-S15 L01.xlsm and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1_FRICO HAAS MATTHEW T3N-R65W-S15 L01.xlsm file.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FRICO T3N-R65W-S15 L02**

Consent Decree Tank System Number: **431**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
FRICO T3N-R65W-S15 L02_FINAL PACKET	pdf	7/24/2015	Facility Final Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
FRICO T3N-R65W-S15 L02_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_Frico	xlsm	12/21/2015	STEM Engineering Evaluation Model
STEM Engineering Evaluation_rev1_FRICO T3N-R65W-S15 L02	xlsm	7/28/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
0096 - Frico Work Request	pdf	NOT DATED	Work Request
FRICO T3N-R65W-S15 L02_FINAL PACKET	pdf	7/24/2015	Rework Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
FRICO T3N-R65W-S15 L02 WALKDOWN	pdf	4/23/2015	Facility Walkdown
FRICO T3N-R65W-S15 L02 2016 Audit Document Request	pdf	5/3/2016	Tank Configuration Confirmation

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
FRICO T3N-R65W-S15 L02_2307_normal	mp4	5/11/2015	IR Inspection Video
FRICO T3N-R65W-S15 L02_2308_dump	mp4	5/11/2015	IR Inspection Video
FRICO T3N-R65W-S15 L02_2309_post	mp4	5/11/2015	IR Inspection Video
FRICO T3N-R65W-S15 L02_SIGNEDVERIFICATION	pdf	5/11/2015	IR Camera Verification Documentation and Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
FRICO T3N-R65W-S15 L02_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FRICO T3N-R65W-S15 L02**

Consent Decree Tank System Number: **431**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**7**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**125**	**125**	**125**	**125**	**125**	**125**		
Dump Valve Size & Trim Size (in)	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**		

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**COMM 200 48"**		
Man. Capacity (MSCFD)	**140**	**157**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**10,074**	**11,032**	**10%**
Calculated Burner Capacity (scfh	**6,899**	**12,375**	
Headspace Surge Capacity (scfh)	**8,017**	**8,017**	
Total VCS Capacity (scfh)	**14,916**	**20,392**	
VCS Capacity minus PPIVF (scfh)	**4,842**	**9,360**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	5/11/2016 & 11/17/2016 & 4/28/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	5/19/2016 &11/29/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FRICO T3N-R65W-S15 L02**

Consent Decree Tank System Number: **431**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**	**-1.02**	**-1.02**	**-1.02**	**-1.02**		
Z2	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**		
Z3	**0.98**	**0.98**	**0.98**	**0.98**	**0.98**	**0.98**		
Z	**-0.90**	**-0.90**	**-0.90**	**-0.90**	**-0.90**	**-0.90**		
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**	**22.9**	**22.9**	**22.9**	**22.9**		

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**	**0.78**	**0.78**	**0.78**	**0.78**	**0.78**		
Valve Coefficent (gpm/psi) (C_v)	**7.20**	**7.20**	**7.20**	**7.20**	**7.20**	**7.20**		
Critical Pressure (psia)[b]	**588**	**588**	**588**	**588**	**588**	**588**		
Vapor Pressure (psia)[c]	**138**	**138**	**138**	**138**	**138**	**138**		
Critical pressure ratio (F_F) [d]	**0.82**	**0.82**	**0.82**	**0.82**	**0.82**	**0.82**		
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**		
Peak Flow (bopd)[f,g]	**1156**	**1156**	**1156**	**1156**	**1156**	**1156**		

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**26.5**	**26.5**	**26.5**	**26.5**	**26.5**	**26.5**		
Working Flow (Mscfd)[h,i]	**11**	**11**	**11**	**11**	**11**	**11**		

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**40**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**6,619**	**6,619**
Oil Tank Working Rate	**2,748**	**2,742**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**1,664**	**713**
Total	**11,032**	**10,074**

LOD ID: **FRICO T3N-R65W-S15 L02**

Consent Decree Tank System Number: **431**

Audit Notes

- Field datasheets dated February 24, 2015 (FINAL PACKET p. 6) indicate that there is no VRT on site. Subsequent documentation makes references to a VRT and a VRT is visible in FLIR video footage (2307_normal 0:31)

-Field notes in final packet and walkdown indicate that there are 2 banks of 4 oil tanks. Final engineering evaluation was completed with only 3 oil tanks. In response to request to confirm the tank configuration the facility has one bank of 3 tanks and one bank of 4 tanks. SLR calculated headspace surge capacity based on 3 oil tanks.

-Noble did not include breathing losses from the non-producing bank. SLR included all tanks in its calculation to account for breathing losses from all tanks.

-The facility has uncontrolled actual VOC emissions greater than 50 tpy. Therefore an IR camera inspection is required

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FURROW ST USX T7N-R64W-S22 L01**

Consent Decree Tank System Number: **2018**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
FURROW ST USX T7N-R64W-S22 L01_SIGNED EVAL 5_8_2015	pdf	5/22/2015	Engineering Evaluation
FURROW ST USX T7N-R64W-S22 L01_SIGNED EVAL 4_28_2016	pdf	5/22/2015	Engineering Evaluation
FURROW ST USX T7N-R64W-S22 L01_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
FURROW ST USX T7N-R64W-S22 L01_SIGNED EVAL 5_8_2015	pdf	5/22/2015	Engineering Evaluation
FURROW ST USX T7N-R64W-S22 L01_SIGNED EVAL 4_28_2016	pdf	5/22/2015	Engineering Evaluation
STEM Engineering Evaluation_Furrow St USX	xlsm	4/28/2015	Tank VOC Analysis
Attach B - STEM EE_rev1_with TLO FURROW L01	xlsm	6/23/2017	Revised Tank VOC Analysis (TLO)

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
FURROW ST USX T7N-R64W-S22 L01 WALKDOWN	pdf	4/29/2015	Walkdown Checklist
0030 - Furrow St USX Work Request	pdf	No Date	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
FURROW ST USX T7N-R64W-S22 L01 WALKDOWN	pdf	4/29/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
FURROW ST USX T7N-R64W-S22 L01_SIGNEDVERIFICATION	pdf	5/11/2015	IR Camera Verification Sheet
FURROW ST USX T7N-R64W-S22 L01_2284_normal	mp4	5/11/2015	IR Camera Video
FURROW ST USX T7N-R64W-S22 L01_2285_dump	mp4	5/11/2015	IR Camera Video
FURROW ST USX T7N-R64W-S22 L01_2286_post	mp4	5/11/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
FURROW ST USX T7N-R64W-S22 L01_SIGNED EVAL 5_8_2015	pdf	5/22/2015	Engineering Evaluation
FURROW ST USX T7N-R64W-S22 L01_SIGNED EVAL 4_28_2016	pdf	5/22/2015	Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FURROW ST USX T7N-R64W-S22 L01**

Consent Decree Tank System Number: **2018**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**5**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**2**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**						
Dump Valve Size & Trim Size (in)	**2" & 1/2"**	**2" & 1/2"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**				
Dump Valve Size & Trim Size (in)	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**				

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

Truck Loadout Vapor Collection Installed? ☑ Yes ☐ No

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**			
Man. Capacity (MSCFD)	**109.272**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**16,847**	**16,853**	**0%**
Calculated Burner Capacity (scfh	**3,716**	**4,553**	
Headspace Surge Capacity (scfh)	**27,736**	**27,736**	
Total VCS Capacity (scfh)	**31,452**	**32,289**	
VCS Capacity minus PPIVF (scfh)	**14,605**	**15,436**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Angela M. Oberlander
Audit Document Review Date:	7/3/2018
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	7/3/2018

SLR

LOD ID: **FURROW ST USX T7N-R64W-S22 L01**

Consent Decree Tank System Number: **2018**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**-0.90**	**-0.90**						
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**	**0.78**						
Valve Coefficent (gpm/psi) (C_v)	**7.20**	**7.20**						
Critical Pressure (psia)[b]	**833**	**833**						
Vapor Pressure (psia)[c]	**407**	**407**						
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**2370**	**2370**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**54.3**	**54.3**						
Working Flow (Mscfd)[h,i]	**23**	**23**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**	**0.78**	**0.78**	**0.78**				
Valve Coefficent (gpm/psi) (C_v)	**7.20**	**7.20**	**7.20**	**7.20**				
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**	**3200**				
Vapor Pressure (psia)[k]	**1**	**1**	**1**	**1**				
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**	**0.96**				
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**				
Peak Flow (bwpd)[f,g]	**3906**	**3906**	**3906**	**3906**				

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**16**	**16**	**16**	**16**				
Working Flow (Mscfd)[l]	**22**	**22**	**22**	**22**				

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**29**	**11**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**4,524**	**4,524**
Oil Tank Working Rate	**1,878**	**1,874**
Water Tank Flash Rate	**2,604**	**2,604**
Water Tank Working Rate	**3,655**	**3,655**
Tank Breathing Rate	**1,664**	**1,664**
Truck Vent Capture Rate	**2,527**	**2,527**
Total	**16,853**	**16,848**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **FURROW ST USX T7N-R64W-S22 L01**

Consent Decree Tank System Number: **2018**

Audit Notes

- Valve size information was not provided. SLR used the largest valve with the confirmed 1/2" trim in its calculations.

-The final walkdown indicated that there are 2 banks of tanks, one with 5 oil tanks and 1 water tank and one with 1 water tank. Noble's engineering evaluation use and unbanked configuration with 5 oil tanks and 1 water tank. SLR calculated headspace surge capacity base on the bank of 5 oil tanks and 1 water tank. All tanks were included in SLR's calculations to account for breathing losses from all tanks.

-Information provided in FURROW ST USX T7N-R64W0S22 L01_FINAL PACKET.pdf indicates a truck vent capture system has been installed onsite; the RISE Tank Load Out sheet has been dated 10/22/2015 (by engineering) with associated MOC #4220. It is unclear as to whether the load out capture ties into the VCS. SLR, because of this, cannot confirm the modeling guidance was applied correctly or that the VCS is designed and sized to handle the PPIVFR.

NEI provided additional information verifying a truck load out (TLO) vapor collection system was installed to the VCS. SLR re-evaluated the engineering evaluation with a truck vent capture line flow rate based on the information provided by Noble on 4/20/2017.

- The revised engineering evaluation (6/23/2017) provided with TLO included 2 additional HP separator water dump streams to the water tank from the previous signed engineering evaluation (5/8/2015).

-Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

UPDATE: Noble revised its PPIVFR determinations to include TLO vapors. Noble completed Engineering Evaluations and submitted a revised COCR with its Semi-Annual Reports (5th) (July 28, 2017) and (6th) (January 29, 2018). Noble provided revised Engineering Evaluation to SLR on May 10, 2018.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **GITTLEIN MARIE T3N-R64W-S4 L01**

Consent Decree Tank System Number: **509**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
GITTLEIN MARIE T3N-R64W-S4 L01_SIGNED EVAL	pdf	5/26/2015	Engineering Evaluation
GITTLEIN MARIE T3N-R64W-S4 L01_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
GITTLEIN MARIE T3N-R64W-S4 L01_SIGNED EVAL	pdf	5/26/2015	Engineering Evaluation
STEM Engineering Evaluation_Marie	xlsm	5/22/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_GITTLEIN MARIE T3N-R64W-S4 L01	xlsm	7/28/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
GITTLEIN MARIE T3N-R64W-S4 L01 WORK REQUEST	pdf	No Date	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
GITTLEIN MARIE T3N-R64W-S4 L01 WALKDOWN	pdf	4/24/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
GITTLEIN MARIE T3N-R64W-S4 L01 IR VERIFICATION	pdf	5/14/2015	IR Camera Verification Sheet
GITTLEIN MARIE T3N-R64W-S4 L01_0698_normal	mp4	5/14/2015	IR Camera Video
GITTLEIN MARIE T3N-R64W-S4 L01_0699_dump	mp4	5/14/2015	IR Camera Video
GITTLEIN MARIE T3N-R64W-S4 L01_0701_post	mp4	5/14/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
GITTLEIN MARIE T3N-R64W-S4 L01_SIGNED EVAL	pdf	5/26/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **GITTLEIN MARIE T3N-R64W-S4 L01**

Consent Decree Tank System Number: **509**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**9**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**3**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**125**				
Dump Valve Size & Trim Size (in)	**2" & 3/4"**	**2" & 3/4"**	**2" & 3/4"**	**2" & 1/2"**				

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**125**	**400**	**400**	**400**	
Dump Valve Size & Trim Size (in)	**2" & 1/4"**	**2" & 1/4"**	**2" & 1/4"**	**2" & 1/4"**	**2" & 1/4"**	**2" & 1/4"**	**2" & 1/4"**	

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	
Man. Capacity (MSCFD)	**140**	**140**	**140**	

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**22,884**	**24,086**	**5%**
Calculated Burner Capacity (scfh	**7,532**	**17,500**	
Headspace Surge Capacity (scfh)	**53,698**	**53,698**	
Total VCS Capacity (scfh)	**61,230**	**71,198**	
VCS Capacity minus PPIVF (scfh)	**38,346**	**47,112**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm & Tom Kussard
Audit Document Review Date:	5/11/2016 & 4/21/2016
Audit Document Review Verified by:	Angela M. Oberlander & James Van Horne
Audit Document Verification Date:	5/23/2016 & 5/16/2017

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **GITTLEIN MARIE T3N-R64W-S4 L01**

Consent Decree Tank System Number: **509**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**	**-1.02**	**-1.02**				
Z2	**-0.86**	**-0.86**	**-0.86**	**-0.86**				
Z3	**0.98**	**0.98**	**0.98**	**0.98**				
Z	**-0.90**	**-0.90**	**-0.90**	**-0.90**				
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**	**22.9**	**22.9**				

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.80**	**0.80**	**0.80**	**0.78**				
Valve Coefficent (gpm/psi) (C_v)	**12.20**	**12.20**	**12.20**	**7.20**				
Critical Pressure (psia)[b]	**833**	**833**	**833**	**588**				
Vapor Pressure (psia)[c]	**407**	**407**	**407**	**138**				
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**	**0.76**	**0.82**				
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**				
Peak Flow (bopd)[f,g]	**4119**	**4119**	**4119**	**1156**				

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**94.3**	**94.3**	**94.3**	**26.5**				
Working Flow (Mscfd)[h,i]	**39**	**39**	**39**	**11**				

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.55**	**0.55**	**0.55**	**0.55**	**0.55**	**0.55**	**0.55**	
Valve Coefficent (gpm/psi) (C_v)	**2.96**	**2.96**	**2.96**	**2.96**	**2.96**	**2.96**	**2.96**	
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**	
Vapor Pressure (psia)[k]	**1**	**1**	**1**	**1**	**1**	**1**	**1**	
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	
Peak Flow (bwpd)[f,g]	**1132**	**1132**	**1132**	**652**	**1132**	**1132**	**1132**	

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**5**	**5**	**5**	**3**	**5**	**5**	**5**	
Working Flow (Mscfd)[l]	**6**	**6**	**6**	**4**	**6**	**6**	**6**	

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**51**	**17**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**12,895**	**12,895**
Oil Tank Working Rate	**5,354**	**5,341**
Water Tank Flash Rate	**1,241**	**1,241**
Water Tank Working Rate	**1,742**	**1,742**
Tank Breathing Rate	**2,853**	**1,664**
Total	**24,086**	**22,883**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **GITTLEIN MARIE T3N-R64W-S4 L01**

Consent Decree Tank System Number: **509**

Audit Notes

- Facility walkdown (FINAL PACKET p. 3) indicates that the tanks are configured as two banks: one with four production tanks and three water tanks, the other with five production tanks. SLR calculated surge capacity for each bank separately. The bank with 5 condenate production tanks was found to have the smallest surge capacity. Breathing from all tanks was included in SLR's calculations. Noble did not include breathing losses from the non-producing tank bank.

-Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

The VOC line size was 3" in the original STEM Engineering Evaluation_Marie.xlsm and was changed to a 4" for the "KO to Burner" line section in the modified STEM Engineering Evaluation_rev1_GITTLEIN MARIE T3N-R64W-S4 L01.xlsm file. SLR confirmed a 4" line via pg 14 of the Final Packet PDF.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **GOLDBERG T5N-R67W-S14 L01**

Consent Decree Tank System Number: **24**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
GOLDBERG T5N-R67W-S14 L01_SIGNED EVAL	pdf	5/26/2015	Engineering Evaluation
GOLDBERG T5N-R67W-S14 L01_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
GOLDBERG T5N-R67W-S14 L01_SIGNED EVAL	pdf	5/26/2015	Engineering Evaluation
STEM Engineering Evaluation_Goldberg	xlsm	N/A	Tank VOC Analysis
STEM Engineering Evaluation_rev1_GOLDBERG T5N-R67W-S14 L01	xlsm	12/28/2016	Revised STEM Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
GOLDBERG T5N-R67W-S14 L01 WORK REQUEST	pdf	5/11/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
GOLDBERG T5N-R67W-S14 L01_FINAL PACKET	pdf	No Date	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
GOLDBERG T5N-R67W-S14 L01_SITEVERIFICATION	pdf	5/4/2015	IR Camera Verification Sheet
GOLDBERG T5N-R67W-S14 L01_2233_normal	mp4	5/4/2015	IR Camera Video
GOLDBERG T5N-R67W-S14 L01_2234_dump	mp4	5/4/2015	IR Camera Video
GOLDBERG T5N-R67W-S14 L01_2235_post	mp4	5/4/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
GOLDBERG T5N-R67W-S14 L01_SIGNED EVAL	pdf	5/26/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **GOLDBERG T5N-R67W-S14 L01**

Consent Decree Tank System Number: **24**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**2**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**	**70**						
Dump Valve Size & Trim Size (in)	**1" & 1/2"**	**1" & 1/2"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**TEC 4-CS (48" Tornado)**	**COMM 200 48"**		
Man. Capacity (MSCFD)	**110.4**	**157**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**7,689**	**8,543**	**11%**
Calculated Burner Capacity (scfh)	**7,739**	**11,142**	
Headspace Surge Capacity (scfh)	**1,408**	**1,408**	
Total VCS Capacity (scfh)	**9,147**	**12,550**	
VCS Capacity minus PPIVF (scfh)	**1,458**	**4,007**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm & Tom Kussard
Audit Document Review Date:	5/11/2016 & 4/28/2017
Audit Document Review Verified by:	Angela M. Oberlander & James Van Horne
Audit Document Verification Date:	5/23/2016 & 5/16/2017

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **GOLDBERG T5N-R67W-S14 L01**

Consent Decree Tank System Number: **24**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**	**0.77**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**0.89**	**0.89**						
Gas/Oil Ratio (scf/bbl)	**112.8**	**112.8**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor	**0.94**	**0.94**						
Valve Coefficent (gpm/psi) (	**5.72**	**5.72**						
Critical Pressure (psia)[b]	**539**	**539**						
Vapor Pressure (psia)[c]	**83**	**83**						
Critical pressure ratio (F_F) [d]	**0.85**	**0.85**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**792**	**792**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**	**89.3**						
Working Flow (Mscfd)[h,i]	**8**	**8**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor								
Valve Coefficent (gpm/psi) (								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**11**	**0**

Flow Rate Summary	**Flow Rate (scfh)**	
	SLR	**Noble**
Oil Tank Flash Rate	**7,440**	**6,613**
Oil Tank Working Rate	**627**	**601**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**475**	**475**
Total	**8,543**	**7,689**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **GOLDBERG T5N-R67W-S14 L01**

Consent Decree Tank System Number: **24**

Audit Notes

- Work request (FINAL PACKET p. 5) specified that auto-shut in function for LP separators be set to 70 psi. The Signed Evaluation (FINAL PACKET p. 19) uses 65 psig as the operating pressures. A 70 psi was used in the audit evaluation per a mark up on the work request provided in the GOLDBERG T5N-R67W-S14 L01_FINAL PACKET.pdf, pg. 5.

- Provided Facility Walkdown is not signed.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

UPDATE: Noble confirmed accuracy of existing Engineering Evaluation. Completed Rework Request documents confirmation that shut-in pressure is 65 psig.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **GREER T2N-R64W-S28 L01**

Consent Decree Tank System Number: **2127**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
GREER T2N-R64W-S28 L01_SIGNED EVAL	pdf	6/30/2015	Engineering Evaluation
GREER T2N-R64W-S28 L01_FINAL PACKET	pdf	7/6/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
GREER T2N-R64W-S28 L01_SIGNED EVAL	pdf	6/30/2015	Engineering Evaluation
GREER T2N-R64W-S28 L01_FINAL PACKET	pdf	7/6/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_GREER T2N-R64W-S28 L01	xlsm	7/28/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
GREER T2N-R64W-S28 L01 WORK REQUEST	pdf	5/5/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
GREER T2N-R64W-S28 L01 WALKDOWN	pdf	6/2/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
FRICO HAAS MATTHEW T3N-R65W-S15 L01 IR VERIFICATION	pdf	6/9/2015	IR Camera Verification Documentation and Field Data Sheet
FRICO HAAS MATTHEW T3N-R65W-S15 L01_0237_NORMAL	mp4	6/9/2015	IR Inspection Video
FRICO HAAS MATTHEW T3N-R65W-S15 L01_0238_DUMP	mp4	6/9/2015	IR Inspection Video
FRICO HAAS MATTHEW T3N-R65W-S15 L01_0239_POST	mp4	6/9/2015	IR Inspection Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
GREER T2N-R64W-S28 L01_SIGNED EVAL	pdf	6/30/2015	Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **GREER T2N-R64W-S28 L01**

Consent Decree Tank System Number: **2127**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**1**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**4**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**65**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**COMM 200 48"**			
Man. Capacity (MSCFD)	**157**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**3,845**	**3,845**	**0%**
Calculated Burner Capacity (scfh)	**4,466**	**6,542**	
Headspace Surge Capacity (scfh)	**704**	**704**	
Total VCS Capacity (scfh)	**5,170**	**7,246**	
VCS Capacity minus PPIVF (scfh)	**1,325**	**3,400**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	3/23/2016 & 11/11/2016
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	3/28/2016 & 11/29/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **GREER T2N-R64W-S28 L01**

Consent Decree Tank System Number: **2127**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.69**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.81**							
Gas/Oil Ratio (scf/bbl)	**104.5**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**535**							
Vapor Pressure (psia)[c]	**78**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**760**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**79.4**							
Working Flow (Mscfd)[h,i]	**7**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**6**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**3,307**	**3,307**
Oil Tank Working Rate	**301**	**300**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**238**	**238**
Total	**3,845**	**3,845**

LOD ID: **GREER T2N-R64W-S28 L01**

Consent Decree Tank System Number: **2127**

Audit Notes

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **GUTTERSON ST T3N-R63W-S17 L01**

Consent Decree Tank System Number: **2368**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
GUTTERSON ST T3N-R63W-S17 L01_FINAL PACKET	pdf	4/23/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
GUTTERSON ST T3N-R63W-S17 L01_SIGNED EVAL	pdf	5/21/2015	Signed Engineering Evaluation
STEM Engineering Evaluation_GUTTERSEN ST T3N-R63W-S17 L01_Banked Update	xlsm	4/15/2015	STEM Engineering Evaluation Model
STEM Engineering Evaluation_rev1_GUTTERSEN ST T3N-R63W-S17 L01	xlsm	7/28/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
GUTTERSON ST T3N-R63W-S17 L01_FINAL PACKET	pdf	4/23/2015	Final Facility Packet
Noble 3rd Party Audit Wave 12 Update Info Request_20170117	pdf	1/17/2017	Noble Info Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
GUTTERSON ST T3N-R63W-S17 L01 WALKDOWN	pdf	4/23/2015	Final Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
GUTTERSON ST T3N-R63W-S17 L01 IR VERIFICATION	pdf		IR Camera Verification Documentation Field Data Sheet
GUTTERSON ST T3N-R63W-S17 L01_0695_normal	mp4		IR Camera Video During Normal Operations
GUTTERSON ST T3N-R63W-S17 L01_0696_dump	mp4		IR Camera Video During Dump Event
GUTTERSON ST T3N-R63W-S17 L01_0697_post	mp4		IR Camera Video Following Dump Event

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
GUTTERSON ST T3N-R63W-S17 L01_SIGNED EVAL	pdf	5/21/2015	Signed Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **GUTTERSON ST T3N-R63W-S17 L01**

Consent Decree Tank System Number: **2368**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**8**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**3**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**3"**
# VOC Lines to KO:	**2**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**					
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**					

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**	**400**	**400**		
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**		

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig) 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	
Man. Capacity (MSCFD)	**140**	**140**	**140**	

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**57,928**	**57,950**	**0%**
Calculated Burner Capacity (scfh)	**7,755**	**17,500**	
Headspace Surge Capacity (scfh)	**171,054**	**171,054**	
Total VCS Capacity (scfh)	**178,809**	**188,554**	
VCS Capacity minus PPIVF (scfh)	**120,881**	**130,604**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/6/2016 & 11/14/2016 & 1/31/2017 & 4/20/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	6/1/2016 & 11/29/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **GUTTERSON ST T3N-R63W-S17 L01**

Consent Decree Tank System Number: **2368**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**	**-1.02**					
Z2	**-0.86**	**-0.86**	**-0.86**					
Z3	**0.98**	**0.98**	**0.98**					
Z	**-0.90**	**-0.90**	**-0.90**					
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**	**22.9**					

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**					
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**					
Critical Pressure (psia)[b]	**833**	**833**	**833**					
Vapor Pressure (psia)[c]	**407**	**407**	**407**					
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**	**0.76**					
Choked Flow?[e]	**Yes**	**Yes**	**Yes**					
Peak Flow (bopd)[f,g]	**6905**	**6905**	**6905**					

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**158.2**	**158.2**	**158.2**					
Working Flow (Mscfd)[h,i]	**66**	**66**	**66**					

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**		
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**	**21.25**	**21.25**	**21.25**		
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**		
Vapor Pressure (psia)[k]	**1**	**1**	**1**	**1**	**1**	**1**		
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**		
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**		
Peak Flow (bwpd)[f,g]	**11381**	**11381**	**11381**	**11381**	**11381**	**11381**		

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**46**	**46**	**46**	**46**	**46**	**46**		
Working Flow (Mscfd)[l]	**64**	**64**	**64**	**64**	**64**	**64**		

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**46**	**17**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**19,769**	**19,769**
Oil Tank Working Rate	**8,209**	**8,188**
Water Tank Flash Rate	**11,381**	**11,381**
Water Tank Working Rate	**15,976**	**15,975**
Tank Breathing Rate	**2,615**	**2,615**
Total	**57,950**	**57,928**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **GUTTERSON ST T3N-R63W-S17 L01**

Consent Decree Tank System Number: **2368**

Audit Notes

Not all tanks can be seen clearly in the IR videos. There are three (3) combustors listed in the signed eval pdf (GUTTERSEN ST T3N-R63W-S17 L01_SIGNED EVAL.pdf) as well as on pg 5 & 10 of the final packet pdf (GUTTERSEN ST T3N-R63W-S17 L01_FINAL PACKET.pdf). There appears to be four (4) or more combustors shown in the IR videos.

-The facility has the uncontrolled actual VOC emissions than 50 tpy. Therefore an IR inspection is required.

- Water dumps from three (3) separator vessels (LP) existed in the original STEM Engineering Evaluation_GUTTERSEN ST T3N-R63W-S17 L01_Banked Update.xlsm, now water dumps from six (6) separator vessels (LP & HP) are shown in the modified STEM Engineering Evaluation_rev1_GUTTERSEN ST T3N-R63W-S17 L01.xlsm. SLR used six (6) water dumps in its calculations.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **GUTTERSEN ST T4N-R63W-S2 L01**

Consent Decree Tank System Number: **452**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
GUTTERSEN ST T4N-R63W-S2 L01_SIGNED EVAL	pdf	6/29/2015	Engineering Evaluation
GUTTERSEN ST T4N-R63W-S2 L01_FINAL PACKET	pdf	7/6/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
GUTTERSEN ST T4N-R63W-S2 L01_SIGNED EVAL	pdf	6/29/2015	Engineering Evaluation
GUTTERSEN ST T4N-R63W-S2 L01_FINAL PACKET	pdf	7/6/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_GUTTERSEN ST T4N-R63W-S2 L01	xlsm	9/22/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
GUTTERSEN ST T4N-R63W-S2 L01 WORK REQUEST	pdf	5/18/2015	Work Request
GUTTERSEN ST T4N-R63W-S2 L01 REWORK REQUEST	pdf	9/29/2015	Rework Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
GUTTERSEN ST T4N-R63W-S2 L01 WALKDOWN	pdf	6/17/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
GUTTERSEN ST T4N-R63W-S2 L01 IR VERIFICATION	pdf	6/17/2015	IR Camera Verification Sheet
GUTTERSEN ST T4N-R63W-S2 L01_0265_NORMAL	mp4	6/17/2015	IR Camera Video
GUTTERSEN ST T4N-R63W-S2 L01_0266_DUMP	mp4	6/17/2015	IR Camera Video
GUTTERSEN ST T4N-R63W-S2 L01_0267_POST	mp4	6/17/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
GUTTERSEN ST T4N-R63W-S2 L01_SIGNED EVAL	pdf	6/29/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **GUTTERSEN ST T4N-R63W-S2 L01**

Consent Decree Tank System Number: **452**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**COMM 200 48"**			
Man. Capacity (MSCFD)	**157**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,746**	**4,747**	**0%**
Calculated Burner Capacity (scfh	**4,907**	**6,542**	
Headspace Surge Capacity (scfh)	**2,783**	**2,783**	
Total VCS Capacity (scfh)	**7,690**	**9,325**	
VCS Capacity minus PPIVF (scfh)	**2,944**	**4,578**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	3/24/2016 & 11/14/2016 & 4/20/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	3/31/2016 & 11/29/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **GUTTERSEN ST T4N-R63W-S2 L01**

Consent Decree Tank System Number: **452**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**17**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**3,720**	**3,720**
Oil Tank Working Rate	**314**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**713**	**713**
Total	**4,747**	**4,746**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **GUTTERSEN ST T4N-R63W-S2 L01**

Consent Decree Tank System Number: **452**

Audit Notes

-Final walkdown sheet, item 1 has no indication as to whether work request items have been completed. (FINAL PACKET p. 18). Completion of each task in the work request can be confirmed in other available documentation.

-A copy of STEM DESIGN CONFIRMATION FORM included in the FINAL PACKET (FINAL PACKET p. 14) Differs from provided SIGNED EVAL and STEM WORK REQUEST FORM included in the FINAL PACKET (FINAL PACKET p. 13) in that the separator operating pressure is listed as 80 psi, not 70 psi. SLR used a confirmed separator pressure of 70 psig.

-FLIR video footage of the dump event shows an indication of a potential leak from the thief hatch in the tank furthest from the VOC burner at 46 seconds into the video (DUMP 0:46).

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original GUTTERSEN ST T4N-R63W-S2 L01_FINAL PACKET.pdf and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1_GUTTERSEN ST T4N-R63W-S2 L01.xlsm file.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **GUTTERSEN T3N-R63W-S5 L01**

Consent Decree Tank System Number: **546**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
GUTTERSEN T3N-R63W-S5 L01_FINAL PACKET	pdf	4/30/2015 (sign	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
GUTTERSEN T3N-R63W-S5 L01_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Evaluation
STEM Engineering Evaluation_Guttersen 5 Pad	xlsm	4/15/2015	STEM Engineering Evaluation Model
STEM Engineering Evaluation_rev1_GUTTERSEN T3N-R63W-S5 L01	xlsm	9/28/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
GUTTERSEN T3N-R63W-S5 L01 REWORK PACKET	pdf	7/10/2015	Rework Request
GUTTERSEN T3N-R63W-S5 L01 Work Request (Completed)	pdf	NOT DATED	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
GUTTERSEN T3N-R63W-S5 L01 WALKDOWN	pdf	4/30/2015	Final Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
GUTTERSEN T3N-R63W-S5 L01 IR VERIFICATION	pdf	5/21/2015	IR Camera Verification Documentation Field Data Sheet
GUTTERSEN T3N-R63W-S5 L01 IR_0758_normal	mp4	5/21/2015	IR Camera Video During Normal Operations
GUTTERSEN T3N-R63W-S5 L01 IR_0759_dump	mp4	5/21/2015	IR Camera Video During Dump Event
GUTTERSEN T3N-R63W-S5 L01 IR_0760_post	mp4	5/21/2015	IR Camera Video Following Dump Event

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
GUTTERSEN T3N-R63W-S5 L01_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **GUTTERSEN T3N-R63W-S5 L01**

Consent Decree Tank System Number: **546**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**10**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**125**	**125**	**125**	**125**	**125**			
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**			

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**COMM 200 48"**		
Man. Capacity (MSCFD)	**140**	**157**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**17,444**	**25,122**	**44%**
Calculated Burner Capacity (scfh)	**6,620**	**12,375**	
Headspace Surge Capacity (scfh)	**23,115**	**30,433**	
Total VCS Capacity (scfh)	**29,735**	**42,808**	
VCS Capacity minus PPIVF (scfh)	**12,291**	**17,686**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/6/2016 & 11/14/2016 & 4/28/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	6/2/2016 & 11/29/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **GUTTERSEN T3N-R63W-S5 L01**

Consent Decree Tank System Number: **546**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**	**-1.02**	**-1.02**	**-1.02**			
Z2	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**			
Z3	**0.98**	**0.98**	**0.98**	**0.98**	**0.98**			
Z	**-0.90**	**-0.90**	**-0.90**	**-0.90**	**-0.90**			
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**	**22.9**	**22.9**	**22.9**			

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**			
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**	**21.25**	**21.25**			
Critical Pressure (psia)[b]	**588**	**588**	**588**	**588**	**588**			
Vapor Pressure (psia)[c]	**138**	**138**	**138**	**138**	**138**			
Critical pressure ratio (F_F) [d]	**0.82**	**0.82**	**0.82**	**0.82**	**0.82**			
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**			
Peak Flow (bopd)[f,g]	**3368**	**3368**	**3368**	**3368**	**3368**			

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**77.1**	**77.1**	**77.1**	**77.1**	**77.1**			
Working Flow (Mscfd)[h,i]	**32**	**32**	**32**	**32**	**32**			

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**57**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**16,071**	**11,495**
Oil Tank Working Rate	**6,673**	**4,761**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**2,377**	**1,189**
Total	**25,122**	**17,445**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **GUTTERSEN T3N-R63W-S5 L01**

Consent Decree Tank System Number: **546**

Audit Notes

The walkdown indicates there are 2 banks of 5 oil tanks each. The signed eval pdf (GUTTERSEN T3N-R63W-S5 L01_SIGNED EVAL.pdf) used five (5) oil tanks. Pg 7 of the final packet pdf (GUTTERSEN T3N-R63W-S5 L01_FINAL PACKET.pdf) shows twelve (12) tanks and the work request pdf (Guttersen 5 Pad - Work Request (Completed).pdf) shows eight (8) tanks being removed but does not indicate how many were onsite in the first place. The IR videos shows at least seven (7) tanks still onsite. For this analysis 10 tanks were assumed to be on site with 2 banks of 5 tanks each.

-There are 3 work requests associated with this facility one is undated and found in the final packet, another is dated 7/10/2015 (Rework Packet), and a third is dated 9/2/2015 and is found in the final packet. The walkdown is dated 4/30/2015. The second and third work requests changes to PSHH and confirmation of valve trim size is 1". Cannot confirm if the work was completed. For calculations assumed that separators are operating and PSV pressure (125 psig) and valve size is 2" with 1" trim.

-Tanks are in a banked configuration. Noble calculations do not account for breathing from non-producing bank. This analysis includes breathing losses from all 10 oil tanks.

-The facility has uncontrolled acutual VOC emissions greater than 50 tpy. Therefore an IR inspection is required.

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original STEM Engineering Evaluation_Guttersen 5 Pad.xlsm and was changed to 12 oz/in^2 in the modified STEM Engineering Evaluation_rev1_GUTTERSEN T3N-R63W-S5 L01.xlsm file.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

UPDATE: Noble confirmed accuracy of existing Engineering Evaluation. Rework Request and Generwell project completion report (Attachment H) documents confirmation that shut-in pressure was changed to 70 psig.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HARPER USX T7N-R65W-S27 L01**

Consent Decree Tank System Number: **1413**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
HARPER USX T7N-R65W-S27 L01 FINAL PACKET	pdf	4-23-2015 (SIGN	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
HARPER USX T7N-R65W-S27 L01_SIGNED EVAL	pdf	5/21/2015	Signed Engineering Evaluation
STEM Engineering Evaluation_Harper USX EE27	xlsm	4/15/2015	STEM Engineering Evaluation Model
STEM Engineering Evaluation_rev1_HARPER USX T7N-R65W-S27 L01.xlsm	xlsm	7/28/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
140 - Harper Work Request	pdf	NOT DATED	Rework Request
HARPER USX T7N-R65W-S27 L01 REWORK PACKET	pdf	9/22/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
HARPER USX T7N-R65W-S27 L01 WALKDOWN	pdf	4/23/2015	Final Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
HARPER USX T7N-R65W-S27 L01 IR VERIFICATION	pdf	5/20/2015	IR Camera Verification Documentation Field Data Sheet
HARPER USX T7N-R65W-S27 L01_0749_normal	mp4	5/20/2015	IR Camera Video During Normal Operations
HARPER USX T7N-R65W-S27 L01_0750_dump	mp4	5/20/2015	IR Camera Video During Dump Event
HARPER USX T7N-R65W-S27 L01_0751_post	mp4	5/20/2015	IR Camera Video Following Dump Event

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
HARPER USX T7N-R65W-S27 L01_SIGNED EVAL	pdf	5/21/2015	Signed Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HARPER USX T7N-R65W-S27 L01**

Consent Decree Tank System Number: **1413**

☑ Yes ☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes ☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**5**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3"**
# VOC Lines to KO:	**2**
# VOC Lines to Burner:	**2**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**	**70**						
Dump Valve Size & Trim Size (in)	**1" & 1/2"**	**1" & 1/2"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	
Man. Capacity (MSCFD)	**140**	**140**	**140**	

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**9,255**	**9,256**	**0%**
Calculated Burner Capacity (scfh	**8,459**	**17,500**	
Headspace Surge Capacity (scfh)	**3,743**	**3,743**	
Total VCS Capacity (scfh)	**12,202**	**21,243**	
VCS Capacity minus PPIVF (scfh)	**2,947**	**11,987**	

☑ Yes ☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes ☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes ☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes ☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/6/2016 & 11/14/2016 & 4/20/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	6/3/2016 & 11/29/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HARPER USX T7N-R65W-S27 L01**

Consent Decree Tank System Number: **1413**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**	**0.77**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**0.89**	**0.89**						
Gas/Oil Ratio (scf/bbl)	**112.8**	**112.8**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**	**0.94**						
Valve Coefficent (gpm/psi) (C_v)	**5.72**	**5.72**						
Critical Pressure (psia)[b]	**539**	**539**						
Vapor Pressure (psia)[c]	**83**	**83**						
Critical pressure ratio (F_F) [d]	**0.85**	**0.85**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**792**	**792**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**	**89.3**						
Working Flow (Mscfd)[h,i]	**8**	**8**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**29**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**7,440**	**7,440**
Oil Tank Working Rate	**627**	**626**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**1,189**	**1,189**
Total	**9,256**	**9,255**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HARPER USX T7N-R65W-S27 L01**

Consent Decree Tank System Number: **1413**

Audit Notes

-There are 2 work requests for this facility one undated and one dated 9/22/2015. The walkdown and IR verificaiton are dated 4/23/2015 and 5/20/2015. Therefore SLR cannot verify the work requested on 9/22/2015 was completed. The work requested in the 9/22/2015 request do not affect the inputs for the engineering design. The undated work request was likely issued prior to 4/23/2015 and verfied in the 4/23/2015 walkdown.

-This facility has uncontrolled actual VOC emissions greater than 50 tpy. Therefore an IR camera inspection is required.

"VOC Design Tank Pressure" was originally 11 oz/in^2 in the original STEM Engineering Evaluation_Harper USX EE27.xlsm file and was changed to 13 oz/in^2 in the modified STEM Engineering Evaluation_rev1_HARPER USX T7N-R65W-S27 L01.xlsm file.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HETTINGER ADAMS MCWILLIAMS DECHANT T3N-R64W-S30 L01**

Consent Decree Tank System Number: **400**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
R64W-S30 L01_FINAL PACKET	pdf	4-30-2015 (SIGN	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
HETTINGER ADAMS MCWILLIAMS DECHANT T3N-R64W-S30 L01_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Evaluation
STEM Engineering Evaluation_McWilliams	xlsm	4/29/2015	STEM Engineering Evaluation Model
STEM Engineering Eval_rev1_HETTINGER ADAMS T3N-R64W-S30 L01	xlsm	7/28/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
HETTINGER ADAMS MCWILLIAMS DECHANT T3N-R64W-S30 L01_WORK REQUEST	xlsx	4/1/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
HETTINGER ADAMS MCWILLIAMS DECHANT T3N-R64W-S30 L01 WALKDOWN	pdf	4/30/2015	Final Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
HETTINGER ADAMS MCWILLIAMS DECHANT T3N-R64W-S30 L01 IR VERIFICATION	pdf	5/18/2015	IR Camera Verification Documentation Field Data Sheet
HETTINGER ADAMS MCWILLIAMS DECHANT T3N-R64W-S30 L01_0718_normal	mp4	5/18/2015	IR Camera Video During Normal Operations
HETTINGER ADAMS MCWILLIAMS DECHANT T3N-R64W-S30 L01_0719_dump1	mp4	5/18/2015	IR Camera Video During Dump Event
HETTINGER ADAMS MCWILLIAMS DECHANT T3N-R64W-S30 L01_0720_dump2	mp4	5/18/2015	IR Camera Video During Dump Event
HETTINGER ADAMS MCWILLIAMS DECHANT T3N-R64W-S30 L01_0721_dump3	mp4	5/18/2015	IR Camera Video During Dump Event
HETTINGER ADAMS MCWILLIAMS DECHANT T3N-R64W-S30 L01_0723_dump4	mp4	5/18/2015	IR Camera Video During Dump Event
HETTINGER ADAMS MCWILLIAMS DECHANT T3N-R64W-S30 L01_0724_dump5	mp4	5/18/2015	IR Camera Video During Dump Event
HETTINGER ADAMS MCWILLIAMS DECHANT T3N-R64W-S30 L01_0725_dump6	mp4	5/18/2015	IR Camera Video During Dump Event
HETTINGER ADAMS MCWILLIAMS DECHANT T3N-R64W-S30 L01_0726_post	mp4	5/18/2015	IR Camera Video Following Dump Event

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
HETTINGER ADAMS MCWILLIAMS DECHANT T3N-R64W-S30 L01_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HETTINGER ADAMS MCWILLIAMS DECHANT T3N-R64W-S30 L01**

Consent Decree Tank System Number: **400**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**5**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**2" & 1"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**	**TEC 4-CS (48" Tornado)**	
Man. Capacity (MSCFD)	**109.272**	**109.272**	**110.4**	

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**13,461**	**13,464**	**0%**
Calculated Burner Capacity (scfh	**8,750**	**13,706**	
Headspace Surge Capacity (scfh)	**18,884**	**18,884**	
Total VCS Capacity (scfh)	**27,634**	**32,590**	
VCS Capacity minus PPIVF (scfh)	**14,173**	**19,126**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/6/2016 & 11/14/2016 & 4/20/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	6/3/2016 & 11/29/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HETTINGER ADAMS MCWILLIAMS DECHANT T3N-R64W-S30 L01**

Consent Decree Tank System Number: **400**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**							
Valve Coefficent (gpm/psi) (C_v)	**21.25**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**2409**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**271.7**							
Working Flow (Mscfd)[h,i]	**23**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**29**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**11,321**	**11,321**
Oil Tank Working Rate	**955**	**952**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**1,189**	**1,189**
Total	**13,464**	**13,462**

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HETTINGER ADAMS MCWILLIAMS DECHANT T3N-R64W-S30 L01**

Consent Decree Tank System Number: **400**

Audit Notes

-VOC's seen in IR videos "dump1 to dump5". Leaks appear to be fixed in the "dump6" IR video. This is noted on the IR inspection form

- There is a note on a marked up version of the work request in the final packet indicating the LP Sep has 1/2" trim dump valve . A 1" trim was used in this is analysis (as indicated in the work order and final eval) since it is more conservative.

-This facility has uncontrolled actual VOC emissions greater than 50 tpy. Therefore an IR inspection is required.

"VOC Design Tank Pressure" was 11 oz/in^2 in the original STEM Engineering Evaluation_McWilliams.xlsm with one (1) "VOC Line KO to Burner" which was changed to 12 oz/in^2 in the modified STEM Engineering Eval_rev1_HETTINGER ADAMS T3N-R64W-S30 L01.xlsm file with two (2) "VOC lines KO to Burner).

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HOFFMAN T4N-R64W-S2 L01**

Consent Decree Tank System Number: **664**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
HOFFMAN T4N-R64W-S2 L01_FINAL PACKET	pdf	8-28-2015 (DAT	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
HOFFMAN T4N-R64W-S2 L01_SIGNED EVAL	pdf	5/21/2015	Engineering Evaluation
STEM Engineering Evaluation_Hoffman C02	xlsm	4/30/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1 HOFFMAN T4N-R64W-S2 L01	xlsm	4/15/2015	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
HOFFMAN T4N-R64W-S2 L01 WORK REQUEST	pdf	NA	Work Request
HOFFMAN T4N-R64W-S2 L01_FINAL PACKET	pdf	8-28-2015 (DAT	Work Request
Noble 3rd Party Audit Wave 12 Update Info Request_20170117	pdf	1/17/2017	Noble Info Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
HOFFMAN T4N-R64W-S2 L01 WALKDOWN	pdf	N/A	Walkdown Checklist
HOFFMAN T4N-R64W-S2 L01_FINAL PACKET	pdf	8-28-2015 (DAT	Final Facility Packet

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
HOFFMAN T4N-R64W-S2 L01 IR VERIFICATION	pdf	8/25/2015	IR Camera Verification Sheet
HOFFMAN T4N-R64W-S2 L01_0001_NORMAL	mp4	8/25/2015	IR Camera Video
HOFFMAN T4N-R64W-S2 L01_0002_DUMP	mp4	8/25/2015	IR Camera Video
HOFFMAN T4N-R64W-S2 L01_0003_POST	mp4	8/25/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
HOFFMAN T4N-R64W-S2 L01_SIGNED EVAL	pdf	5/21/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HOFFMAN T4N-R64W-S2 L01**

Consent Decree Tank System Number: **664**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**2" & 1"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**			
Man. Capacity (MSCFD)	**109.272**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,926**	**12,988**	**164%**
Calculated Burner Capacity (scfh	**3,763**	**4,553**	
Headspace Surge Capacity (scfh)	**4,568**	**11,528**	
Total VCS Capacity (scfh)	**8,331**	**16,081**	
VCS Capacity minus PPIVF (scfh)	**3,405**	**3,093**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/6/2016 & 11/14/2016 & 1/31/2017 & 4/28/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	6/9/2016 & 11/29/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HOFFMAN T4N-R64W-S2 L01**

Consent Decree Tank System Number: **664**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**							
Valve Coefficent (gpm/psi) (C_v)	**21.25**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**2409**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**271.7**							
Working Flow (Mscfd)[h,i]	**23**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**17**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**11,321**	**3,885**
Oil Tank Working Rate	**955**	**327**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**713**	**713**
Total	**12,988**	**4,925**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HOFFMAN T4N-R64W-S2 L01**

Consent Decree Tank System Number: **664**

Audit Notes

-Note on pg 10 of final packet pdf states "theif hatch leaking on #1 stock tank." No emissions were indicated on the IR inspection form or visible in the IR camera videos.

-There is not any signed documentation showing that the oil dump valves were changed from 1" to 1/2" trim. SLR will use 2" valves with 1" trim for the oil dumps as indicated on the walkdown sheet and field datasheet.

-Final walkdown form is not signed or dated

-Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

The separator max operating pressure (80 psig) in the original STEM Engineering Evaluation_Hoffman C02.xlsm is different than the separator max operating pressure (70 psig) unput in the modified STEM Engineering Evaluation_rev1 HOFFMAN T4N-R64W-S2 L01.xlsm file. Noble provided documentation to SLR proving the operating pressure is 70psig. Therefore SLR used 70 psig in their calculations.

The number of VOC lines between the "Tanks to KO" is not consitent between the HOFFMAN T4N-R64W-S2 L01 - STEM Engineering Evaluation Check.xlsm calcbook and the modified HOFFMAN T4N-R64W-S2 L01 - STEM Engineering Evaluation Check.xlsm. SLR used the most recent value (1 line) provided in the modified HOFFMAN T4N-R64W-S2 L01 - STEM Engineering Evaluation Check.xlsm STEM calcbook

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HOLMAN COCKROFT T5N-R64W-S15 L01**

Consent Decree Tank System Number: **2074**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
HOLMAN COCKROFT T5N-R64W-S15 L01_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
HOLMAN COCKROFT T5N-R64W-S15 L01_SIGNED EVAL	pdf	5/21/2015	Engineering Evaluation
STEM Engineering Evaluation_Holman Cockroft	xlsm	8/28/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_HOLMAN COCKROFT T5N-R64W-S15 L01	xlsm	7/28/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
HOLMAN COCKROFT T5N-R64W-S15 L01 WORK REQUEST	xlsx	4/1/2015	Work Request
HOLMAN COCKROFT T5N-R64W-S15 L01 FINAL PACKET	pdf	4-24-2015 (SIGN	Work Request
Noble 3rd Party Audit Wave 12 Update Info Request_20170117	pdf	1/17/2017	Noble Info Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
HOLMAN COCKROFT T5N-R64W-S15 L01 WALKDOWN	pdf	4/24/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
HOLMAN COCKROFT T5N-R64W-S15 L01 IR VERIFICATION	pdf	5/12/2015	IR Camera Verification Sheet
HOLMAN COCKROFT T5N-R64W-S15 L01_2369_normal	mp4	5/12/2015	IR Camera Video
HOLMAN COCKROFT T5N-R64W-S15 L01_2371_post	mp4	5/12/2015	IR Camera Video
HOLMAN COCKROFT T5N-R64W-S15 L01_2370_dump	mp4	5/12/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
HOLMAN COCKROFT T5N-R64W-S15 L01_SIGNED EVAL	pdf	5/21/2015	Signed Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HOLMAN COCKROFT T5N-R64W-S15 L01**

Consent Decree Tank System Number: **2074**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**14**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**4**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**				
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**				

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**
Dump Valve Size & Trim Size (in)	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	
Man. Capacity (MSCFD)	**140**	**140**	**140**	

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**51,935**	**54,103**	**4%**
Calculated Burner Capacity (scfh	**7,008**	**17,500**	
Headspace Surge Capacity (scfh)	**120,931**	**120,931**	
Total VCS Capacity (scfh)	**127,939**	**138,431**	
VCS Capacity minus PPIVF (scfh)	**76,004**	**84,328**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	7/20/2016 & 11/14/2016 & 1/31/2017 & 4/28/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	8/4/2016 & 11/29/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HOLMAN COCKROFT T5N-R64W-S15 L01**

Consent Decree Tank System Number: **2074**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**	**-1.02**	**-1.02**				
Z2	**-0.86**	**-0.86**	**-0.86**	**-0.86**				
Z3	**0.98**	**0.98**	**0.98**	**0.98**				
Z	**-0.90**	**-0.90**	**-0.90**	**-0.90**				
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**	**22.9**	**22.9**				

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**	**0.77**				
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**	**21.25**				
Critical Pressure (psia)[b]	**833**	**833**	**833**	**833**				
Vapor Pressure (psia)[c]	**407**	**407**	**407**	**407**				
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**	**0.76**	**0.76**				
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**				
Peak Flow (bopd)[f,g]	**6905**	**6905**	**6905**	**6905**				

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**158.2**	**158.2**	**158.2**	**158.2**				
Working Flow (Mscfd)[h,i]	**66**	**66**	**66**	**66**				

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**	**0.78**	**0.78**	**0.78**	**0.78**	**0.78**	**0.78**	**0.78**
Valve Coefficent (gpm/psi) (C_v)	**7.20**	**7.20**	**7.20**	**7.20**	**7.20**	**7.20**	**7.20**	**7.20**
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**
Vapor Pressure (psia)[k]	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Peak Flow (bwpd)[f,g]	**3906**	**3906**	**3906**	**3906**	**3906**	**3906**	**3906**	**3906**

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**
Working Flow (Mscfd)[l]	**22**	**22**	**22**	**22**	**22**	**22**	**22**	**22**

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**80**	**23**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**26,359**	**26,359**
Oil Tank Working Rate	**10,945**	**10,918**
Water Tank Flash Rate	**5,209**	**5,208**
Water Tank Working Rate	**7,311**	**7,311**
Tank Breathing Rate	**4,279**	**2,140**
Total	**54,103**	**51,936**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HOLMAN COCKROFT T5N-R64W-S15 L01**

Consent Decree Tank System Number: **2074**

Audit Notes

IR Camera videos do not clearly show all tanks.

HOLMAN COCKROFT T5N-R64W-S15 L01_FINAL PACKET.pdf, Pg 8, does not indicates the water dump valves size. It was assumed the water dump valves were 2" valves, matching the oil dump valve size.

Audit spreadsheet includes all tanks and account for breathing losses from both banks. Configuration has two banks - each with 7 oil tanks and 2 water tanks. Noble did not account for breathing losses from the non-producing bank.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original STEM Engineering Evaluation_Holman Cockroft.xlsm and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1_HOLMAN COCKROFT T5N-R64W-S15 L01.xlsm file.

- Water dumps from one four (4) separator vessels (LP) existed in the original STEM Engineering Evaluation_Holman Cockroft.xlsm, now water dumps from eight (8) separator vessels (LP & HP) are shown in the modified STEM Engineering Evaluation_rev1_HOLMAN COCKROFT T5N-R64W-S15 L01.xlsm file. From Noble on 1/17/2017 - Initially, the original (Rev0) evaluation combined the water production dump from eight separate separators (4 HP and 4 LP) as a four water dumps. The revised (Rev1) evaluation incorporated four additional water dumps to provide a dedicated water dump scenario for each separator. SLR used 8 separate water dumps in its calculations.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HONEY BADGER T5N-R66W-S31 L01**

Consent Decree Tank System Number: **2366**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
HONEY BADGER UPRC BERNHARDT T5N-R66W-S31 L01_FINAL PACKET	pdf	4/23/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
HONEY BADGER T5N-R66W-S31 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation
STEM Engineering Evaluation_Honey Badger	xlsm	4/28/2015	Tank VOC Analysis
STEM Engineering Eval_rev1_HONEY BADGER UPRC T5N-R66W-S31 L01	xlsm	7/28/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
HONEY BADGER UPRC BERNHARDT T5N-R66W-R31 L01 WORK REQUEST	xslx	4/1/2015	Work Request
HONEY BADGER UPRC BERNHARDT T5N-R66W-S31 L01_FINAL PACKET	pdf	4/23/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
HONEY BADGER UPRC BERNHARDT T5N-R66W-S31 L01 WALKDOWN	pdf	5/6/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
HONEY BADGER UPRC BERNHARDT T5N-R66W-S31 L01_SIGNEDVERIFICATION	pdf	5/4/2015	IR Camera Verification Sheet
HONEY BADGER T5N-R66W-S31 L01_2242_normal	mp4	5/4/2015	IR Camera Video
HONEY BADGER T5N-R66W-S31 L01_2243_dump	mp4	5/4/2015	IR Camera Video
HONEY BADGER T5N-R66W-S31 L01_2244_post	mp4	5/4/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
HONEY BADGER T5N-R66W-S31 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HONEY BADGER T5N-R66W-S31 L01**

Consent Decree Tank System Number: **2366**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**2**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**1**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**							
Dump Valve Size & Trim Size (in)	**2" & 1"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**270**					
Dump Valve Size & Trim Size (in)	**2" & 1/2"**	**2" & 1"**	**1" & 1/2"**					

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**TEC 4-CS (48" Tornado**			
Man. Capacity (MSCFD)	**110.4**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**14,401**	**17,403**	**21%**
Calculated Burner Capacity (scfh)	**4,089**	**4,600**	
Headspace Surge Capacity (scfh)	**41,849**	**42,696**	
Total VCS Capacity (scfh)	**45,938**	**47,296**	
VCS Capacity minus PPIVF (scfh)	**31,537**	**29,893**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/6/2016 & 11/14/2016 & 4/28/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	5/25/2016 & 11/29/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HONEY BADGER T5N-R66W-S31 L01**

Consent Decree Tank System Number: **2366**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**-0.90**							
Gas/Oil Ratio (scf/bbl)	**22.9**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**							
Valve Coefficent (gpm/psi) (C_v)	**21.25**							
Critical Pressure (psia)[b]	**833**							
Vapor Pressure (psia)[c]	**407**							
Critical pressure ratio (F_F) [d]	**0.76**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**6905**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**158.2**							
Working Flow (Mscfd)[h,i]	**66**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**	**0.77**	**0.94**					
Valve Coefficent (gpm/psi) (C_v)	**7.20**	**21.25**	**5.72**					
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**					
Vapor Pressure (psia)[k]	**1**	**1**	**1**					
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**					
Choked Flow?[e]	**Yes**	**Yes**	**Yes**					
Peak Flow (bwpd)[f,g]	**3906**	**11381**	**3093**					

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**16**	**46**	**12**					
Working Flow (Mscfd)[l]	**22**	**64**	**17**					

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**11**	**6**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**6,590**	**6,590**
Oil Tank Working Rate	**2,736**	**2,729**
Water Tank Flash Rate	**3,064**	**1,818**
Water Tank Working Rate	**4,300**	**2,551**
Tank Breathing Rate	**713**	**713**
Total	**17,403**	**14,401**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HONEY BADGER T5N-R66W-S31 L01**

Consent Decree Tank System Number: **2366**

Audit Notes

There is no documentation to verify the Honey Bader J31-64-1HN LP separator water dump valve had a 1/2" trim installed. The audit evaluation assumed the trim was unchanged and completed the audit assessment with a 2" valve with a 1" trim based on the field notes provided on pg. 8, HONEY BADGER UPRC BERNHARDT T5N-R66W-S31 L01_FINAL PACKET.pdf

Five (5) tanks appear in the IR Videos, where the signed evaluation pdf (HONEY BADGER UPRC BERNHARDT T5N-R66W-S31 L01_SIGNED EVAL.pdf) only shows three (3) tanks total being onsite. Pg. 10 & 11 of the final packet pdf (HONEY BADGER UPRC BERNHARDT T5N-R66W-S31 L01_FINAL PACKET.pdf) show five (5) 300bbl tanks onsite. The use of only 3 tanks will result in less headspace surge capacity and less breathing losses.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HP FARMS T3N-R64W-S32 L01/HP T3N-R64W-S32-L01**

Consent Decree Tank System Number: 426

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
HP FARMS T3N-R64W-S32 L01_FINAL PACKET	pdf	5/26/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
HP FARMS T3N-R64W-S32 L01_SIGNED EVAL	pdf	6/26/2015	Signed Engineering Design Evaluation
EM Engineering Evaluation_HP FARMS T3N-R64W-S32 L	xlsm	6/24/2015	STEM Engineering Evaluation Model
STEM Engineering Evaluation_rev1 HP FARMS T3N-R64W-S32 L01	xlsm	9/23/3016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
HP FARMS T3N-R64W-S32 L01 WORK REQUEST	pdf	5/4/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
HP FARMS T3N-R64W-S32 L01 WALKDOWN	pdf	5/26/2015	Tank System Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
HP FARMS T3N-R64W-S32_0171_NORMAL	mp4	5/26/2015	IR Inspection Video During Normal Operations
HP FARMS T3N-R64W-S32_0172_DUMP	mp4	5/26/2015	IR Inspection Video During Dump Event
HP FARMS T3N-R64W-S32_0174_POST	mp4	5/26/2015	IR Inspection Video Following Dump Event
HP FARMS T3N-R64W-S32 IR VERIFICATION	pdf	5/26/2015	IR Camera Verification Documentation and Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
HP FARMS T3N-R64W-S32 L01_SIGNED EVAL	pdf	6/26/2015	Signed Engineering Design Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HP FARMS T3N-R64W-S32 L01/HP T3N-R64W-S32-L01**

Consent Decree Tank System Number: **426**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**4**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**		
Man. Capacity (MSCFD)	**140**	**140**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,984**	**4,985**	**0%**
Calculated Burner Capacity (scfh	**5,314**	**11,667**	
Headspace Surge Capacity (scfh)	**5,785**	**5,785**	
Total VCS Capacity (scfh)	**11,099**	**17,452**	
VCS Capacity minus PPIVF (scfh)	**6,115**	**12,467**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	4/11/2016 & 11/14/2016 & 4/20/2016
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	4/12/2016 & 11/30/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HP FARMS T3N-R64W-S32 L01/HP T3N-R64W-S32-L01**

Consent Decree Tank System Number: **426**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**23**	**0**

Flow Rate Summary	**Flow Rate (scfh)**	
	SLR	**Noble**
Oil Tank Flash Rate	**3,720**	**3,720**
Oil Tank Working Rate	**314**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**951**	**951**
Total	**4,985**	**4,984**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HP FARMS T3N-R64W-S32 L01/HP T3N-R64W-S32-L01**

Consent Decree Tank System Number: **426**

Audit Notes

-Automation noted in 5/7/2015 email that PSHH was set to trip at 70 psig instead of 80 psig requested in work order. 70 psig was utilized in this evaluation.
"Max Operating Pressure" was originally 80 psi in the original STEM Engineering Evaluation_HP FARMS T3N-R64W-S32 L01.xlsm and was changed to 70 psi in the modified STEM Engineering Evaluation_rev1 HP FARMS T3N-R64W-S32 L01.xlsm file. 70 psig was utilized in this evaluation.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HSR DECHANT PARKMAN SAFRANS BARBOUR PETRIE T3N-R64W-S7 L01**

Consent Decree Tank System Number: **388**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
HSR DECHANT PARKMAN SAFRANS BARBOUR PETRIE T3N-R64W-S7 L01_FINAL PACKET	pdf	7/6/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
HSR DECHANT PARKMAN SAFRANS BARBOUR PETRIE T3N-R64W-S7 L01_SIGNED EVAL	pdf	6/26/2015	Engineering Evaluation
HSR DECHANT PARKMAN SAFRANS BARBOUR PETRIE T3N-R64W-S7 L01_FINAL PACKET	pdf	7/6/2015	Tank VOC Analysis
STEM Eng Eval_rev1 HSR DECHANT T3N-R64W-S7 L01	xlsm	7/28/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
HSR DECHANT PARKMAN SAFRANS BARBOUR PETRIE T3N-R64W-S7 L01 WORK REQUEST	pdf	5/19/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
HSR DECHANT PARKMAN SAFRANS BARBOUR PETRIE T3N-R64W-S7 L01 WALKDOWN	pdf	6/10/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
HSR DECHANT PARKMAN SAFRANS BARBOUR PETRIE T3N-R64W-S7 IR VERIFICATION	pdf	6/10/2015	IR Camera Verification Sheet
HSR DECHANT PARKMAN SAFRANS BARBOUR PETRIE T3N-R64W-S7 L01_0243_NORMAL	mp4	6/10/2015	IR Camera Video
HSR DECHANT PARKMAN SAFRANS BARBOUR PETRIE T3N-R64W-S7 L01_0244_DUMP	mp4	6/10/2015	IR Camera Video
HSR DECHANT PARKMAN SAFRANS BARBOUR PETRIE T3N-R64W-S7 L01_0245_POST	mp4	6/10/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
HSR DECHANT PARKMAN SAFRANS BARBOUR PETRIE T3N-R64W-S7 L01_SIGNED EVAL	pdf	6/26/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HSR DECHANT PARKMAN SAFRANS BARBOUR PETRIE T3N-R64W-S7 L01**

Consent Decree Tank System Number: **388**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**2**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**2" & 2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**COMM 200 48"**			
Man. Capacity (MSCFD)	**157**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**12,748**	**32,974**	**159%**
Calculated Burner Capacity (scfh	**4,960**	**6,542**	
Headspace Surge Capacity (scfh)	**13,290**	**15,528**	
Total VCS Capacity (scfh)	**18,250**	**22,070**	
VCS Capacity minus PPIVF (scfh)	**5,502**	**-10,904**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm
Audit Document Review Date:	3/31/2016
Audit Document Review Verified by:	Angela M. Oberlander & James Van Horne
Audit Document Verification Date:	4/1/2016 & 5/16/2017

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HSR DECHANT PARKMAN SAFRANS BARBOUR PETRIE T3N-R64W-S7 L01**

Consent Decree Tank System Number: **388**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.76**							
Valve Coefficent (gpm/psi) (C_v)	**57.00**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**6378**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**719.3**							
Working Flow (Mscfd)[h,i]	**61**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**11**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**29,971**	**11,321**
Oil Tank Working Rate	**2,527**	**952**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**475**	**475**
Total	**32,974**	**12,748**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HSR DECHANT PARKMAN SAFRANS BARBOUR PETRIE T3N-R64W-S7 L01**

Consent Decree Tank System Number: **388**

Audit Notes

-Field docuementation shows a 2" valve size of with a 2" trim in the initial walkdown (final packet page 6). A modification to valve trim was not requested in the work request. Noble used a 2" valve with 1" trim in their signed final evaluation.

-Final walkdown sheet, item 1 has no indication as to whether work order items have been completed. (FINAL PACKET p. 20). Tasks completions that cannot be confirmed with other documentation include:

- Install dedicated 48" COMM burner for LP gas header.
- Modify existing 48" COMM burner, so that both stages are used for tank VOC service.
- Modify existing LP gas header design to be consistent with the standard 125# Standard Design (i.e. remove floats from LPs, install wellmark & PRV on LP KO, etc.)

UPDATE: Updated Engineering Evaluation submitted with the 5th semiannual report (July 28, 2017). Dump valve was verified to be a Kimray 212, which does not have an adjustable trim and seat. The updated Engineering Evaluation considered the specific dump valve characteristics, which are comparable to a 1.5” trim. Additionally, field verification confirmed that a dedicated LP gas system was installed. Satellite imagery of the Tank System (before and after) shows the dedicated system that was installed.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HSR WALDBAUM WILLENBORG T4N-R65W-S21 L01**

Consent Decree Tank System Number: **2100**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
HSR WALDBAUM WILLENBORG T4N-R65W-S21 L01_FINAL PACKET	pdf	5/28/2015	RISE field packet, field notes

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
HSR WALDBAUM WILLENBORG T4N-R65W-S21 L01_SIGNED EVAL	pdf	6/29/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_HSR WALDBAUM WILLENBORG T4N-R65W-S21 L01	xlsm	4/28/2015	STEM Engineering Evaluation Model
STEM Engineering Eval_rev1 HSR WALDBAUM T4N-R65W-S21 L01.xlsm	xlsm	7/28/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
HSR WALDBAUM WILLENBORG T4N-R65W-S21 L01 WORK REQUEST	pdf	5/6/2015	STEM work request form

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
HSR WALDBAUM WILLENBORG T4N-R65W-S21 L01_FIELD VER	pdf	5/28/2015	Field verification of modification

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
HSR WALDBAUM WILLENBORG T4N-R65W-S21 L01_0181_NORMAL	mp4	unk	IR Video of site during normal operation
HSR WALDBAUM WILLENBORG T4N-R65W-S21 L01_0182_DUMP	mp4	unk	IR Video of site during separator dump event
HSR WALDBAUM WILLENBORG T4N-R65W-S21 L01_0183_POST	mp4	unk	IR Video of site post dump event
HSR WALDBAUM WILLENBORG T4N-R65W-S21 L01 IR VERIFICATION	pdf	5/28/2015	IR Camera Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
HSR WALDBAUM WILLENBORG T4N-R65W-S21 L01_SIGNED EVAL	pdf	6/29/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HSR WALDBAUM WILLENBORG T4N-R65W-S21 L01**

Consent Decree Tank System Number: **2100**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**2**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	
Water Tank Capacity (bbl):	
VOC Line Size (in):	**4**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**COMM 200 48"**			
Man. Capacity (MSCFD)	**157**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,508**	**4,509**	**0%**
Calculated Burner Capacity (scfh)	**4,960**	**6,542**	
Headspace Surge Capacity (scfh)	**2,808**	**2,662**	
Total VCS Capacity (scfh)	**7,768**	**9,204**	
VCS Capacity minus PPIVF (scfh)	**3,260**	**4,695**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Jaclyn Fitzgerald/Tom Kussard
Audit Document Review Date:	4/14/2016 & 11/14/2016 & 4/21/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	4/20/2016 & 11/30/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HSR WALDBAUM WILLENBORG T4N-R65W-S21 L01**

Consent Decree Tank System Number: **2100**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	
scfh vapor/tank[i]	**238**	
Mscfd	**11**	

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**3,720**	**3,720**
Oil Tank Working Rate	**314**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**475**	**475**
Total	**4,509**	**4,508**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **HSR WALDBAUM WILLENBORG T4N-R65W-S21 L01**

Consent Decree Tank System Number: **2100**

Audit Notes

-LP max certification pressure differs in the SIGNED EVAL (70 psig) and FINAL PACKET (80 psig). Email from Jeff Kennedy (Friday May 15, 2015 9:25am) states that the "pressure switch is set to trip at 70 lbs." This pressure (70 psig) was used in the SLR analysis.

- 4" above ground VOC line installed (per Stem QC Checklist, page 15 of FINAL PACKET), 3" scf 40 was used in SIGNED EVAL. SLR used 4" in the calculations.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **IRVINE T6N-R65W-S2 L01**

Consent Decree Tank System Number: **73**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
IRVINE T6N-R65W-S2 L01_FINAL PACKET	pdf	7/14/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
IRVINE T6N-R65W-S2 L01_SIGNED EVAL	pdf	7/20/2015	Engineering Evaluation
IRVINE T6N-R65W-S2 L01_FINAL PACKET	pdf	7/14/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1 IRVINE T6N-R65W-S2 L01.xlsm	xlsm	7/28/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
IRVINE T6N-R65W-S2 L01 WORK REQUEST	pdf	6/9/2015	Work Request
IRVINE T6N-R65W-S2 L01_FINAL PACKET	pdf	7/14/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
IRVINE T6N-R65W-S2 L01 WALKDOWN	pdf	7/13/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
IRVINE T6N-R65W-S2 L01 IR VERIFICATION	pdf	7/13/2015	IR Camera Verification Sheet
IRVINE T6N-R65W-S2 L01_0059_NORMAL	mp4	7/13/2015	IR Camera Video
IRVINE T6N-R65W-S2 L01_0060_DUMP	mp4	7/13/2015	IR Camera Video
IRVINE T6N-R65W-S2 L01_0061_POST	mp4	7/13/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
IRVINE T6N-R65W-S2 L01_SIGNED EVAL	pdf	7/20/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **IRVINE T6N-R65W-S2 L01**

Consent Decree Tank System Number: **73**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**4**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**2" & 1"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**		
Man. Capacity (MSCFD)	**109.272**	**109.272**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**13,224**	**13,226**	**0%**
Calculated Burner Capacity (scfh	**6,520**	**9,106**	
Headspace Surge Capacity (scfh)	**18,665**	**18,665**	
Total VCS Capacity (scfh)	**25,185**	**27,771**	
VCS Capacity minus PPIVF (scfh)	**11,961**	**14,545**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	3/29/2016 & 11/14/2016 & 4/21/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	3/31/2016 & 11/30/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **IRVINE T6N-R65W-S2 L01**

Consent Decree Tank System Number: **73**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**							
Valve Coefficent (gpm/psi) (C_v)	**21.25**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**2409**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**271.7**							
Working Flow (Mscfd)[h,i]	**23**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**23**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**11,321**	**11,321**
Oil Tank Working Rate	**955**	**952**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**951**	**951**
Total	**13,226**	**13,224**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **IRVINE T6N-R65W-S2 L01**

Consent Decree Tank System Number: **73**

Audit Notes

Five (5) oil tanks shown on pg. 6 of the final packet pdf with indication that one tank is out of service. Four (4) oil tanks shown in the signed evaluation pdf. Page 11 of the final packet pdf notes oil tank #1 was unhooked. Five (5) tanks visible in IR videos.

Page 8 of the final packet pdf shows a 1/2" trim size for the LP Sep dump valve. Where 1" trim size is shown in the signed evaluation pdf. SLR Utilized a 2" valve with a 1" trim in evaluation to be conservative.

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original IRVINE T6N-R65W-S2 L01_FINAL PACKET.pdf and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1 IRVINE T6N-R65W-S2 L01.xlsm file.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **JOHNSON ROBERTSON REIS UPRR PAN AM T2N-R64W-S19 L01**

Consent Decree Tank System Number: **439**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
JOHNSON ROBERTSON REIS UPRR PAN AM T2N-R64W-S19 L01_FINAL PACKET	pdf	8/26/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
JOHNSON ROBERTSON REIS UPRR PAN AM T2N-R64W-S19 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation
STEM Engineering Evaluation_Robertson_Oil	xlsm	5/22/2015	Tank VOC Analysis
STEM Eng Eval_rev1_JOHNSON ROBERTSON T2N-R64W-S19 L01_Oil	xlsm	4/15/2015	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
0064 - Robertson Work Request	pdf	NA	Work Request
JOHNSON ROBERTSON REIS UPRR PAN AM T2N-R64W-S19 L01_FINAL PACKET	pdf	8/26/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
JOHNSON ROBERTSON REIS UPRR PAN AM T2N-R64W-S19 L01 WALKDOWN	pdf	4/25/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
JOHNSON ROBERTSON REIS UPRR PAN AM T2N-R64W-S19 L01_SIGNEDVERIFICATION	pdf	5/7/2015	IR Camera Verification Sheet
JOHNSON ROBERTSON REIS UPRR PAN AM T2N-R64W-S19 L01_2301_normal	mp4	5/7/2015	IR Camera Video
JOHNSON ROBERTSON REIS UPRR PAN AM T2N-R64W-S19 L01_2302_dump	mp4	5/7/2015	IR Camera Video
JOHNSON ROBERTSON REIS UPRR PAN AM T2N-R64W-S19 L01_2303_post	mp4	5/7/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
JOHNSON ROBERTSON REIS UPRR PAN AM T2N-R64W-S19 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **JOHNSON ROBERTSON REIS UPRR PAN AM T2N-R64W-S19 L01**

Consent Decree Tank System Number: **439**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**11**
Oil Tank Capacity (bbl):	**400**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**300**	**125**	**125**	**125**	**125**			
Dump Valve Size & Trim Size (in)	**1" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**			

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**COMM 200 48"**		
Man. Capacity (MSCFD)	**140**	**157**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**10,356**	**12,264**	**18%**
Calculated Burner Capacity (scfh)	**6,620**	**12,375**	
Headspace Surge Capacity (scfh)	**19,766**	**19,766**	
Total VCS Capacity (scfh)	**26,386**	**32,141**	
VCS Capacity minus PPIVF (scfh)	**16,030**	**19,877**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/6/2016 & 11/14/2016 & 4/28/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	6/17/2016 & 11/30/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **JOHNSON ROBERTSON REIS UPRR PAN AM T2N-R64W-S19 L01**

Consent Decree Tank System Number: **439**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**	**-1.02**	**-1.02**	**-1.02**			
Z2	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**			
Z3	**0.98**	**0.98**	**0.98**	**0.98**	**0.98**			
Z	**-0.90**	**-0.90**	**-0.90**	**-0.90**	**-0.90**			
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**	**22.9**	**22.9**	**22.9**			

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**	**0.78**	**0.78**	**0.78**	**0.78**			
Valve Coefficent (gpm/psi) (C_v)	**5.72**	**7.20**	**7.20**	**7.20**	**7.20**			
Critical Pressure (psia)[b]	**744**	**588**	**588**	**588**	**588**			
Vapor Pressure (psia)[c]	**313**	**138**	**138**	**138**	**138**			
Critical pressure ratio (F_F) [d]	**0.78**	**0.82**	**0.82**	**0.82**	**0.82**			
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**			
Peak Flow (bopd)[f,g]	**1875**	**1156**	**1156**	**1156**	**1156**			

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**42.9**	**26.5**	**26.5**	**26.5**	**26.5**			
Working Flow (Mscfd)[h,i]	**18**	**11**	**11**	**11**	**11**			

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**400**	**0**
scfh vapor/tank[i]	**317**	**0**
Mscfd	**84**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**6,202**	**6,202**
Oil Tank Working Rate	**2,575**	**2,569**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**3,487**	**1,585**
Total	**12,264**	**10,356**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **JOHNSON ROBERTSON REIS UPRR PAN AM T2N-R64W-S19 L01**

Consent Decree Tank System Number: **439**

Audit Notes

IR Camera videos do not clearly show all tanks.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

Noble did not include breathing losses from non-producing tank bank. All tanks were included in SLR's calculations to accommodate a banked configuration for breathing losses and surge capacity. Configuration has two banks - one with 6 oil tanks, another with 5 oil tanks.

The IR Camera Video JOHNSON ROBERTSON REIS UPRR PAN AM T2N-R64W-S19 L01_2301_normal.mp4, and indicates there is a leak on the tank battery. The IR Camera Verification sheet, JOHNSON ROBERTSON REIS UPRR PAN AM T2N-R64W-S19 L01_SIGNEDVERIFICATION.pdf indicates the leak was repaired.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **JOHNSON T7N-R65W-S33 L01**

Consent Decree Tank System Number: **1914**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
JOHNSON T7N-R65W-S33 L01_FINAL PACKET	pdf	4/30/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
JOHNSON T7N-R65W-S33 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation
STEM Engineering Evaluation_Johnson	xlsm	4/30/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1 JOHNSON T7N-R65W-S33 L01	xlsm	7/28/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
JOHNSON T7N-R65W-S33 L01 WORK REQUEST	xlsx	4/1/2015	Work Request
JOHNSON T7N-R65W-S33 L01_FINAL PACKET	pdf	4/30/2015	Job Sheets

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
JOHNSON T7N-R65W-S33 L01 WALKDOWN	pdf	4/30/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
JOHNSON T7N-R65W-S33 L01_SIGNEDVERIFICATION	pdf	5/6/2015	IR Camera Verification
JOHNSON T7N-R65W-S33 L01_2287_dump	mp4	5/6/2015	IR Camera Video
JOHNSON T7N-R65W-S33 L01_2288_post	mp4	5/6/2015	IR Camera Video
JOHNSON T7N-R65W-S33 L01_2289_normal	mp4	5/6/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
JOHNSON T7N-R65W-S33 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **JOHNSON T7N-R65W-S33 L01**

Consent Decree Tank System Number: **1914**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**90**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	**TEC 4-CS (48" Tornado**	
Man. Capacity (MSCFD)	**140**	**140**	**110.4**	

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**12,986**	**6,723**	**48%**
Calculated Burner Capacity (scfh	**7,817**	**16,267**	
Headspace Surge Capacity (scfh)	**13,422**	**3,554**	
Total VCS Capacity (scfh)	**21,239**	**19,821**	
VCS Capacity minus PPIVF (scfh)	**8,253**	**13,098**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/6/2016 & 11/14/2016 & 4/28/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	6/17/2016 & 11/30/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **JOHNSON T7N-R65W-S33 L01**

Consent Decree Tank System Number: **1914**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**1.04**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**1.16**							
Gas/Oil Ratio (scf/bbl)	**148.5**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**557**							
Vapor Pressure (psia)[c]	**103**							
Critical pressure ratio (F_F) [d]	**0.84**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**913**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**135.5**							
Working Flow (Mscfd)[h,i]	**9**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**17**	**0**

Flow Rate Summary	**Flow Rate (scfh)**	
	SLR	**Noble**
Oil Tank Flash Rate	**5,648**	**11,321**
Oil Tank Working Rate	**362**	**952**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**713**	**713**
Total	**6,723**	**12,986**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **JOHNSON T7N-R65W-S33 L01**

Consent Decree Tank System Number: **1914**

Audit Notes

JOHNSON T7N-R65W-S33 L01_FINAL PACKET.pdf, pg. 8 indicates all dump valves being a 1" valve with a 1/2" trim. JOHNSON T7N-R65W-S33 L01 WORK REQUEST.pdf does not indicate any modifications to the LP separator valve. JOHNSON T7N-R65W-S33 L01_SIGNED EVAL.pdf indicates a maximum trim size of 1." SLR utilized the confirmed 1" valve with a 1/2" trim in the engineering audit.

JOHNSON T7N-R65W-S33 L01 WORK REQUEST.xslx indicates the LP Separator pressure be limited to 90 psig. JOHNSON T7N-R65W-S33 L01_SIGNED EVAL.pdf indicates the LP Separator pressure was evaluated at 70 psig. The confirmed operating pressure of 90 psig was utilized in the engineering evaluation audit. The overestimation due to a larger valve trim outweighs the use of a lower pressure.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original STEM Engineering Evaluation_Johnson.xlsm and was changed to 12 oz/in^2 in the modified STEM Engineering Evaluation_rev1 JOHNSON T7N-R65W-S33 L01.xlsm file.

UPDATE: Noble agrees that Engineering Evaluation was incorrect. An updated Engineering Evaluation was completed and a revised COCR submitted with Noble's Semi-Annual Report (5th) (July 28, 2017).

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **JURGENS LOWER LATHAM ST T5N-R64W-S8 L01**

Consent Decree Tank System Number: **305**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
JURGENS LOWER LATHAM ST T5N-R64W-S8 L01_FINAL PACKET	pdf	4-24-2015 (sign	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
JURGENS LOWER LATHAM ST T5N-R64W-S8 L01_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Evaluation
STEM Engineering Evaluation_Jurgens, Lower Latham	xlsm	4/15/2015	STEM Engineering Evaluation Model
STEM Engineering Evaluation_rev1_JURGENS LOWER LATHAM ST T5N-R64W-S8 L01	xlsm	9/21/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
JURGENS LOWER LATHAM ST T5N-R64W-S8 L01 WORK REQUEST	xlsx	4/1/2015	Work Request
Noble 3rd Party Audit Wave 12 Update Info Request_20170117	pdf	1/17/2017	Noble Info Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
JURGENS LOWER LATHAM ST T5N-R64W-S8 L01 WALKDOWN	pdf	4/24/2015	Final Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
JURGENS LOWER LATHAM ST T5N-R64W-S8 L01 IR VERIFICATION	pdf	5/20/2015	IR Camera Verification Documentation Field Data Sheet
JURGENS LOWER LATHAM ST T5N-R64W-S8 L01_0736_normal	mp4	5/20/2015	IR Camera Video During Normal Operations
JURGENS LOWER LATHAM ST T5N-R64W-S8 L01_0737_dump	mp4	5/20/2015	IR Camera Video During Dump Event
JURGENS LOWER LATHAM ST T5N-R64W-S8 L01_0738_post	mp4	5/20/2015	IR Camera Video Following Dump Event

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
JURGENS LOWER LATHAM ST T5N-R64W-S8 L01_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **JURGENS LOWER LATHAM ST T5N-R64W-S8 L01**

Consent Decree Tank System Number: **305**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**5**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**2" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**		
Man. Capacity (MSCFD)	**109.272**	**109.272**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**5,222**	**5,402**	**3%**
Calculated Burner Capacity (scfh	**6,399**	**9,106**	
Headspace Surge Capacity (scfh)	**6,680**	**7,099**	
Total VCS Capacity (scfh)	**13,079**	**16,205**	
VCS Capacity minus PPIVF (scfh)	**7,857**	**10,803**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/6/2016 & 11/14/2016 & 1/31/2017 & 4/28/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	6/9/2016 & 11/30/2016

LOD ID: **JURGENS LOWER LATHAM ST T5N-R64W-S8 L01**

Consent Decree Tank System Number: **305**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**							
Valve Coefficent (gpm/psi) (C_v)	**7.20**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**827**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**93.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**29**	**0**

Flow Rate Summary	**Flow Rate (scfh)**	
	SLR	**Noble**
Oil Tank Flash Rate	**3,885**	**3,720**
Oil Tank Working Rate	**328**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**1,189**	**1,189**
Total	**5,402**	**5,222**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **JURGENS LOWER LATHAM ST T5N-R64W-S8 L01**

Consent Decree Tank System Number: **305**

Audit Notes

-Dump valve trim is 1/2" given on pg 23 of the "JURGENS LOWER LATHAM ST T5N-R64W-S8 L01_FINAL PACKET.pdf". The valve size is not provided. SLR used the largest valve with 1/2" trim, a 2" valve size, in its calculations. Noble used a 1" valve in their analysis.

-The facility has uncontorlled actual VOC emissions greater than 50 tpy. Therefore an IR camera inspection is required.

-"JURGENS LOWER LATHAM ST T5N-R64W-S8 L01 WORK REQUEST.xlsx" requests the LP Sep dump valve be set at 90 psig. The "JURGENS LOWER LATHAM ST T5N-R64W-S8 L01_SIGNED EVAL.pdf" shows the dump valve pressure set at 80 psig. The work request on pg 5 of the "JURGENS LOWER LATHAM ST T5N-R64W-S8 L01_FINAL PACKET.pdf" requests the LP Sep dump valve be set to 80 psig. See "max operating pressure" note below.

-"Max Operating Pressure" was originally 80 psi the original STEM Engineering Evaluation_Jurgens, Lower Latham.xlsm and was changed to 70 psi in the modified STEM Engineering Evaluation_rev1_JURGENS LOWER LATHAM ST T5N-R64W-S8 L01.xlsm file. Noble provided documentation showing the max operating pressure is 70 psi.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **KATE RED GUTTERSEN T3N-R64W-S29 L01**

Consent Decree Tank System Number: **545**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
KATE RED GUTTERSEN T3N-R64W-S29 L01_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
KATE RED GUTTERSEN T3N-R64W-S29 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation
STEM Engineering Evaluation_Guttersen, Kate Red_Oil	xlsm	4/28/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_KATE RED GUTTERSEN T3N-R64W-S29 L01_Oil	xlsm	9/21/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
0071 - Guttersen Kate Red Work Request	pdf	No Date	Work Request
KATE RED GUTTERSEN T3N-R64W-S29 L01 DESIGN PACKET	pdf	5/20/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
KATE RED GUTTERSEN T3N-R64W-S29 L01 WALKDOWN	pdf	4/29/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
KATE RED GUTTERSEN T3N-R64W-S29 L01_SIGNEDVERIFICATION	pdf	5/8/2015	IR Camera Verification Sheet
KATE RED GUTTERSEN T3N-R64W-S29 L01_2316_normal	mp4	5/8/2015	IR Camera Video
KATE RED GUTTERSEN T3N-R64W-S29 L01_2317_dump	mp4	5/8/2015	IR Camera Video
KATE RED GUTTERSEN T3N-R64W-S29 L01_2318_post	mp4	5/8/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
KATE RED GUTTERSEN T3N-R64W-S29 L01_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **KATE RED GUTTERSEN T3N-R64W-S29 L01**

Consent Decree Tank System Number: **545**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**12**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**4**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**				
Dump Valve Size & Trim Size (in)	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**				

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**	**LEED 48" Gen 1 #7**	
Man. Capacity (MSCFD)	**109.272**	**109.272**	**140**	

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**14,221**	**15,657**	**10%**
Calculated Burner Capacity (scfh	**8,049**	**14,939**	
Headspace Surge Capacity (scfh)	**30,600**	**30,600**	
Total VCS Capacity (scfh)	**38,649**	**45,539**	
VCS Capacity minus PPIVF (scfh)	**24,428**	**29,883**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/6/2016 & 11/15/2016 & 4/28/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	6/3/2016 & 11/30/2016

SLR

LOD ID: **KATE RED GUTTERSEN T3N-R64W-S29 L01**

Consent Decree Tank System Number: **545**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**	**-1.02**	**-1.02**				
Z2	**-0.86**	**-0.86**	**-0.86**	**-0.86**				
Z3	**0.98**	**0.98**	**0.98**	**0.98**				
Z	**-0.90**	**-0.90**	**-0.90**	**-0.90**				
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**	**22.9**	**22.9**				

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**	**0.78**	**0.78**	**0.78**				
Valve Coefficent (gpm/psi) (C_v)	**7.20**	**7.20**	**7.20**	**7.20**				
Critical Pressure (psia)[b]	**833**	**833**	**833**	**833**				
Vapor Pressure (psia)[c]	**407**	**407**	**407**	**407**				
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**	**0.76**	**0.76**				
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**				
Peak Flow (bopd)[f,g]	**2370**	**2370**	**2370**	**2370**				

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**54.3**	**54.3**	**54.3**	**54.3**				
Working Flow (Mscfd)[h,i]	**23**	**23**	**23**	**23**				

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**68**	**0**

Flow Rate Summary	**Flow Rate (scfh)**	
	SLR	**Noble**
Oil Tank Flash Rate	**9,047**	**9,047**
Oil Tank Working Rate	**3,757**	**3,747**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**2,853**	**1,426**
Total	**15,657**	**14,220**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **KATE RED GUTTERSEN T3N-R64W-S29 L01**

Consent Decree Tank System Number: **545**

Audit Notes

IR Camera videos do not clearly show all tanks.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

Noble did not include breathing losses from both tank banks. SLR included all tanks in its calculations to accommodate a banked configuration for breathing losses. Configuration has two banks - each with 6 oil tanks.

No documentation provided which indicates the oil dump valve size. SLR used the largest valve with a 1/2" trim size, 2" valve. Noble also used a 2" valve size in their evaluation.

The field data sheet (pg. 7, KATE RED GUTTERSEN T3N-R64W-S29 L01_FINAL PACKET.pdf) indicates there are 7 oil tanks in one of the banks. A view of Google Earth also indicates there is an additional tank adjacent to a bank. It is assumed to be a atmospheric Maintenance tank.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **KISSLER T4N-R66W-S21 L05**

Consent Decree Tank System Number: **183**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
KISSLER T4N-R66W-S21 L05_FINAL PACKET	pdf	7/9/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
KISSLER T4N-R66W-S21 L05_SIGNED EVAL	pdf	7/16/2015	Engineering Evaluation
KISSLER T4N-R66W-S21 L05_FINAL PACKET	pdf	7/9/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1 KISSLER T4N-R66W S21 L05	xlsm	9-23-2016`	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
KISSLER T4N-R66W-S21 L05 WORK REQUEST	pdf	5/20/2015	Work Request
KISSLER T4N-R66W-S21 L05_FINAL PACKET	pdf	7/9/2015	Job Sheet

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
KISSLER T4N-R66W-S21 L05 WALKDOWN	pdf	7/6/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
KISSLER T4N-R66W-S21 L05 IR VERIFICATION		7/6/2015	IR Camera Verification Sheet
KISSLER T4N-R66W-S21 L05_0039_NORMAL	mp4	7/6/2015	IR Camera Video
KISSLER T4N-R66W-S21 L05_0040_DUMP	mp4	7/6/2015	IR Camera Video
KISSLER T4N-R66W-S21 L05_0041_POST	mp4	7/6/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
KISSLER T4N-R66W-S21 L05_SIGNED EVAL	pdf	7/16/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **KISSLER T4N-R66W-S21 L05**

Consent Decree Tank System Number: **183**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**2**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**			
Man. Capacity (MSCFD)	**109.272**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,508**	**4,509**	**0%**
Calculated Burner Capacity (scfh)	**3,788**	**4,553**	
Headspace Surge Capacity (scfh)	**2,650**	**2,650**	
Total VCS Capacity (scfh)	**6,438**	**7,203**	
VCS Capacity minus PPIVF (scfh)	**1,930**	**2,694**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	3/29/2016 & 11/15/2016 & 4/21/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	3/31/2016 & 11/30/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **KISSLER T4N-R66W-S21 L05**

Consent Decree Tank System Number: **183**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**11**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**3,720**	**3,720**
Oil Tank Working Rate	**314**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**475**	**475**
Total	**4,509**	**4,508**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **KISSLER T4N-R66W-S21 L05**

Consent Decree Tank System Number: **183**

Audit Notes

Two (2) Burners onsite, one (1) 48" Cimarron burner controls the tanks.
"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original KISSLER T4N-R66W-S21 L05_FINAL PACKET.pdf and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1 KISSLER T4N-R66W-S21 L05.xlsm file.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **Kodak T6N-67W-S35**

Consent Decree Tank System Number: **1684**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
KODAK T6N-R67W-S35 L01_FINAL PACKET	pdf	7/6/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
KODAK T6N-R67W-S35 L01_SIGNED EVAL	pdf	7/8/2015	Engineering Evaluation
KODAK T6N-R67W-S35 L01_FINAL PACKET	pdf	7/6/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_KODAK T6N-R67W S35 L01 (update)	xlsm	11/15/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
KODAK T6N-R67W-S35 L01 WORK REQUEST	pdf	5/29/2015	Work Request
Noble 3rd Party Audi Wave 12 Update Info Request_20170117	pdf	1/17/2017	Information Request Response

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
KODAK T6N-R67W-S35 L01 WALKDOWN	pdf	6/25/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
KODAK T6N-R67W-S35 L01 IR VERIFICATION	pdf	6/25/2015	IR Camera Verification Sheet
KODAK T6N-R67W-S35 L01_0294_NORMAL	mp4	6/25/2015	IR Camera Video
KODAK T6N-R67W-S35 L01_0295_Dump	mp4	6/25/2015	IR Camera Video
KODAK T6N-R67W-S35 L01_0296_Post	mp4	6/25/2015	`

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
KODAK T6N-R67W-S35 L01_SIGNED EVAL	pdf	7/8/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **Kodak T6N-67W-S35**

Consent Decree Tank System Number: **1684**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**2**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**235**							
Dump Valve Size & Trim Size (in)	**1" & 3/16"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**COMM 200 48"**	**COMM 200 48"**		
Man. Capacity (MSCFD)	**157**	**157**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**6,570**	**6,570**	**0%**
Calculated Burner Capacity (scfh	**8,312**	**13,083**	
Surge Capacity (scfh)	**0**	**0**	
Total VCS Capacity (scfh)	**8,312**	**13,083**	
VCS Capacity minus PPIVF (scfh)	**1,742**	**6,513**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	James Van Horne/Tom Kussard
Audit Document Review Date:	2/29/2016 & 11/15/2016 & 1/31/2017 & 4/28/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	3/28/2016 & 11/30/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **Kodak T6N-67W-S35**

Consent Decree Tank System Number: **1684**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**1.99**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**2.10**							
Gas/Oil Ratio (scf/bbl)	**536.2**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor	**0.59**							
Valve Coefficent (gpm/psi) (	**1.51**							
Critical Pressure (psia)[b]	**686**							
Vapor Pressure (psia)[c]	**248**							
Critical pressure ratio (F_F) [d]	**0.79**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**268**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**143.7**							
Working Flow (Mscfd)[h,i]	**3**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor								
Valve Coefficent (gpm/psi) (								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**11**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**5,989**	**5,989**
Oil Tank Working Rate	**106**	**106**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**475**	**475**
Total	**6,570**	**6,570**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **Kodak T6N-67W-S35**

Consent Decree Tank System Number: **1684**

Audit Notes

-Field notes did not confirm valve size. SLR used a 1" valve, the only valve size with a 3/16" trim. Noble also used a 1" valve size in their calculations

-"Max Operating Pressure" was originally 275 psi in the original KODAK T6N-R67W-S35 L01_SIGNED EVAL.pdf and was changed to 235 psi in the modified STEM Engineering Evaluation_rev1_KODAK T6N-R67W-S35 L01 (update).xlsm file. Noble confirm 235psi is the correct pressure in a 1/17/2017 response to a data request.

UPDATE: Noble confirmed accuracy of existing Engineering Evaluation. SLR applied an incorrect VOC capacity to the COMM burner for this location. Appendix B of the Draft Report (attached) documents the KODAK was evaluated with 95 MSCFD VOC capacity, however Appendix A of the Draft Report (Attachment Q) documents a COMM burner capacity of 157 MSCFD.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **KUMMER T8N-R61W-S23 L02**

Consent Decree Tank System Number: **569**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
KUMMER T8N-R61W-S23 L02_FINAL PACKET	pdf	7/6/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
KUMMER T8N-R61W-S23 L02_SIGNED EVAL	pdf	7/14/2015	Signed Engineering Evaluation
STEM Engineering Evaluation_rev1 KUMMER T8N-R61W-S23 L02	xlsm	10/19/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
KUMMER T8N-R61W-S23 L02 WORK REQUEST	pdf	5/18/2015	Work Request
KUMMER T8N-R61W-S23 L02_FINAL PACKET	pdf	7/6/2015	Final Facility Packet

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
KUMMER T8N-R61W-S23 L02 WALKDOWN	pdf	6/22/2015	Facility Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
KUMMER T8N-R61W-S23 L02 IR VERIFICATION	pdf	6/24/2015	IR Camera Verification Documentation Field Datasheet
KUMMER T8N-R61W-S23 L02_0287_NORMAL	MP4	6/24/2015	IR Camera Video
KUMMER T8N-R61W-S23 L02_0288_DUMP	MP4	6/24/2015	IR Camera Video
KUMMER T8N-R61W-S23 L02_0289_POST	MP4	6/24/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
KUMMER T8N-R61W-S23 L02_SIGNED EVAL	pdf	7/14/2015	Signed Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **KUMMER T8N-R61W-S23 L02**

Consent Decree Tank System Number: **569**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**12**
Oil Tank Capacity (bbl):	**500**
# of Water Tanks:	**4**
Water Tank Capacity (bbl):	**500**
VOC Line Size (in):	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**	**70**	**70**	**70**				
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**				

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**500**	**500**	**500**	**500**				
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**				

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

Truck Loadout Vapor Collection Installed? ☑ Yes ☐ No

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	
Man. Capacity (MSCFD)	**140**	**140**	**140**	

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**72,593**	**78,300**	**8%**
Calculated Burner Capacity (scfh	**6,805**	**17,500**	
Headspace Surge Capacity (scfh)	**174,266**	**174,266**	
Total VCS Capacity (scfh)	**181,071**	**191,766**	
VCS Capacity minus PPIVF (scfh)	**108,478**	**113,466**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	3/29/2016 & 11/15/2016 & 4/28/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	4/3/2016 & 11/30/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **KUMMER T8N-R61W-S23 L02**

Consent Decree Tank System Number: **569**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**	**0.77**	**0.77**	**0.77**				
Z2	**-0.86**	**-0.86**	**-0.86**	**-0.86**				
Z3	**0.98**	**0.98**	**0.98**	**0.98**				
Z	**0.89**	**0.89**	**0.89**	**0.89**				
Gas/Oil Ratio (scf/bbl)	**112.8**	**112.8**	**112.8**	**112.8**				

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**	**0.77**				
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**	**21.25**				
Critical Pressure (psia)[b]	**539**	**539**	**539**	**539**				
Vapor Pressure (psia)[c]	**83**	**83**	**83**	**83**				
Critical pressure ratio (F_F) [d]	**0.85**	**0.85**	**0.85**	**0.85**				
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**				
Peak Flow (bopd)[f,g]	**2409**	**2409**	**2409**	**2409**				

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**271.7**	**271.7**	**271.7**	**271.7**				
Working Flow (Mscfd)[h,i]	**23**	**23**	**23**	**23**				

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**	**0.77**				
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**	**21.25**				
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**	**3200**				
Vapor Pressure (psia)[k]	**1**	**1**	**1**	**1**				
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**	**0.96**				
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**				
Peak Flow (bwpd)[f,g]	**12689**	**12689**	**12689**	**12689**				

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**51**	**51**	**51**	**51**				
Working Flow (Mscfd)[l]	**71**	**71**	**71**	**71**				

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**500**	**500**
scfh vapor/tank[i]	**396**	**396**
Mscfd	**114**	**38**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**45,282**	**45,282**
Oil Tank Working Rate	**3,818**	**3,809**
Water Tank Flash Rate	**8,459**	**8,459**
Water Tank Working Rate	**11,874**	**11,873**
Tank Breathing Rate	**6,340**	**3,170**
Truck Vent Capture Rate	**2,527**	**0**
Total	**78,300**	**72,593**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **KUMMER T8N-R61W-S23 L02**

Consent Decree Tank System Number: **569**

Audit Notes

There is a second work request on Pg 23 of the final packet dated 7-14-2015. A job sheet indicates this work was completed on 8-20-2015. The walkdown and IR inspection occurred prior to the modifications on the second work order being complete.

The scond work request on Pg. 23 of the final packet dated 7-14-2015 indicates something about reworking the truck vent capture line. It is unknown if the vapor from the truck vent capture line is directed to same combustor as the tanks based on the infomation provided. As a conservative approach SLR included truck vent capture line flow rate based on the information provided by Noble on 4/20/2017.

-Noble only included breathing losses from one of the tank banks. SLR included all tanks at the site in it's calculations to account for breathing losses from all tanks.

Pg 4 of final packet pdf shows thief hatches set to 16 oz/in2. Pg 1 of the signed eval pdf shows a VCS contingency capacity at 14 oz/in2.

UPDATE: Noble revised its PPIVFR determinations to include TLO vapors. Noble completed Engineering Evaluations and submitted a revised COCR with its Semi-Annual Reports (5th) (July 28, 2017) and (6th) (January 29, 2018).

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **KY BLUE DECHANT T3N-R65W-S25 L02**

Consent Decree Tank System Number: **433**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
KY BLUE DECHANT T3N-R65W-S25 L02_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
STEM Engineering Evaluation_Dechant Ky Blue	xlsm	4/29/2015	VOC Tank Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
KY BLUE DECHANT T3N-R65W-S25 L02 WORK REQUEST	pdf	5/13/2015	Work Request
KY BLUE DECHANT T3N-R65W-S25 L02 COMPLETED REWORK	pdf	10/29/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
KY BLUE DECHANT T3N-R65W-S25 L02 WALKDOWN	pdf	5/6/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
KY BLUE DECHANT T3N-R65W-S25 L02 IR VERIFICATION	pdf	5/21/2015	IR Camera Verification Sheet
KY BLUE DECHANT T3N-R65W-S25 L02_0755_post	mp4	5/21/2015	IR Camera Video
KY BLUE DECHANT T3N-R65W-S25 L02_0756_normal	mp4	5/21/2015	IR Camera Video
KY BLUE DECHANT T3N-R65W-S25 L02_0757_dump	mp4	5/21/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
KY BLUE DECHANT T3N-R65W-S25 L02_SIGNED EVAL	pdf	5/26/2015	Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **KY BLUE DECHANT T3N-R65W-S25 L02**

Consent Decree Tank System Number: **433**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**7**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**2**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**60**							
Dump Valve Size & Trim Size (in)	**2" & 3/4"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**60**	**400**	**400**					
Dump Valve Size & Trim Size (in)	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**					

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**		
Man. Capacity (MSCFD)	**109.272**	**109.272**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**10,553**	**11,744**	**11%**
Calculated Burner Capacity (scfh)	**6,648**	**9,106**	
Headspace Surge Capacity (scfh)	**11,335**	**11,335**	
Total VCS Capacity (scfh)	**17,983**	**20,441**	
VCS Capacity minus PPIVF (scfh)	**7,430**	**8,697**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	5/10/2016 & 11/15/2016 & 4/28/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	6/3/2016 & 11/30/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **KY BLUE DECHANT T3N-R65W-S25 L02**

Consent Decree Tank System Number: **433**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.61**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.72**							
Gas/Oil Ratio (scf/bbl)	**96.4**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.80**							
Valve Coefficent (gpm/psi) (C_v)	**12.20**							
Critical Pressure (psia)[b]	**530**							
Vapor Pressure (psia)[c]	**73**							
Critical pressure ratio (F_F) [d]	**0.86**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**1320**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**127.2**							
Working Flow (Mscfd)[h,i]	**13**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**	**0.78**	**0.78**					
Valve Coefficent (gpm/psi) (C_v)	**7.20**	**7.20**	**7.20**					
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**					
Vapor Pressure (psia)[k]	**1**	**1**	**1**					
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**					
Choked Flow?[e]	**Yes**	**Yes**	**Yes**					
Peak Flow (bwpd)[f,g]	**1629**	**3906**	**3906**					

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**7**	**16**	**16**					
Working Flow (Mscfd)[l]	**9**	**22**	**22**					

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**40**	**11**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**5,299**	**5,299**
Oil Tank Working Rate	**523**	**522**
Water Tank Flash Rate	**1,574**	**1,574**
Water Tank Working Rate	**2,209**	**2,209**
Tank Breathing Rate	**2,140**	**2,140**
Total	**11,744**	**11,744**

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **KY BLUE DECHANT T3N-R65W-S25 L02**

Consent Decree Tank System Number: **433**

Audit Notes

Facility walkdown checklist (KY BLUE DECHANT T3N-R65W-S25 L02 WALKDOWN.pdf) indicates the items on the work request are incomplete, but give no explanation of what was left unfinished. Information contained on the Job Sheet and STEM Retrofit Walkdown Checklist in the rework packet (pg. 11 & pp. 3-7, KY BLUE DECHANT T3N-R65W-S25 L02 COMPLETED REWORK.pdf) as well as the job sheets in the final packet (pp. 17-19, 27-29, KY BLUE DECHANT T3N-R65W-S25 L02_FINAL PACKET.pdf) indicate requested work was completed.

The 11/2/2015 e-mail from H. Figueroa (pg.19, KY BLUE DECHANT T3N-R65W-S25 L02 COMPLETED REWORK.pdf) indicates the PSHH is set at 60 psig vs the 70 psig indicated in the engineering evaluation. Audit assessment completed with a 60 psig setting.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

Tanks are in a banked configuration. Noble calculations do not account for breathing from non-producing bank. Total tanks in audit sheet account for both banks (One bank of 3-300 bbl oil tanks and 1-300 bbl water tank, another bank of 4-300 bbl oil tanks and 1-300 bbl water tank.)

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original KY BLUE DECHANT T3N-R65W-S25 L02 - STEM Engineering Evaluation Check.xlsm and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1 KY BLUE DECHANT T3N-R65W-S25 L02.xlsm file.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **KYLE WHITE ESTES RHINO HIPPO T3N-R64W-S27 L01**

Consent Decree Tank System Number: **556**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
KYLE WHITE ESTES RHINO HIPPO T3N-R64W-S27 L01_FINAL PACKET	pdf	5/13/2016	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
KYLE WHITE ESTES RHINO HIPPO T3N-R64W-S27 L01_SIGNED EVAL	pdf	5/21/2015	Engineering Evaluation
STEM Engineering Evaluation_Hippo Rhino	xlsm	4/30/2015	Tank VOC Analysis
STEM Eng Eval_rev1_KYLE WHITE ESTES RHINO HIPPO T3N-R64W-S27 L01	xlsm	9/27/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
KYLE WHITE ESTES RHINO HIPPO T3N-R64W-S27 L01 REWORK PACKET	pdf	9/22/2015	Work Request
KYLE WHITE ESTES RHINO HIPPO T3N-R64W-S27 L01_FINAL PACKET	pdf	4/30/2015	Work Request
0105 - Hippo Rhino Work Request	pdf	No Date	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
KYLE WHITE ESTES RHINO HIPPO T3N-R64W-S27 L01 WALKDOWN	pdf	4/30/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
KYLE WHITE ESTES RHINO HIPPO T3N-R64W-S27 L01 IR VERIFICATION	pdf	5/18/2015	IR Camera Verification Sheet
KYLE WHITE ESTES RHINO HIPPO T3N-R64W-S27 L01_0730_normal	mp4	5/18/2015	IR Camera Video
KYLE WHITE ESTES RHINO HIPPO T3N-R64W-S27 L01_0731_dump	mp4	5/18/2015	IR Camera Video
KYLE WHITE ESTES RHINO HIPPO T3N-R64W-S27 L01_0732_post	mp4	5/18/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
KYLE WHITE ESTES RHINO HIPPO T3N-R64W-S27 L01_SIGNED EVAL	pdf	5/21/2015	Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **KYLE WHITE ESTES RHINO HIPPO T3N-R64W-S27 L01**

Consent Decree Tank System Number: **556**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**10**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**4**
# VOC Lines to KO:	**4**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**80**	**80**	**80**					
Dump Valve Size & Trim Size (in)	**1" & 1/2"**	**1" & 1/2"**	**2" & 1 1/2"**					

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**TEC 4-CS (48" Tornado)**	**TEC 4-CS (48" Tornado)**	**TEC 4-CS (48" Tornado)**	
Man. Capacity (MSCFD)	**110.4**	**110.4**	**110.4**	

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**14,656**	**29,309**	**100%**
Calculated Burner Capacity (scfh)	**11,853**	**13,800**	
Headspace Surge Capacity (scfh)	**15,525**	**35,420**	
Total VCS Capacity (scfh)	**27,378**	**49,220**	
VCS Capacity minus PPIVF (scfh)	**12,722**	**19,911**	

☑ **Yes**	☐ **No**	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/6/2016 & 11/15/2016 & 4/21/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	5/13/2016 & 12/1/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **KYLE WHITE ESTES RHINO HIPPO T3N-R64W-S27 L01**

Consent Decree Tank System Number: **556**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.92**	**0.92**	**0.92**					
Z2	**-0.86**	**-0.86**	**-0.86**					
Z3	**0.98**	**0.98**	**0.98**					
Z	**1.03**	**1.03**	**1.03**					
Gas/Oil Ratio (scf/bbl)	**130.1**	**130.1**	**130.1**					

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**	**0.94**	**0.79**					
Valve Coefficent (gpm/psi) (C_v)	**5.72**	**5.72**	**23.30**					
Critical Pressure (psia)[b]	**548**	**548**	**548**					
Vapor Pressure (psia)[c]	**93**	**93**	**93**					
Critical pressure ratio (F_F) [d]	**0.84**	**0.84**	**0.84**					
Choked Flow?[e]	**Yes**	**Yes**	**Yes**					
Peak Flow (bopd)[f,g]	**854**	**854**	**2922**					

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**111.1**	**111.1**	**380.2**					
Working Flow (Mscfd)[h,i]	**8**	**8**	**28**					

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**57**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**25,097**	**11,325**
Oil Tank Working Rate	**1,834**	**953**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**2,377**	**2,377**
Total	**29,309**	**14,656**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **KYLE WHITE ESTES RHINO HIPPO T3N-R64W-S27 L01**

Consent Decree Tank System Number: **556**

Audit Notes

The signed evaluation pdf (KYLE WHITE ESTES RHINO HIPPO T3N-R64W-S27 L01_SIGNED EVAL.pdf) shows ten (10) oil tanks onsite. Pg. 10 of the final packet pdf (KYLE WHITE ESTES RHINO HIPPO T3N-R64W-S27 L01_FINAL PACKET.pdf) shows nine (9) oil tanks to be onsite. The IR videos show ten (10) tanks onsite.

Date not provided on "0105 - Hippo Rhino Work Request.pdf". The date on "KYLE WHITE ESTES RHINO HIPPO T3N-R64W-S27 L01 REWORK PACKET.pdf" is 9-22-2015. The date on "KYLE WHITE ESTES RHINO HIPPO T3N-R64W-S27 L01 WALKDOWN.pdf" is 4-30-2015. It appears the walkdown file confirms the completed work in "0105 - Hippo Rhino Work Request.pdf."

The Kyle White well is treated by Sep 7 according to pg. 7 of the final packet pdf (KYLE WHITE ESTES RHINO HIPPO T3N-R64W-S27 L01_FINAL PACKET.pdf). Pg. 8 of the final packet pdf (KYLE WHITE ESTES RHINO HIPPO T3N-R64W-S27 L01_FINAL PACKET.pdf) shows separator 7 having a 2" valve but does not state the trim size. SLR used the largest trim size for a 2" Kimray 212 SMA PO valve, 1 1/2" trim was utilized for its calculations.

The "0105 - Hippo Rhino Work Request.pdf" shows a request to set the two (2) LP Sep and the one (1) HLP Sep shut-in to 80psig. The signed evaluation pdf (KYLE WHITE ESTES RHINO HIPPO T3N-R64W-S27 L01_SIGNED EVAL.pdf) indicates a shut-in pressure of 70 psig for all separators. The value of 80 psi was used in the audit evaluation as the "KYLE WHITE ESTES RHINO HIPPO T3N-R64W-S27 L01 WALKDOWN.pdf" corresponds to the work completed in the "0105 - Hippo Rhino Work Request.pdf."

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LDS SINJIN ST T6N-R65W-S36 L01**

Consent Decree Tank System Number: **65**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
LDS SINJIN ST T6N-R65W-S36 L01_FINAL PACKET	pdf	7/6/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
LDS SINJIN ST T6N-R65W-S36 L01_SIGNED EVAL	pdf	6/26/2015	Engineering Evaluation
LDS SINJIN ST T6N-R65W-S36 L01_FINAL PACKET	pdf	7/6/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1 LDS SINJIN ST T6N-R65W-S36 L01	xlsm	9/26/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
LDS SINJIN ST T6N-R65W-S36 L01 WORK REQUEST	pdf	5/5/2015	Work Request
LDS SINJIN ST T6N-R65W-S36 L01_FINAL PACKET	pdf	7/6/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
LDS SINJIN ST T6N-R65W-S36 L01 WALKDOWN	pdf	5/29/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
LDS SINJIN ST T6N-R65W-S36 L01 IR VERIFICATION	pdf	5/28/2015	IR Camera Verification Sheet
LDS SINJIN ST T6N-R65W-S36 L01_0178_NORMAL	mp4	5/28/2015	IR Camera Video
LDS SINJIN ST T6N-R65W-S36 L01_0178_DUMP	mp4	5/28/2015	IR Camera Video
LDS SINJIN ST T6N-R65W-S36 L01_0178_POST	mp4	5/28/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
LDS SINJIN ST T6N-R65W-S36 L01_SIGNED EVAL	pdf	6/26/2015	Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LDS SINJIN ST T6N-R65W-S36 L01**

Consent Decree Tank System Number: **65**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**4**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**2" & 3/4"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**TEC 4-CS (48" Tornado)**	**TEC 4-CS (48" Tornado)**		
Man. Capacity (MSCFD)	**110.4**	**110.4**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**8,272**	**8,273**	**0%**
Calculated Burner Capacity (scfh)	**6,787**	**9,200**	
Headspace Surge Capacity (scfh)	**11,391**	**11,391**	
Total VCS Capacity (scfh)	**18,178**	**20,591**	
VCS Capacity minus PPIVF (scfh)	**9,906**	**12,318**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	3/30/2016 & 11/15/2016 & 4/28/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	4/1/2016 & 12/1/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LDS SINJIN ST T6N-R65W-S36 L01**

Consent Decree Tank System Number: **65**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.80**							
Valve Coefficent (gpm/psi) (C_v)	**12.20**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**1437**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**162.1**							
Working Flow (Mscfd)[h,i]	**14**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**23**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**6,753**	**6,753**
Oil Tank Working Rate	**569**	**568**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**951**	**951**
Total	**8,273**	**8,272**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LDS SINJIN ST T6N-R65W-S36 L01**

Consent Decree Tank System Number: **65**

Audit Notes

-The work request pdf shows a request to change the LP Separator dump valve size to a 2" with a 3/4" trim. However on pg. 10 of the final packet pdf, a 1" valve with a 1/2" trim is being used in the calculations. The walkdown (LDS SINJIN ST T6N-R65W-S36 L01_WALKDOWN.pdf) indicated all items on the work request have been completed. SLR used a 2" valve with 3/4" trim in our calculations

-The signed engineering evaluation (LDS SINJIN ST T6N-R65W-S36 L01_SINGED EVAL.pdf) states the LP Separator Pressure is 80 psig Max. The 5/18/2015 e-mail from Jeff Kennedy in the LDS SINJIN ST T6N-R65W-S36 L01_FINAL PACKET.pdf indicates the PSHH on the LP shuts valves at 70 psig. A 70 psig max pressure was used in the audit evaluation.

-IR Camera video of dump (LDS SINJIN ST T6N-R65W-S36 L01_0179_DUMP.mp4) has indication of a possible leak at footage 2:09-2:15 on Tank 98619.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LDS T3N-R64W-S5 L01**

Consent Decree Tank System Number: **693**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
LDS T3N-R64W-S5 L01_FINAL PACKET	pdf	7/8/2015	Final Facilty Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
LDS T3N-R64W-S5 L01_SIGNED EVAL	pdf	7/21/2015	Signed Engineering Design Evaluation
LDS T3N-R64W-S5 L01_FINAL PACKET	pdf	7/8/2015	Final Facilty Packet
STEM Engineering Evaluation_rev1_LDS T3N-R64W-S5 L01	xlsm	9/21/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
LDS T3N-R64W-S5 L01_FINAL PACKET	pdf	7/8/2015	Final Facilty Packet
LDS T3N-R64W-S5 L01 WORK REQUEST GAS COMMINGLE REWORK	pdf	6/12/2015	Rework Request
LDS T3N-R64W-S5 L01 WORK REQUEST	pdf	5/13/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
LDS T3N-R64W-S5 L01 WALKDOWN	pdf	7/7/2015	facility walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
LDS T3N-R64W-S5 L01_0042_NORMAL	mp4	unk	IR Video of site during normal operation
LDS T3N-R64W-S5 L01_0043_DUMP	mp4	unk	IR Video of site during separator dump event
LDS T3N-R64W-S5 L01_0044_POST	mp4	unk	IR Video of site post dump event
LDS T3N-R64W-S5 L01 IR VERIFICATION	pdf	7/7/2015	IR Camera Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
LDS T3N-R64W-S5 L01_SIGNED EVAL	pdf	7/21/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LDS T3N-R64W-S5 L01**

Consent Decree Tank System Number: **693**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**4**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	
Water Tank Capacity (bbl):	
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**TEC 4-CS (48" Tornado)**			
Man. Capacity (MSCFD)	**110.4**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,984**	**4,985**	**0%**
Calculated Burner Capacity (scfh)	**4,021**	**4,600**	
Headspace Surge Capacity (scfh)	**4,588**	**4,588**	
Total VCS Capacity (scfh)	**8,609**	**9,188**	
VCS Capacity minus PPIVF (scfh)	**3,625**	**4,203**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Jaclyn Fitzgerald/Tom Kussard
Audit Document Review Date:	4/12/2016 & 11/15/2016 & 4/28/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	4/13/2016 & 12/1/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LDS T3N-R64W-S5 L01**

Consent Decree Tank System Number: **693**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	
scfh vapor/tank[i]	**238**	
Mscfd	**23**	

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**3,720**	**3,720**
Oil Tank Working Rate	**314**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**951**	**951**
Total	**4,985**	**4,984**

LOD ID: **LDS T3N-R64W-S5 L01**

Consent Decree Tank System Number: **693**

Audit Notes

-Final testing on PHSS could not be completed on wells 08-29 and 08-30 could not be completed because the wells were not Tree'd. These are the high pressure separators and are not critical to the design.

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original LDS T3N-R64W-S5 L01 - STEM Engineering Evaluation Check.xlsm and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1_LDS T3N-R64W-S5 L01.xlsm file.

UPDATE: After reviewing SLR's Draft Report, Noble contacted Tornado to confirm that its burners can handle capacities beyond the published specification or 10 oz/in2. Tornado confirmed that the published burner curve can be hydraulically extrapolated beyond 10 oz/in2. Moreover, Tornado noted the stated capacity is based on heat release (86.4 MSCFD at 2,300 BTU/scf). Noble's typical flash gas is lighter in composition (1,800 BTU/scf) such that the Tornado burner would be capable of handling up to 110.4 MSCFD at the published heat release limit. The Tornado specification sheet notes the maximum flow is dependent on heating value of the gas, consistent with Noble's conversation.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LDS T3N-R64W-S17 L01**

Consent Decree Tank System Number: **384**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
LDS T3N-R64W-S17 L01_SIGNED EVAL	pdf	6/29/2015	Engineering Evaluation
STEM Engineering Evaluation_LDS T3N-R64W-S17 L01	xlsm	4/28/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_LDS T3N-R64W-S17 L01	xlsm	9/21/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
LDS T3N-R64W-S17 L01 WORK REQUEST	pdf	5/5/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
LDS T3N-R64W-S17 L01 WALKDOWN	pdf	6/1/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
LDS T3N-R64W-S17 L01 IR VERIFICATION	pdf	6/1/2015	IR Camera Verification Sheet
LDS T3N-R64W-S17 L01_0197_NORMAL	mp4	6/1/2015	IR Camera Video
LDS T3N-R64W-S17 L01 _0198_DUMP	mp4	6/1/2015	IR Camera Video
LDS T3N-R64W-S17 L01_0199_POST	mp4	6/1/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
LDS T3N-R64W-S17 L01_SIGNED EVAL	pdf	6/29/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LDS T3N-R64W-S17 L01**

Consent Decree Tank System Number: **384**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**4**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**80**							
Dump Valve Size & Trim Size (in)	**2" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**		
Man. Capacity (MSCFD)	**140**	**140**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,984**	**6,138**	**23%**
Calculated Burner Capacity (scfh	**5,314**	**11,667**	
Headspace Surge Capacity (scfh)	**4,113**	**3,309**	
Total VCS Capacity (scfh)	**9,427**	**14,976**	
VCS Capacity minus PPIVF (scfh)	**4,443**	**8,838**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	4/20/2016 & 11/15/2016 & 4/28/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	4/28/2016 & 12/1/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LDS T3N-R64W-S17 L01**

Consent Decree Tank System Number: **384**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.92**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**1.03**							
Gas/Oil Ratio (scf/bbl)	**130.1**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**							
Valve Coefficent (gpm/psi) (C_v)	**7.20**							
Critical Pressure (psia)[b]	**548**							
Vapor Pressure (psia)[c]	**93**							
Critical pressure ratio (F_F) [d]	**0.84**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**891**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**116.0**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**23**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**4,833**	**3,720**
Oil Tank Working Rate	**353**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**951**	**951**
Total	**6,138**	**4,984**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LDS T3N-R64W-S17 L01**

Consent Decree Tank System Number: **384**

Audit Notes

LDS T3N-R64W-S17 L01 WORK REQUEST.pdf indicates a LP Separator PSHH set at 80 psi; the LDS T3N-R64W-S17 L01 SIGNED EVAL.pdf shows a certified max pressure of 70 psi. The 80 psi was used in the SLR evaluation as it is the verified vessel pressure.

The documentation provided for the engineering evaluation audit had no indication of the LP Separator dump valve size. The largest valve with a with a 1/2" trim was used in the SLR evaluation, a 2" valve.

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original STEM Engineering Evaluation_LDS T3N-R64W-S17 L01.xlsm and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1_LDS T3N-R64W-S17 L01.xlsm file.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LDS T3N-R64W-S17 L02**

Consent Decree Tank System Number: **387**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
LDS T3N-R64W-S17 L02_FINAL PACKET	pdf	7/9/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
LDS T3N-R64W-S17 L02_SIGNED EVAL	pdf	7/14/2015	Engineering Evaluation
LDS T3N-R64W-S17 L02_FINAL PACKET	pdf	7/9/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1 LDS T3N-R64W-S17 L02	xlsm	11/15/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
LDS T3N-R64W-S17 L02 WORK REQUEST	pdf	5/12/2014	Work Request
LDS T3N-R64W-S17 L02_FINAL PACKET	pdf	7/6/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
LDS T3N-R64W-S17 L02 WALKDOWN	pdf	6/4/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
LDS T3N-R64W-S17 L02 IR VERIFICATION	pdf	6/4/2015	IR Camera Verification Sheet
LDS T3N-R64W-S17 L02 _0228_NORMAL	mp4	6/4/2015	IR Camera Video
LDS T3N-R64W-S17 L02 _0229_DUMP	mp4	6/4/2015	IR Camera Video
LDS T3N-R64W-S17 L02 _0230_POST	mp4	6/4/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
LDS T3N-R64W-S17 L02_SIGNED EVAL	pdf	7/14/2015	Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LDS T3N-R64W-S17 L02**

Consent Decree Tank System Number: **387**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**2" & 1"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**		
Man. Capacity (MSCFD)	**109.272**	**109.272**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**11,690**	**12,988**	**11%**
Calculated Burner Capacity (scfh	**6,648**	**9,106**	
Headspace Surge Capacity (scfh)	**13,690**	**12,332**	
Total VCS Capacity (scfh)	**20,338**	**21,438**	
VCS Capacity minus PPIVF (scfh)	**8,648**	**8,450**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	3/30/2016 & 11/15/2016 & 4/28/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	4/4/2016 & 12/1/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LDS T3N-R64W-S17 L02**

Consent Decree Tank System Number: **387**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**							
Valve Coefficent (gpm/psi) (C_v)	**21.25**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**2409**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**271.7**							
Working Flow (Mscfd)[h,i]	**23**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**17**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**11,321**	**10,062**
Oil Tank Working Rate	**955**	**914**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**713**	**713**
Total	**12,988**	**11,689**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LDS T3N-R64W-S17 L02**

Consent Decree Tank System Number: **387**

Audit Notes

-E-mail from Jeff Kennedy dated 5/21/2015 (LDS T3N-R64W-S17 L02_FINAL PACKET.pdf) indicates the pressure switch was set to 70 psi not 65 psi as indicated in the site work request (LDS T3N-R64W-S17 L02_WORK REQUEST.pdf). A pressure of 70 psi was used for the SLR audit evaluation. Noble used a 65 psi pressure in their engineering evaluation

-"VOC Design Tank Pressure" was originally 10 oz/in^2 in the originalLDS T3N-R64W-S17 L02_FINAL PACKET.pdf and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1 LDS T3N-R64W-S17 L02.xlsm file.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LINDA RAE WINTER T6N-R64W-S19 L01**

Consent Decree Tank System Number: **2265**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
LINDA RAE WINTER T6N-R64W-S19 L01_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
LINDA RAE WINTER T6N-R64W-S19 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation
STEM Engineering Evaluation_Linda Rae	xlsm	5/22/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1 LINDA RAE WINTER T6N-R64W-S19 L01	xlsm	9/21/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
LINDA RAE WINTER T6N-R64W-S19 L01 WORK REQUEST	pdf	5/11/2015	Work Request
LINDA RAE WINTER T6N-R64W-S19 L01_FINAL PACKET	pdf	No Date	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
LINDA RAE WINTER T6N-R64W-S19 L01 WALKDOWN	pdf	4/29/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
LINDA RAE WINTER T6N-R64W-S19 L01_SIGNEDVERIFICATION	pdf	5/6/2015	IR Camera Verification Sheet
LINDA RAE WINTER T6N-R64W-S19 L01_2277_normal	mp4	5/6/2015	IR Camera Video
LINDA RAE WINTER T6N-R64W-S19 L01_2278_dump	mp4	5/6/2015	IR Camera Video
LINDA RAE WINTER T6N-R64W-S19 L01_2279_post	mp4	5/6/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
LINDA RAE WINTER T6N-R64W-S19 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LINDA RAE WINTER T6N-R64W-S19 L01**

Consent Decree Tank System Number: **2265**

☑ Yes ☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes ☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**			
Man. Capacity (MSCFD)	**109.272**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,926**	**4,747**	**4%**
Calculated Burner Capacity (scfh	**3,763**	**4,553**	
Headspace Surge Capacity (scfh)	**4,273**	**4,019**	
Total VCS Capacity (scfh)	**8,036**	**8,572**	
VCS Capacity minus PPIVF (scfh)	**3,110**	**3,825**	

☑ Yes ☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes ☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes ☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes ☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/6/2016 & 11/15/2016 & 4/21/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	8/4/2016 & 12/1/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LINDA RAE WINTER T6N-R64W-S19 L01**

Consent Decree Tank System Number: **2265**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**17**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**3,720**	**3,885**
Oil Tank Working Rate	**314**	**327**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**713**	**713**
Total	**4,747**	**4,925**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LINDA RAE WINTER T6N-R64W-S19 L01**

Consent Decree Tank System Number: **2265**

Audit Notes

The work request pdf (LINDA RAE WINTER T6N-R64W-S19 L01 WORK REQUEST.pdf) shows the well shut-in pressure to be set at 80 psig. The signed evaluation pdf (LINDA RAE WINTER T6N-R64W-S19 L01_SIGNED EVAL.pdf) utilizes a shut-in pressure of 75 psi. The facility walkdown checklist (LINDA RAE WINTER T6N-R64W-S19 L01 WALKDOWN.pdf) indicates the HLP shut-in function is missing. A 7/13/2016 letter from Bill Oberman, Noble, to Kenny Malmquist, SLR International, verified the completion of the HLP separator 70 psi shut-in automation.

The job sheet (LINDA RAE WINTER T6N-R64W-S19 L01 FINAL PACKET.pdf, pp 23), indicates the 2" oil and water dump valves were removed and replaced with 1", 1400 series valves with 1/2' trim. Noble used a 2" valve with 1/2" trim in there analysis. SLR still considers the modeling guideline applied correctly because Nobles analysis resulted in a higher PPIVFR than SLR.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LOEFFLER K01 ECONODE T4N-R66W-S1 L01**

Consent Decree Tank System Number: **2375**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
LOEFFLER K01 ECONODE T4N-R66W-S1 L01_FINAL PACKET	pdf	4/23/2014	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
LOEFFLER K01 ECONODE T4N-R66W-S1 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation
STEM Engineering Evaluation_Loeffler Econode	xlsm	4/15/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_LOEFFLER K01 ECONODE T4N-R66W-S1 L01	xlsm	9/21/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
LOEFFLER K01 ECONODE T4N-R66W-S1 L01 WALKDOWN	pdf	4/23/2014	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
LOEFFLER K01 ECONODE T4N-R66W-S1 L01 IR VERIFICATION	pdf	5/14/2015	IR Camera Verification Sheet
LOEFFLER K01 ECONODE T4N-R66W-S1 L01_0682_normal	mp4	5/14/2015	IR Camera Video
LOEFFLER K01 ECONODE T4N-R66W-S1 L01_0683_dump	mp4	5/14/2015	IR Camera Video
LOEFFLER K01 ECONODE T4N-R66W-S1 L01_0684_post	mp4	5/14/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
LOEFFLER K01 ECONODE T4N-R66W-S1 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LOEFFLER K01 ECONODE T4N-R66W-S1 L01**

Consent Decree Tank System Number: **2375**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**10**
Oil Tank Capacity (bbl):	**500**
# of Water Tanks:	**6**
Water Tank Capacity (bbl):	**500**
VOC Line Size (in):	**6**
# VOC Lines to KO:	**2**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**	**400**			
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**			

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**	**400**			
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**			

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	
Man. Capacity (MSCFD)	**140**	**140**	**140**	

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**72,562**	**75,767**	**4%**
Calculated Burner Capacity (scfh	**8,848**	**17,500**	
Headspace Surge Capacity (scfh)	**178,100**	**178,100**	
Total VCS Capacity (scfh)	**186,948**	**195,600**	
VCS Capacity minus PPIVF (scfh)	**114,386**	**119,833**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/9/2016 & 11/15/2016 & 4/28/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	6/2/2016 & 12/1/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LOEFFLER K01 ECONODE T4N-R66W-S1 L01**

Consent Decree Tank System Number: **2375**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	-1.02	-1.02	-1.02	-1.02	-1.02			
Z2	-0.86	-0.86	-0.86	-0.86	-0.86			
Z3	0.98	0.98	0.98	0.98	0.98			
Z	-0.90	-0.90	-0.90	-0.90	-0.90			
Gas/Oil Ratio (scf/bbl)	22.9	22.9	22.9	22.9	22.9			

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	0.77	0.77	0.77	0.77	0.77			
Valve Coefficent (gpm/psi) (C_v)	21.25	21.25	21.25	21.25	21.25			
Critical Pressure (psia)[b]	833	833	833	833	833			
Vapor Pressure (psia)[c]	407	407	407	407	407			
Critical pressure ratio (F_F) [d]	0.76	0.76	0.76	0.76	0.76			
Choked Flow?[e]	Yes	Yes	Yes	Yes	Yes			
Peak Flow (bopd)[f,g]	6905	6905	6905	6905	6905			

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	158.2	158.2	158.2	158.2	158.2			
Working Flow (Mscfd)[h,i]	66	66	66	66	66			

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	0.77	0.77	0.77	0.77	0.77			
Valve Coefficent (gpm/psi) (C_v)	21.25	21.25	21.25	21.25	21.25			
Critical Pressure (psia)[j]	3200	3200	3200	3200	3200			
Vapor Pressure (psia)[k]	1	1	1	1	1			
Critical pressure ratio (F_F)[d]	0.96	0.96	0.96	0.96	0.96			
Choked Flow?[e]	Yes	Yes	Yes	Yes	Yes			
Peak Flow (bwpd)[f,g]	11381	11381	11381	11381	11381			

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	46	46	46	46	46			
Working Flow (Mscfd)[l]	64	64	64	64	64			

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	500	500
scfh vapor/tank[i]	396	396
Mscfd	95	57

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	32,949	32,949
Oil Tank Working Rate	13,681	13,647
Water Tank Flash Rate	9,485	9,484
Water Tank Working Rate	13,313	13,312
Tank Breathing Rate	6,340	3,170
Total	75,767	72,562

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LOEFFLER K01 ECONODE T4N-R66W-S1 L01**

Consent Decree Tank System Number: **2375**

Audit Notes

IR Camera videos do not clearly show all tanks.

There is no provided documentation which verifies the valve and trim size of the LP separator water dump valves. It is assumed LP separator water and oil dump valves are the same size/trim.

Noble did not account for breathing losses from all tanks. All tanks were included in SLR's calculations to account for breathing losses from the non-producing tank bank. Configuration has two banks - each with 5 oil tanks and 3 water tanks.
Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the originalSTEM Engineering Evaluation_Loeffler Econode.xlsm and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1_LOEFFLER K01 ECONODE T4N-R66W-S1 L01.xlsm file.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LOWER LATHAM T5N-R65W-S35 L02**

Consent Decree Tank System Number: **231**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
LOWER LATHAM T5N-R65W-S35 L02_FINAL PACKET	.pdf	7/6/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
LOWER LATHAM T5N-R65W-S35 L02_SIGNED EVAL	pdf	7/15/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_rev1_LOWER LATHAM T5N-R65W-S35 L02	xlsm	7/28/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
LOWER LATHAM T5N-R65W-S35 L02 WORK REQUEST	pdf	6/9/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
LOWER LATHAM T5N-R65W-S35 L02 WALKDOWN	pdf	7/2/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
LOWER LATHAM T5N-R65W-S35 L02_0035_NORMAL	mp4	7/6/2015	IR Video of site during normal operation
LOWER LATHAM T5N-R65W-S35 L02_0036_DUMP	mp4	7/6/2015	IR Video of site during separator dump event
LOWER LATHAM T5N-R65W-S35 L02_0037_POST	mp4	7/6/2015	IR Video of site post dump event
LOWER LATHAM T5N-R65W-S35 L02 IR VERIFICATION	pdf	7/6/2015	IR Camera Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
LOWER LATHAM T5N-R65W-S35 L02_SIGNED EVAL	pdf	7/15/2015	Signed Engineering Design Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LOWER LATHAM T5N-R65W-S35 L02**

Consent Decree Tank System Number: **231**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**2**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**80**							
Dump Valve Size & Trim Size (in)	**2" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**		
Man. Capacity (MSCFD)	**140**	**140**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,688**	**5,662**	**21%**
Calculated Burner Capacity (scfh	**5,456**	**11,667**	
Headspace Surge Capacity (scfh)	**1,641**	**1,047**	
Total VCS Capacity (scfh)	**7,097**	**12,714**	
VCS Capacity minus PPIVF (scfh)	**2,409**	**7,052**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	5/11/2016 & 11/15/2016 & 5/1/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	5/11/2016 & 12/1/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LOWER LATHAM T5N-R65W-S35 L02**

Consent Decree Tank System Number: **231**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.92**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**1.03**							
Gas/Oil Ratio (scf/bbl)	**130.1**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**							
Valve Coefficent (gpm/psi) (C_v)	**7.20**							
Critical Pressure (psia)[b]	**548**							
Vapor Pressure (psia)[c]	**93**							
Critical pressure ratio (F_F) [d]	**0.84**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**891**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**116.0**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**11**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**4,833**	**3,885**
Oil Tank Working Rate	**353**	**327**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**475**	**475**
Total	**5,662**	**4,687**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LOWER LATHAM T5N-R65W-S35 L02**

Consent Decree Tank System Number: **231**

Audit Notes

-Model Input sheet states 2" oil valve. Pre-workorder Facility Walkthrough states 1" valve. A 2" valve was used in calculations to be conservative.

-Work request states that PSHH should be set to 70 psig. There is not confirmation that the PSHH was installed. Instead walkdown sheet states that PCV is set to 80 psig. 80 psig was therefore used for this evaluation. "VOC Design Tank Pressure" was originally 10 oz/in^2 in the original LOWER LATHAM T5N-R65W-S35 L02_SIGNED EVAL.pdf and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1_LOWER LATHAM T5N-R65W-S35 L02.xlsm file.

UPDATE: Confirmed accuracy of existing Engineering Evaluation. SLR misread Page 21 of the Final Packet. The specified pressure of 80 psig is referring to PCV-103, which is supposed to be set 10 psig higher than the shut-in pressure. Work request and walkdown checklist documents the identified misinterpretation by SLR.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LUCCI ST T5N-R64W-S1 L01**

Consent Decree Tank System Number: **301**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
LUCCI ST T5N-R64W-S1 L01_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
LUCCI ST T5N-R64W-S1 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation
STEM Engineering Evaluation_Lucci St B03	xlsm	4/28/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_LUCCI T5N-R64W-S1 L01 & LUCCI T5N-R64W-S1 L06	xlsm	4/29/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
LUCCI ST T5N-R64W-S1 L01 WALKDOWN	pdf	4/30/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
LUCCI ST T5N-R64W-S1 L01 IR VERIFICATION	pdf	5/11/2015	IR Camera Verification Sheet
LUCCI ST T5N-R64W-S1 L01_2337_normal	mp4	5/11/2015	IR Camera Video
LUCCI ST T5N-R64W-S1 L01_2338_dump	mp4	5/11/2015	IR Camera Video
LUCCI ST T5N-R64W-S1 L01_2339_post	mp4	5/11/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
LUCCI ST T5N-R64W-S1 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LUCCI ST T5N-R64W-S1 L01**

Consent Decree Tank System Number: **301**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**8**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**2**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**					
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**					

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**					
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**					

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**		
Man. Capacity (MSCFD)	**109.272**	**109.272**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**28,708**	**44,034**	**53%**
Calculated Burner Capacity (scfh	**6,648**	**9,106**	
Headspace Surge Capacity (scfh)	**58,381**	**35,956**	
Total VCS Capacity (scfh)	**65,029**	**45,062**	
VCS Capacity minus PPIVF (scfh)	**36,321**	**1,028**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/9/2016 & 11/15/2016 & 5/1/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	5/26/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LUCCI ST T5N-R64W-S1 L01**

Consent Decree Tank System Number: **301**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**	**-1.02**					
Z2	**-0.86**	**-0.86**	**-0.86**					
Z3	**0.98**	**0.98**	**0.98**					
Z	**-0.90**	**-0.90**	**-0.90**					
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**	**22.9**					

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**					
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**					
Critical Pressure (psia)[b]	**833**	**833**	**833**					
Vapor Pressure (psia)[c]	**407**	**407**	**407**					
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**	**0.76**					
Choked Flow?[e]	**Yes**	**Yes**	**Yes**					
Peak Flow (bopd)[f,g]	**6905**	**6905**	**6905**					

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**158.2**	**158.2**	**158.2**					
Working Flow (Mscfd)[h,i]	**66**	**66**	**66**					

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**					
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**					
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**					
Vapor Pressure (psia)[k]	**1**	**1**	**1**					
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**					
Choked Flow?[e]	**Yes**	**Yes**	**Yes**					
Peak Flow (bwpd)[f,g]	**11381**	**11381**	**11381**					

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**46**	**46**	**46**					
Working Flow (Mscfd)[l]	**64**	**64**	**64**					

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**46**	**11**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**19,769**	**13,179**
Oil Tank Working Rate	**8,209**	**5,459**
Water Tank Flash Rate	**5,691**	**3,794**
Water Tank Working Rate	**7,988**	**5,325**
Tank Breathing Rate	**2,377**	**951**
Total	**44,034**	**28,708**

LOD ID: **LUCCI ST T5N-R64W-S1 L01**

Consent Decree Tank System Number: **301**

Audit Notes

VOC emission visible on top of tank in all IR Camera videos. IR videos do not show all applicable components of the VCS.

The signed engineering evaluation (LUCCI ST T5N-R64W-S1 L01_SIGNED EVAL.pdf) shows a non-banked tank configuration of eight (8) oil tanks and two (2) water tanks onsite. The walkdown pdf (LUCCI ST T5N-R64W-S1 L01 WALKDOWN.pdf) indicated the storage tanks are a banked configuration with 2 banks of 3 oil tanks and 1 water tank and one bank of 2 oil tanks. Noble used a banked configuration with 3 oil and 1 water tank in their revised engineeing analysis. A banked tank configuration was used in SLR's calculations. All tanks were included to account for breathing losses from non-producing banks. Headspace surge capacity was calculated for a bank of 3 oil and 1 water tank.

There is no provided documentation which verifies the valve and trim size of the separator water dump valves. It is assumed LP 1-69, LP 3-69, and HP 1-99 separator water and oil dump valves are the same size/trim.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

The original signed evaluation dated 5/26/2015 included dumps from three wells (Lucci State B03-69HNL, Lucci State B01-69HNL, and Lucci B01-99HZ). The revised evaluation only includes dumps from 2 wells (Lucci State B03-69HNL and Lucci State B01-69HNL). Field data in final packet indicates 3 separators dump to the tanks. No documentation was provided indicating modifications were requested to be completed at this site.

UPDATE: Noble agrees that Engineering Evaluation was incorrect. Updated Engineering Evaluation submitted with Noble's Semi-Annual Report (5th) (July 28, 2017).

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LUNDVALL T5N-R66W-S18 L03**

Consent Decree Tank System Number: **36**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
LUNDVALL T5N-R66W-S18 L03_FINAL PACKET	pdf	7/8/2015	Final Facilty Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
LUNDVALL T5N-R66W-S18 L03_SIGNED EVAL	pdf	7/21/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_rev1_LUNDVALL T5N-R66W-S18 L03	xlsm	9/21/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
LUNDVALL T5N-R66W-S18 L03 WORK REQUEST	pdf	6/4/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
LUNDVALL T5N-R66W-S18 L03 WALKDOWN	pdf	7/7/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
LUNDVALL T5N-R66W-S18 L03_0049_NORMAL	mp4	7/7/2015	IR Video of site during normal operation
LUNDVALL T5N-R66W-S18 L03_0050_DUMP	mp4	7/7/2015	IR Video of site during separator dump event
LUNDVALL T5N-R66W-S18 L03_0051_POST	mp4	7/7/2015	IR Video of site post dump event
LUNDVALL T5N-R66W-S18 L03 IR VERIFICATION	pdf	7/7/2015	IR Camera Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
LUNDVALL T5N-R66W-S18 L03_SIGNED EVAL	pdf	7/21/2015	Signed Engineering Design Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LUNDVALL T5N-R66W-S18 L03 (5 Tank Bank)**

Consent Decree Tank System Number: **36**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**11**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**60**	**60**						
Dump Valve Size & Trim Size (in)	**1" & 1/2"**	**1" & 1/2"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**		
Man. Capacity (MSCFD)	**140**	**140**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**7,601**	**9,029**	**19%**
Calculated Burner Capacity (scfh	**5,246**	**11,667**	
Headspace Surge Capacity (scfh)	**6,907**	**6,907**	
Total VCS Capacity (scfh)	**12,153**	**18,574**	
VCS Capacity minus PPIVF (scfh)	**4,552**	**9,544**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	4/6/2016 & 11/15/2016 & 5/1/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	4/1/2016 & 12/1/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LUNDVALL T5N-R66W-S18 L03 (5 Tank Bank)**

Consent Decree Tank System Number: **36**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.61**	**0.61**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**0.72**	**0.72**						
Gas/Oil Ratio (scf/bbl)	**96.4**	**96.4**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**	**0.94**						
Valve Coefficent (gpm/psi) (C_v)	**5.72**	**5.72**						
Critical Pressure (psia)[b]	**530**	**530**						
Vapor Pressure (psia)[c]	**73**	**73**						
Critical pressure ratio (F_F) [d]	**0.86**	**0.86**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**727**	**727**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**70.1**	**70.1**						
Working Flow (Mscfd)[h,i]	**7**	**7**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**63**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**5,838**	**5,838**
Oil Tank Working Rate	**576**	**575**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**2,615**	**1,189**
Total	**9,029**	**7,602**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **LUNDVALL T5N-R66W-S18 L03**

Consent Decree Tank System Number: **36**

Audit Notes

-Because tanks are banked, calculations include breathing losses from all 11 tanks by entering the total number of tanks into the calcuclation sheet. Noble did not include breathing losses from the other bank.
"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original LUNDVALL T5N-R66W-S18 L03_SIGNED EVAL.pdf and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1_LUNDVALL T5N-R66W-S18 L03.xlsm file.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **MOSER CHAMP T4N-R65W-S34 L01**

Consent Decree Tank System Number: **432**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
MOSER CHAMP T4N-R65W-S34 L01_FINAL PACKET	pdf	8/26/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
MOSER CHAMP T4N-R65W-S34 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation
STEM Engineering Evaluation_Moser Champ	xlsm	5/22/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_MOSER CHAMP T4N-R65W-S34 L01	xlsm	9/27/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
MOSER CHAMP T4N-R65W-S34 L01_FINAL PACKET	pdf	8/26/2015	Work Request
Noble 3rd Party Audi Wave 12 Update Info Request_20170117	pdf	1/17/2017	Information Request Response

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
MOSER CHAMP T4N-R65W-S34 L01 WALKDOWN	pdf	4/23/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
MOSER CHAMP T4N-R65W-S34 L01_SIGNEDVERIFICATION	pdf	5/7/2015	Ir Camera Verification Sheet
MOSER CHAMP T4N-R65W-S34 L01_2310_normal	mp4	5/7/2015	IR Camera Video
MOSER CHAMP T4N-R65W-S34 L01_2311_dump	mp4	5/7/2015	IR Camera Video
MOSER CHAMP T4N-R65W-S34 L01_2312_post	mp4	5/7/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
MOSER CHAMP T4N-R65W-S34 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **MOSER CHAMP T4N-R65W-S34 L01**

Consent Decree Tank System Number: **432**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**5**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**1**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**						
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**					
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**					

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**TEC 4-CS (48" Tornado**			
Man. Capacity (MSCFD)	**110.4**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**33,505**	**33,757**	**1%**
Calculated Burner Capacity (scfh	**4,021**	**4,600**	
Headspace Surge Capacity (scfh)	**73,695**	**110,614**	
Total VCS Capacity (scfh)	**77,716**	**115,214**	
VCS Capacity minus PPIVF (scfh)	**44,211**	**81,457**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/9/2016 & 11/15/2016 & 5/1/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	5/26/2016 & 12/1/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **MOSER CHAMP T4N-R65W-S34 L01**

Consent Decree Tank System Number: **432**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**-0.90**	**-0.90**						
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**						
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**						
Critical Pressure (psia)[b]	**833**	**833**						
Vapor Pressure (psia)[c]	**407**	**407**						
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**6905**	**6905**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**158.2**	**158.2**						
Working Flow (Mscfd)[h,i]	**66**	**66**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**					
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**					
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**					
Vapor Pressure (psia)[k]	**1**	**1**	**1**					
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**					
Choked Flow?[e]	**Yes**	**Yes**	**Yes**					
Peak Flow (bwpd)[f,g]	**11381**	**11381**	**11381**					

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**46**	**46**	**46**					
Working Flow (Mscfd)[l]	**64**	**64**	**64**					

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**29**	**6**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**13,179**	**13,179**
Oil Tank Working Rate	**5,473**	**5,459**
Water Tank Flash Rate	**5,691**	**5,690**
Water Tank Working Rate	**7,988**	**7,987**
Tank Breathing Rate	**1,426**	**1,189**
Total	**33,757**	**33,505**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **MOSER CHAMP T4N-R65W-S34 L01**

Consent Decree Tank System Number: **432**

Audit Notes

Emissions from four (4) oil tanks are evaluated in the signed engineering evaluation, MOSER CHAMP T4N-R65W-S34 L01_SIGNED EVAL.pdf. The field data sheets, MOSER CHAMP T4N-R65W-S34 L01_FINAL PACKET.pdf, pg. 10, indicate there are five (5) oil tanks and one (1) water tank on site. The IR Camera videos indicate there are six (6) 300 bbl tanks on site. The audit was completed with five (5) oil tanks and one (1) water tank. SLR still considers the engineering guideline applied correctly because less tanks results in less headspace surge capacity.

The field note are unclear as to which separator is associated with 34-64HN, and as such the oil and water dump valve trim sizes can not be verified. Nothing is provided on the field data sheets (MOSER CHAMP T4N-R65W-S34 L01 FINAL PACKET.pdf, pg. 7)nor the work request (MOSER CHAMP T4N-R65W-S34 L01 FINAL PACKET.pdf, pg. 17,36, & 55) or job sheets MOSER CHAMP T4N-R65W-S34 L01 FINAL PACKET.pdf, pg. 29-30, 33-35, 48-49, 52-54). A 1" trim was utilized for both oil and water dump valves, the largest trim for a kimray 2200 SMA valve.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

The "Max Operating Pressure" for the HLP increased from 125 psig in the original STEM Engineering Evaluation_Moser Champ.xlsm to 400 psig in the modified STEM Engineering Evaluation_rev1_MOSER CHAMP T4N-R65W-S34 L01.xlsm file. SLR used 400 psig in their calculation to be conservative.

- Water dumps from two (2) separator vessels (LP & HLP) existed in the original STEM Engineering Evaluation_Moser Champ.xlsm, now water dumps from three (3) separator vessels (HP, LP & HP) are shown in the modified STEM Engineering Evaluation_rev1_MOSER CHAMP T4N-R65W-S34 L01.xlsm.

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original STEM Engineering Evaluation_Moser Champ.xlsm and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1_MOSER CHAMP T4N-R65W-S34 L01.xlsm file.

UPDATE: Confirmed accuracy of existing Engineering Evaluation. TLO walkdown picture (Attachment L) confirms that one of the tanks is a Maintenance Tank and is not part of the Vapor Control System.

UPDATE: After reviewing SLR's Draft Report, Noble contacted Tornado to confirm that its burners can handle capacities beyond the published specification or 10 oz/in2. Tornado confirmed that the published burner curve can be hydraulically extrapolated beyond 10 oz/in2. Moreover, Tornado noted the stated capacity is based on heat release (86.4 MSCFD at 2,300 BTU/scf). Noble's typical flash gas is lighter in composition (1,800 BTU/scf) such that the Tornado burner would be capable of handling up to 110.4 MSCFD at the published heat release limit. The Tornado specification sheet notes the maximum flow is dependent on heating value of the gas, consistent with Noble's conversation.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **MOSER T4N-R65W-S20 L02**

Consent Decree Tank System Number: **1958**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
MOSER T4N-R65W-S10 L02_FINAL PACKET	pdf	6/2/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
MOSER T4N-R65W-S10 L02_SIGNED EVAL	pdf	6/29/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_rev1_MOSER T4N-R65W-S10 L02 (update)	xlsm	4/28/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
MOSER T4N-R65W-S10 L02 WORK REQUEST	pdf	5/11/2015	work request
STEM Engineering Evaluation_rev1_MOSER T4N-R65W-S10 L02 (update)	xlsm	4/28/2016	Revised Engineering Evaluation

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
MOSER T4N-R65W-S10 L02 WALKDOWN	pdf	7/6/2015	facility walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
MOSER T4N-R65W-S10 L02_0187_NORMAL	mp4	6/1/2015	IR Video of site during normal operation
MOSER T4N-R65W-S10 L02_0188_DUMP	mp4	6/1/2015	IR Video of site during separator dump event
MOSER T4N-R65W-S10 L02_0189_POST	mp4	6/1/2015	IR Video of site post dump event
MOSER T4N-R65W-S10 L02 IR VERIFICATION	pdf	6/22/2015	IR Camera Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
MOSER T4N-R65W-S10 L02_SIGNED EVAL	pdf	6/29/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **MOSER T4N-R65W-S20 L02**

Consent Decree Tank System Number: **1958**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**1**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**230**							
Dump Valve Size & Trim Size (in)	**1" & 3/16"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**		
Man. Capacity (MSCFD)	**109.272**	**109.272**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**6,065**	**6,065**	**0%**
Calculated Burner Capacity (scfh	**7,811**	**9,106**	
Surge Capacity (scfh)	**0**	**0**	
Total VCS Capacity (scfh)	**7,811**	**9,106**	
VCS Capacity minus PPIVF (scfh)	**1,746**	**3,041**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Angela M. Oberlander/Tom Kussard
Audit Document Review Date:	2/25/2016 & 11/15/2016 & 1/31/2017 & 4/21/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	3/17/2016 & 12/2/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **MOSER T4N-R65W-S20 L02**

Consent Decree Tank System Number: **1958**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**1.97**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**2.08**							
Gas/Oil Ratio (scf/bbl)	**519.1**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.59**							
Valve Coefficent (gpm/psi) (C_v)	**1.51**							
Critical Pressure (psia)[b]	**682**							
Vapor Pressure (psia)[c]	**243**							
Critical pressure ratio (F_F) [d]	**0.79**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**265**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**137.3**							
Working Flow (Mscfd)[h,i]	**3**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**6**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**5,722**	**5,722**
Oil Tank Working Rate	**105**	**105**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**238**	**238**
Total	**6,065**	**6,065**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **MOSER T4N-R65W-S20 L02**

Consent Decree Tank System Number: **1958**

Audit Notes

-Field notes did not confirm valve size. SLR used the only valve size with a 3/16" valve trim size.

-Noble Energy/IES STEM Data checklist has information on the type of combustors/burners (#1 - Cimmaron 48", #2 - Cimm 48") which conflicts with the units in the engineering evaluation (#1 - Cimmarron 48 HV, #2 - COMM 200 48"). RISE packet indicates "burner was added a few months ago," which may have ment to indicate burner was replaced/swapped to a different manufacturer/model. The COMM has a higher capacity than the cimmaron.

The Max Operating Pressure decreased from the 275 psig in the orginal evaluation, MOSER T4N-R65W-S10 L02_FINAL PACKET.pdf, to 230 psig in the modified evaluation, STEM Engineering Evaluation_rev1_MOSER T4N-R65W-S10 L02 (update).xlsm. Noble confirmed the pressure to be 230 psi.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **MOSER THORSON T3N-R65W-S27 L01**

Consent Decree Tank System Number: **2096**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
MOSER THORSON T3N-R65W-S27 L01_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
MOSER THORSON T3N-R65W-S27 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation
STEM Engineering Evaluation_Moser Thorsen	xlsm	5/22/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_MOSER THORSON T3N-R65W-S27 L01	xlsm	7/28/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
MOSER THORSON T3N-R65W-S27 L01 WORK REQUEST	xlsx	4/1/2015	Work Request
MOSER THORSON T3N-R65W-S27 L01_FINAL PACKET	pdf	No Date	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
MOSER THORSON T3N-R65W-S27 L01 WALKDOWN	pdf	4/24/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
MOSER THORSON T3N-R65W-S27 L01_SIGNEDVERIFICATION	pdf	5/7/2015	IR Camera Verification Sheet
MOSER THORSON T3N-R65W-S27 L01_2304_normal	mp4	5/7/2015	IR Camera Video
MOSER THORSON T3N-R65W-S27 L01_2305_dump	mp4	5/7/2015	IR Camera Video
MOSER THORSON T3N-R65W-S27 L01_2306_post	mp4	5/7/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
MOSER THORSON T3N-R65W-S27 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **MOSER THORSON T3N-R65W-S27 L01**

Consent Decree Tank System Number: **2096**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**4**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**	**70**						
Dump Valve Size & Trim Size (in)	**2" & 3/4"**	**2" & 3/4"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**COMM 200 48"**	**COMM 200 48"**		
Man. Capacity (MSCFD)	**157**	**157**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**12,591**	**15,595**	**24%**
Calculated Burner Capacity (scfh	**7,839**	**13,083**	
Headspace Surge Capacity (scfh)	**13,427**	**13,194**	
Total VCS Capacity (scfh)	**21,266**	**26,277**	
VCS Capacity minus PPIVF (scfh)	**8,675**	**10,682**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/9/2016 & 11/16/2016 & 5/1/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	5/25/2016 & 12/2/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **MOSER THORSON T3N-R65W-S27 L01**

Consent Decree Tank System Number: **2096**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**	**0.77**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**0.89**	**0.89**						
Gas/Oil Ratio (scf/bbl)	**112.8**	**112.8**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.80**	**0.80**						
Valve Coefficent (gpm/psi) (C_v)	**12.20**	**12.20**						
Critical Pressure (psia)[b]	**539**	**539**						
Vapor Pressure (psia)[c]	**83**	**83**						
Critical pressure ratio (F_F) [d]	**0.85**	**0.85**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**1437**	**1437**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**162.1**	**162.1**						
Working Flow (Mscfd)[h,i]	**14**	**14**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**23**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**13,505**	**10,597**
Oil Tank Working Rate	**1,139**	**1,043**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**951**	**951**
Total	**15,595**	**12,591**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **MOSER THORSON T3N-R65W-S27 L01**

Consent Decree Tank System Number: **2096**

Audit Notes

MOSER THORSON T3N-R65W-S27 L01_FINAL PACKET.pdf pg. 27 indicates oil leg dump valve models as "2400." The valve trims were modified to 3/4" per work request MOSER THORSON T3N-R65W-S27 L01 WORK REQUEST.xslx and confirmed via MOSER THORSON T3N-R65W-S27 L01 WALKDOWN.pdf

The work request document (MOSER THORSON T3N-R65W-S27 L01 WORK REQUEST.xslx) requests a LP Separator dump valve pressure setting of 70 psig. The signed evaluation pdf (MOSER THORSON T3N-R65W-S27 L01_SIGNED EVAL.pdf) was completed with a LP Separator dump valve pressure setting of 60 psig. The confirmed 70 psig was used in the audit.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

UPDATE: Noble confirmed accuracy of existing Engineering Evaluation. Although initial work request specifies 70 psig shut-in pressure, subsequent rework documents confirmation that shut-in pressure was set to 60 psig. Completed Rework Request documents confirmation that shut-in pressure is 60 psig.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **NAKAGAWA T5N-R64W-S13 L01**

Consent Decree Tank System Number: **2048**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
NAKAGAWA T5N-R64W-S13 L01_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
NAKAGAWA T5N-R64W-S13 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation
STEM Engineering Evaluation_Nakagawa B13HN	xlsm	4/28/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_NAKAGAWA T5N-R64W-S13 L01	xlsm	4/15/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
NAKAGAWA T5N-R64W-S13 L01 WORK REQUEST	xslx	4/1/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
NAKAGAWA T5N-R64W-S13 L01 WALKDOWN	pdf	4/23/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
NAKAGAWA T5N-R64W-S13 L01 IR VERIFICATION	pdf	5/12/2015	IR Camera Verification Sheet
NAKAGAWA T5N-R64W-S13 L01_2375_normal	mp4	5/12/2015	IR Camera Video
NAKAGAWA T5N-R64W-S13 L01_2376_dump	mp4	5/12/2015	IR Camera Video
NAKAGAWA T5N-R64W-S13 L01_2377_post	mp4	5/12/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
NAKAGAWA T5N-R64W-S13 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **NAKAGAWA T5N-R64W-S13 L01**

Consent Decree Tank System Number: **2048**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**9**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**3**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**6**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**					
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**					

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**					
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**					

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig) 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**		
Man. Capacity (MSCFD)	**140**	**140**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**43,062**	**44,509**	**3%**
Calculated Burner Capacity (scfh)	**5,635**	**11,667**	
Headspace Surge Capacity (scfh)	**85,723**	**85,723**	
Total VCS Capacity (scfh)	**91,358**	**97,390**	
VCS Capacity minus PPIVF (scfh)	**48,296**	**52,880**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/10/2016 & 11/15/2016 & 5/1/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	5/26/2016 & 12/2/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **NAKAGAWA T5N-R64W-S13 L01**

Consent Decree Tank System Number: **2048**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**	**-1.02**					
Z2	**-0.86**	**-0.86**	**-0.86**					
Z3	**0.98**	**0.98**	**0.98**					
Z	**-0.90**	**-0.90**	**-0.90**					
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**	**22.9**					

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**					
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**					
Critical Pressure (psia)[b]	**833**	**833**	**833**					
Vapor Pressure (psia)[c]	**407**	**407**	**407**					
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**	**0.76**					
Choked Flow?[e]	**Yes**	**Yes**	**Yes**					
Peak Flow (bopd)[f,g]	**6905**	**6905**	**6905**					

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**158.2**	**158.2**	**158.2**					
Working Flow (Mscfd)[h,i]	**66**	**66**	**66**					

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**					
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**					
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**					
Vapor Pressure (psia)[k]	**1**	**1**	**1**					
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**					
Choked Flow?[e]	**Yes**	**Yes**	**Yes**					
Peak Flow (bwpd)[f,g]	**11381**	**11381**	**11381**					

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**46**	**46**	**46**					
Working Flow (Mscfd)[l]	**64**	**64**	**64**					

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**51**	**17**

Flow Rate Summary	**Flow Rate (scfh)**	
	SLR	**Noble**
Oil Tank Flash Rate	**19,769**	**19,769**
Oil Tank Working Rate	**8,209**	**8,188**
Water Tank Flash Rate	**5,691**	**5,690**
Water Tank Working Rate	**7,988**	**7,987**
Tank Breathing Rate	**2,853**	**1,426**
Total	**44,509**	**43,060**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **NAKAGAWA T5N-R64W-S13 L01**

Consent Decree Tank System Number: **2048**

Audit Notes

IR Camera videos do not clearly show all tanks.

There is no provided documentation which verifies the valve and trim size of the LP separator water dump valves. It is assumed LP separator water and oil dump valves are the same size/trim.

Noble did not include breathing losses from the non-producing tank bank. SLR included all tanks in its calculations to include breathing losses from all tanks. Configuration has two banks - one bank with 6 oil tanks, one bank with 3 oil tanks and 3 water tanks.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

"VOC Design Tank Pressure" was originally 11 oz/in^2 in the original STEM Engineering Evaluation_Nakagawa B13HN.xlsm and was changed to 12 oz/in^2 in the modified STEM Engineering Evaluation_rev1_NAKAGAWA T5N-R64W-S13 L01.xlsm file.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **NEI OSTER T4N-R64W-S18 L01**

Consent Decree Tank System Number: **651**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
NEI OSTER T4N-R64W-S18 L01_FINAL PACKET	pdf	7/16/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
NEI OSTER T4N-R64W-S18 L01_SIGNED EVAL	pdf	7/21/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_rev1 NEI OSTER T4N-R64W-S18 L01	xlsm	9/26/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
NEI OSTER T4N-R64W-S18 L01 WORK REQUEST	pdf	6/18/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
NEI OSTER T4N-R64W-S18 L01 WALKDOWN	pdf	7/14/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
NEI OSTER T4N-R64W-S18 L01_0062_NORMAL	mp4	7/14/2015	IR Video of site during normal operation
NEI OSTER T4N-R64W-S18 L01_0063_DUMP	mp4	7/14/2015	IR Video of site during separator dump event
NEI OSTER T4N-R64W-S18 L01_0064_POST	mp4	7/14/2015	IR Video of site post dump event
NEI OSTER T4N-R64W-S18 L01 IR VERIFICATION	pdf	7/14/2015	IR Camera Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
NEI OSTER T4N-R64W-S18 L01_SIGNED EVAL	pdf	7/21/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **NEI OSTER T4N-R64W-S18 L01**

Consent Decree Tank System Number: **651**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**2**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**60**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**			
Man. Capacity (MSCFD)	**140**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**3,920**	**3,920**	**0%**
Calculated Burner Capacity (scfh)	**2,944**	**5,833**	
Headspace Surge Capacity (scfh)	**3,472**	**3,472**	
Total VCS Capacity (scfh)	**6,416**	**9,305**	
VCS Capacity minus PPIVF (scfh)	**2,496**	**5,385**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	2/29/2016 & 11/15/2016 & 4/21/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	3/30/2016 & 12/2/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **NEI OSTER T4N-R64W-S18 L01**

Consent Decree Tank System Number: **651**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.61**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.72**							
Gas/Oil Ratio (scf/bbl)	**96.4**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**530**							
Vapor Pressure (psia)[c]	**73**							
Critical pressure ratio (F_F) [d]	**0.86**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**727**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**70.1**							
Working Flow (Mscfd)[h,i]	**7**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**17**	**0**

Flow Rate Summary	**Flow Rate (scfh)**	
	SLR	**Noble**
Oil Tank Flash Rate	**2,919**	**2,919**
Oil Tank Working Rate	**288**	**287**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**713**	**713**
Total	**3,920**	**3,919**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **NEI OSTER T4N-R64W-S18 L01**

Consent Decree Tank System Number: **651**

Audit Notes

-Vapor apprears starting at 32 seconds and 1:31 into Dump Video. Vapors from earlier could be from the combustor. No leaks were reported on the IR inspection Form.

-Due to potentail leaks on IR videos this site is selected for IR inspection
"VOC Design Tank Pressure" was originally 11 oz/in^2 in the original NEI OSTER T4N-R64W-S18 L01 - STEM Engineering Evaluation Check.xlsm and was changed to 12 oz/in^2 in the modified STEM Engineering Evaluation_rev1 NEI OSTER T4N-R64W-S18 L01.xlsm file.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **NO WORRIES T4N-R65W-S14 L01**

Consent Decree Tank System Number: **2369**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
NO WORRIES T4N-R65W-S14 L01_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
NO WORRIES T4N-R65W-S14 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation
STEM Engineering Evaluation_No Worries PC	xlsm	4/15/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_NO WORRIES T4N-R65W-S14 L01	xlsm	9/22/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
NO WORRIES T4N-R65W-S14 L01 WALKDOWN	pdf	5/6/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
NO WORRIES T4N-R65W-S14 L01 IR VERIFICATION	pdf	5/14/2015	IR Camera Verification Sheet
NO WORRIES T4N-R65W-S14 L01_0685_normal	mp4	5/14/2015	IR Camera Video
NO WORRIES T4N-R65W-S14 L01_0686_dump	mp4	5/14/2015	IR Camera Video
NO WORRIES T4N-R65W-S14 L01_0687_post	mp4	5/14/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
NO WORRIES T4N-R65W-S14 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **NO WORRIES T4N-R65W-S14 L01**

Consent Decree Tank System Number: **2369**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**12**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**4**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**				
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**				

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**				
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**				

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**		
Man. Capacity (MSCFD)	**109.272**	**109.272**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**57,416**	**59,346**	**3%**
Calculated Burner Capacity (scfh)	**6,285**	**9,106**	
Headspace Surge Capacity (scfh)	**114,083**	**114,083**	
Total VCS Capacity (scfh)	**120,368**	**123,189**	
VCS Capacity minus PPIVF (scfh)	**62,952**	**63,843**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/10/2016 & 11/15/2016 & 5/1/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	5/24/2016 & 12/2/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **NO WORRIES T4N-R65W-S14 L01**

Consent Decree Tank System Number: **2369**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**	**-1.02**	**-1.02**				
Z2	**-0.86**	**-0.86**	**-0.86**	**-0.86**				
Z3	**0.98**	**0.98**	**0.98**	**0.98**				
Z	**-0.90**	**-0.90**	**-0.90**	**-0.90**				
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**	**22.9**	**22.9**				

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**	**0.77**				
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**	**21.25**				
Critical Pressure (psia)[b]	**833**	**833**	**833**	**833**				
Vapor Pressure (psia)[c]	**407**	**407**	**407**	**407**				
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**	**0.76**	**0.76**				
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**				
Peak Flow (bopd)[f,g]	**6905**	**6905**	**6905**	**6905**				

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**158.2**	**158.2**	**158.2**	**158.2**				
Working Flow (Mscfd)[h,i]	**66**	**66**	**66**	**66**				

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**	**0.77**				
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**	**21.25**				
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**	**3200**				
Vapor Pressure (psia)[k]	**1**	**1**	**1**	**1**				
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**	**0.96**				
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**				
Peak Flow (bwpd)[f,g]	**11381**	**11381**	**11381**	**11381**				

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**46**	**46**	**46**	**46**				
Working Flow (Mscfd)[l]	**64**	**64**	**64**	**64**				

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**68**	**23**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**26,359**	**26,359**
Oil Tank Working Rate	**10,945**	**10,918**
Water Tank Flash Rate	**7,588**	**7,587**
Water Tank Working Rate	**10,650**	**10,650**
Tank Breathing Rate	**3,804**	**1,902**
Total	**59,346**	**57,416**

LOD ID: **NO WORRIES T4N-R65W-S14 L01**

Consent Decree Tank System Number: **2369**

Audit Notes

IR videos do not clearly show all tanks.

The facility walkdown indicates there are three tanks, one with 6 oil and 2 water tanks, one with 6 oil tanks and one with 2 water tanks. Noble calculated PPIVFR and headspace surge capacity from the bank with 6 oil and 2 water tanks. Noble did not include breathing losses from non-producting tank banks. SLR included all tanks on in our calcualtions to account for breathing losses from all tanks.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

"VOC Design Tank Pressure" was originally 11 oz/in^2 in the original STEM Engineering Evaluation_No Worries PC.xlsm and was changed to 12 oz/in^2 in the modified STEM Engineering Evaluation_rev1_NO WORRIES T4N-R65W-S14 L01.xlsm file.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **NOFFSINGER T5N-R65W-S2 L01**

Consent Decree Tank System Number: **1515**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
NOFFSINGER T5N-R65W-S2 L01_FINAL PACKET	pdf	4-30-2015 (sign	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
NOFFSINGER T5N-R65W-S2 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation
STEM Engineering Evaluation_Noffsinger F2-4,5	xlsm	4/28/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_NOFFSINGER T5N-R65W-S2 L01	xlsm	9/22/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
NOFFSINGER T5N-R65W-S2 L01 WORK REQUEST	pdf	5/11/2015	Work Request
NOFFSINGER T5N-R65W-S2 L01_FINAL PACKET	pdf	4-30-2015 (sign	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
NOFFSINGER T5N-R65W-S2 L01 WALKDOWN	pdf	4/30/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
NOFFSINGER T5N-R65W-S2 L01 IR VERIFICATION	pdf	5/15/2015	IR Camera Verification Sheet
NOFFSINGER T5N-R65W-S2 L01_0708_normal	mp4	5/15/2015	IR Camera Video
NOFFSINGER T5N-R65W-S2 L01_0709_dump	mp4	5/15/2015	IR Camera Video
NOFFSINGER T5N-R65W-S2 L01_0710_post	mp4	5/15/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
NOFFSINGER T5N-R65W-S2 L01_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **NOFFSINGER T5N-R65W-S2 L01**

Consent Decree Tank System Number: **1515**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**2**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**80**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**TEC 4-CS (48" Tornado)**			
Man. Capacity (MSCFD)	**110.4**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,508**	**5,441**	**21%**
Calculated Burner Capacity (scfh	**4,088**	**4,600**	
Headspace Surge Capacity (scfh)	**2,430**	**2,033**	
Total VCS Capacity (scfh)	**6,518**	**6,633**	
VCS Capacity minus PPIVF (scfh)	**2,010**	**1,192**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	7/20/2016 & 11/15/2016 & 4/21/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	8/4/2016 & 12/2/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **NOFFSINGER T5N-R65W-S2 L01**

Consent Decree Tank System Number: **1515**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.92**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**1.03**							
Gas/Oil Ratio (scf/bbl)	**130.1**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**548**							
Vapor Pressure (psia)[c]	**93**							
Critical pressure ratio (F_F) [d]	**0.84**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**854**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**111.1**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**11**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**4,628**	**3,720**
Oil Tank Working Rate	**338**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**475**	**475**
Total	**5,441**	**4,508**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **NOFFSINGER T5N-R65W-S2 L01**

Consent Decree Tank System Number: **1515**

Audit Notes

-VOC emissions seen in IR video "NOFFSINGER T5N-R65W-S2 L01_0710_post.mp4." The Verification Document (NOFFSINGER T5N-R65W-S2 L01 IR VERIFICATION.pdf) indicated it was the result of a pilot light failure and that once re-lit, the emissions were no longer observed.

-Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

-"Max Operating Pressure" was originally 80 psi in the original STEM Engineering Evaluation_Noffsinger F2-4,5.xlsm and was changed to 70 psi in the modified STEM Engineering Evaluation_rev1_NOFFSINGER T5N-R65W-S2 L01.xlsm file. SLR is unable to confirm the 70psi pressure, therefore 80psi is used in SLR's calculations.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ORR ROGERS EGGE USX T6N-R64W-S3 L01**

Consent Decree Tank System Number: **1381**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
ORR ROGERS EGGE USX T6N-R64W-S3 L01_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
ORR ROGERS EGGE USX T6N-R64W-S3 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation
STEM Engineering Evaluation_Orr	xlsm	5/22/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_ORR ROGERS EGGE USX T6N-R64W-S3 L01	xlsm	7/28/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
0210 - Orr, Egge, Rogers Work Request	pdf	5/11/2015	Work Request
ORR ROGERS EGGE USX T6N-R64W-S3 L01 REWORK DESIGN PACKET	pdf	9/2/2015	Work Request
ORR ROGERS EGGE USX T6N-R64W-S3 L01_FINAL PACKET	pdf	No Date	Work Request
Noble 3rd Party Audi Wave 12 Update Info Request_20170117	pdf	1/17/2017	Information Request Response

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
ORR ROGERS EGGE USX T6N-R64W-S3 L01 WALKDOWN	pdf	4/28/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
ORR ROGERS EGGE USX T6N-R64W-S3 L01 IR VERIFICATION	pdf	7/9/2015	IR Camera Verification Sheet
ORR ROGERS EGGE USX T6N-R64W-S3 L01_0052_NORMAL	mp4	7/9/2015	IR Camera Video
ORR ROGERS EGGE USX T6N-R64W-S3 L01_0053_DUMP	mp4	7/9/2015	IR Camera Video
ORR ROGERS EGGE USX T6N-R64W-S3 L01_0054_POST	mp4	7/9/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
ORR ROGERS EGGE USX T6N-R64W-S3 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ORR ROGERS EGGE USX T6N-R64W-S3 L01**

Consent Decree Tank System Number: **1381**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**			
Man. Capacity (MSCFD)	**140**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,746**	**4,747**	**0%**
Calculated Burner Capacity (scfh)	**2,916**	**5,833**	
Headspace Surge Capacity (scfh)	**4,037**	**4,037**	
Total VCS Capacity (scfh)	**6,953**	**9,870**	
VCS Capacity minus PPIVF (scfh)	**2,207**	**5,123**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/10/2016 & 11/16/2016 & 1/31/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	5/24/2016 & 12/2/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ORR ROGERS EGGE USX T6N-R64W-S3 L01**

Consent Decree Tank System Number: **1381**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**17**	**0**

Flow Rate Summary	**Flow Rate (scfh)**	
	SLR	**Noble**
Oil Tank Flash Rate	**3,720**	**3,720**
Oil Tank Working Rate	**314**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**713**	**713**
Total	**4,747**	**4,746**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ORR ROGERS EGGE USX T6N-R64W-S3 L01**

Consent Decree Tank System Number: **1381**

Audit Notes

Both Walkdown lists provided predate (4/25/15 & 7/9/15) the completion and verification of the site work (9/25/15 - 9/29/15) per the job sheet provided on pg 41, ORR ROGERS EGGE USX T6N-R64W-S3 L01_FINAL PACKET.pdf.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

"VOC Design Tank Pressure" was originally 11 oz/in^2 in the original ORR ROGERS EGGE USX T6N-R64W-S3 L01_SIGNED EVAL.pdf and was changed to 13 oz/in^2 in the modified STEM Engineering Evaluation_rev1_ORR ROGERS EGGE USX T6N-R64W-S3 L01.xlsm file.

Noble confirmed a max operating pressure of 70 psi via the Noble 3rd Party Audit Wave 12 Update Info Request_20170117.pdf.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **OSCAR Y10 ECONODE T2N-R64W-S10 L01**

Consent Decree Tank System Number: **2335**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
OSCAR Y10 ECONODE T2N-R64W-S10 L01_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
OSCAR Y10 ECONODE T2N-R64W-S10 L01_SIGNED EVAL	pdf	5/26/2015	Engineering Evaluation
STEM Engineering Evaluation_Oscar Y10 Econode_Oil	xlsm	4/28/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_OSCAR Y10 ECONODE T2N-R64W-S10 L01_Oil	xlsm	9/22/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
0066 - Oscar Y10 Econode Work Request	pdf	12/30/2015	Work Request
OSCAR Y10 ECONODE T2N-R64W-S10 L01_FINAL PACKET	pdf	No Date	Work Request
FW Noble Data Request Response - OSCAR Y10 ECONODE	msg	6/15/2016	Email confimation of Valve and Trim Size

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
OSCAR Y10 ECONODE T2N-R64W-S10 L01 WALKDOWN	pdf	5/6/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
OSCAR Y10 ECONODE T2N-R64W-S10 L01 IR VERIFICATION	pdf	5/14/2015	IR Camera Verification Sheet
OSCAR Y10 ECONODE T2N-R64W-S10 L01_0691_normal	mp4	5/14/2015	IR Camera Video
OSCAR Y10 ECONODE T2N-R64W-S10 L01_0692_dump	mp4	5/14/2015	IR Camera Video
OSCAR Y10 ECONODE T2N-R64W-S10 L01_0694_post	mp4	5/14/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
OSCAR Y10 ECONODE T2N-R64W-S10 L01_SIGNED EVAL	pdf	5/26/2015	Signed Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **OSCAR Y10 ECONODE T2N-R64W-S10 L01**

Consent Decree Tank System Number: **2335**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**9**
Oil Tank Capacity (bbl):	**500**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**6**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**						
Dump Valve Size & Trim Size (in)	**3" & 2"**	**3" & 2"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**	**Cimarron 48 HV**	**Cimarron 48 HV**
Man. Capacity (MSCFD)	**109.272**	**109.272**	**109.272**	**109.272**

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**48,503**	**48,536**	**0%**
Calculated Burner Capacity (scfh	**12,600**	**18,212**	
Headspace Surge Capacity (scfh)	**199,168**	**199,168**	
Total VCS Capacity (scfh)	**211,768**	**217,380**	
VCS Capacity minus PPIVF (scfh)	**163,265**	**168,844**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	7/20/2016 & 11/16/2016 & 5/1/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	8/4/2016 & 12/2/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **OSCAR Y10 ECONODE T2N-R64W-S10 L01**

Consent Decree Tank System Number: **2335**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**-0.90**	**-0.90**						
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor	**0.75**	**0.75**						
Valve Coefficent (gpm/psi) (	**52.60**	**52.60**						
Critical Pressure (psia)[b]	**833**	**833**						
Vapor Pressure (psia)[c]	**407**	**407**						
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**16649**	**16649**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**381.3**	**381.3**						
Working Flow (Mscfd)[h,i]	**158**	**158**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor								
Valve Coefficent (gpm/psi) (								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**500**	**0**
scfh vapor/tank[i]	**396**	**0**
Mscfd	**86**	**0**

Flow Rate Summary	**Flow Rate (scfh)**	
	SLR	**Noble**
Oil Tank Flash Rate	**31,776**	**31,776**
Oil Tank Working Rate	**13,194**	**13,161**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**3,566**	**3,566**
Total	**48,536**	**48,503**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **OSCAR Y10 ECONODE T2N-R64W-S10 L01**

Consent Decree Tank System Number: **2335**

Audit Notes

The field data sheets (OSCAR Y10 ECONODE T2N-R64W-S10 L01_FINAL PACKET.pdf, pg 8) indicate the LP Seps to have 3" oil dump valves with 1" trims. A 2" valve with a 1" trim utilized in the Noble Engineering Evaluation. Noble confirmed in an email on 6/15/2016 from Russell Thesing to Kenny Malmquist that the valve installed is a 3" valve with a 2" trim. Noble corrected the valve and trim size to 3" and 2" respectively in the revised engineering evaluation.

IR Camera videos do not clearly show all tanks.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

UPDATE: Noble agrees that Engineering Evaluation was incorrect. An updated Engineering Evaluation was completed and a revised COCR submitted with Noble's Semi-Annual Report (5th) (July 28, 2017).

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **PATRIOT T5N-R64W-S16 L02**

Consent Decree Tank System Number: **304**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
PATRIOT T5N-R64W-S16 L02_FINAL PACKET	pdf	6/3/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
PATRIOT T5N-R64W-S16 L02_SIGNED EVAL	pdf	7/9/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_rev1_PATRIOT T5N-R64W-S16 L02	xlsm	7/28/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
PATRIOT T5N-R64W-S16 L02 WORK REQUEST	pdf	5/13/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
PATRIOT T5N-R64W-S16 L02 WALKDOWN	pdf	6/3/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
PATRIOT T5N-R64W-S16 L02_0218_NORMAL	mp4	6/3/2015	IR Video of site during normal operation
PATRIOT T5N-R64W-S16 L02_0219_DUMP	mp4	6/3/2015	IR Video of site during separator dump event
PATRIOT T5N-R64W-S16 L02_0220_POST	mp4	6/3/2015	IR Video of site post dump event
PATRIOT T5N-R64W-S16 L02 IR VERIFICATION	pdf	6/3/2015	IR Camera Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
PATRIOT T5N-R64W-S16 L02_SIGNED EVAL	pdf	7/9/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **PATRIOT T5N-R64W-S16 L02**

Consent Decree Tank System Number: **304**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**2**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**4"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**150**							
Dump Valve Size & Trim Size (in)	**1" & 1/4"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**TEC 4-CS (48" Tornado)**	**COMM 200 48"**		
Man. Capacity (MSCFD)	**110.4**	**157**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**5,178**	**5,178**	**0%**
Calculated Burner Capacity (scfh)	**8,374**	**11,142**	
Headspace Surge Capacity (scfh)	**0**	**0**	
Total VCS Capacity (scfh)	**8,374**	**11,142**	
VCS Capacity minus PPIVF (scfh)	**3,196**	**5,963**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	3/28/2016 & 11/16/2016 & 4/21/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	3/30/2016 & 12/2/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **PATRIOT T5N-R64W-S16 L02**

Consent Decree Tank System Number: **304**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**1.57**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**1.68**							
Gas/Oil Ratio (scf/bbl)	**281.0**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**							
Valve Coefficent (gpm/psi) (C_v)	**2.17**							
Critical Pressure (psia)[b]	**610**							
Vapor Pressure (psia)[c]	**163**							
Critical pressure ratio (F_F) [d]	**0.82**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**388**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**109.2**							
Working Flow (Mscfd)[h,i]	**4**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**11**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**4,549**	**4,549**
Oil Tank Working Rate	**154**	**154**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**475**	**475**
Total	**5,178**	**5,178**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **PATRIOT T5N-R64W-S16 L02**

Consent Decree Tank System Number: **304**

Audit Notes

-Design evaluation describes facility with 2 HP separators, but only one running at a time.

-Vapor appears on video at the 42 second mark of the Dump video. Source of vapor cannot be seen on video. May be dust due to wind.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **PATRIOT T5N-R64W-S16 L01 AND L04**

Consent Decree Tank System Number: **1503**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
PATRIOT T5N-R64W-S16 L01 AND L04_FINAL PACKET	pdf	7/16/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
PATRIOT T5N-R64W-S16 L01 AND L04_SIGNED EVAL	pdf	7/20/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_rev1_PATRIOT T5N-R64W-S16 L04	xlsm	7/28/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
PATRIOT T5N-R64W-S16 L01 AND L04 WORK REQUEST	pdf	6/18/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
PATRIOT T5N-R64W-S16 L01 AND L04 WALKDOWN	pdf	7/16/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
PATROIT T5N-R64W-S16 L01, L04_0172_NORMAL	mp4	7/16/2015	IR Video of site during normal operation
PATROIT T5N-R64W-S16 L01, L04_0173_DUMP	mp4	7/16/2015	IR Video of site during separator dump event
PATROIT T5N-R64W-S16 L01, L04_	mp4	7/16/2015	IR Video of site post dump event
PATRIOT T5N-R64W-S16 L01 AND L04 IR VERIFICATION	pdf	7/16/2015	IR Camera Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
PATRIOT T5N-R64W-S16 L01 AND L04_SIGNED EVAL	pdf	7/20/2015	Signed Engineering Design Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **PATRIOT T5N-R64W-S16 L01 AND L04**

Consent Decree Tank System Number: **1503**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**140**	**140**	**140**					
Dump Valve Size & Trim Size (in)	**1" & 3/8"**	**1" & 3/8"**	**1" & 3/8"**					

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**COMM 200 48"**	**TEC 4-CS (48" Tornado)**	**COMM 200 48"**	
Man. Capacity (MSCFD)	**157**	**110.4**	**157**	

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**22,143**	**22,144**	**0%**
Calculated Burner Capacity (scfh)	**10,625**	**17,683**	
Headspace Surge Capacity (scfh)	**21,038**	**21,038**	
Total VCS Capacity (scfh)	**31,663**	**38,721**	
VCS Capacity minus PPIVF (scfh)	**9,520**	**16,577**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	3/28/2016 & 11/16/2016 & 4/21/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	3/30/2016 & 12/2/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **PATRIOT T5N-R64W-S16 L01 AND L04**

Consent Decree Tank System Number: **1503**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**1.50**	**1.50**	**1.50**					
Z2	**-0.86**	**-0.86**	**-0.86**					
Z3	**0.98**	**0.98**	**0.98**					
Z	**1.61**	**1.61**	**1.61**					
Gas/Oil Ratio (scf/bbl)	**256.2**	**256.2**	**256.2**					

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.91**	**0.91**	**0.91**					
Valve Coefficent (gpm/psi) (C_v)	**3.22**	**3.22**	**3.22**					
Critical Pressure (psia)[b]	**601**	**601**	**601**					
Vapor Pressure (psia)[c]	**153**	**153**	**153**					
Critical pressure ratio (F_F) [d]	**0.82**	**0.82**	**0.82**					
Choked Flow?[e]	**Yes**	**Yes**	**Yes**					
Peak Flow (bopd)[f,g]	**645**	**645**	**645**					

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**165.3**	**165.3**	**165.3**					
Working Flow (Mscfd)[h,i]	**6**	**6**	**6**					

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**17**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**20,664**	**20,664**
Oil Tank Working Rate	**767**	**765**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**713**	**713**
Total	**22,144**	**22,142**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **PATRIOT T5N-R64W-S16 L01 AND L04**

Consent Decree Tank System Number: **1503**

Audit Notes

-Wells 16-18, 22 missing from initial Noble walkdown performed 3/10/2015, included in final packet.
"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original PATRIOT T5N-R64W-S16 L01 AND L04_SIGNED EVAL.pdf and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1_PATRIOT T5N-R64W-S16 L04.xlsm file.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **PHILLIPS T5N-R67W-S24 L02**

Consent Decree Tank System Number: **28**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
PHILLIPS T5N-R67W-S24 L02_FINAL PACKET	pdf	7/6/2015	Final Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
PHILLIPS T5N-R67W-S24 L02_SIGNED EVAL	pdf	6/26/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_rev1_PHILLIPS T5N-R67W-S24 L02	xlsm	7/28/2016	Revised Engineering Evaluation
Noble 3rd Party Audi Wave 12 Update Info Request_20170117	pdf	1/17/2017	Information Request Response

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
PHILLIPS T5N-R67W-S24 L02 WORK REQUEST	pdf	5/12/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
PHILLIPS T5N-R67W-S24 L02 WALKDOWN	pdf	5/29/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
PHILLIPS T5N-R67W-S24 L02_0184_NORMAL	mp4	5/29/2015	IR Video of site during normal operation
PHILLIPS T5N-R76W-S24 L02_0185_DUMP	mp4	5/29/2015	IR Video of site during separator dump event
PHILLIPS T5N-R76W-S24 L02_0186_POST	mp4	5/29/2015	IR Video of site post dump event
PHILLIPS T5N-R67W-S24 L02 IR VERIFICATION	pdf	5/29/2015	IR Camera Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
PHILLIPS T5N-R67W-S24 L02_SIGNED EVAL	pdf	6/26/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **PHILLIPS T5N-R67W-S24 L02**

Consent Decree Tank System Number: **28**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**5**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**2" & 1"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**COMM 200 48"**			
Man. Capacity (MSCFD)	**157**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**13,461**	**13,464**	**0%**
Calculated Burner Capacity (scfh	**4,804**	**6,542**	
Headspace Surge Capacity (scfh)	**26,847**	**26,847**	
Total VCS Capacity (scfh)	**31,651**	**33,389**	
VCS Capacity minus PPIVF (scfh)	**18,190**	**19,925**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	3/25/2016 & 11/16/2016 & 2/1/2017 & 4/21/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	3/25/2016 & 12/2/2016

LOD ID: **PHILLIPS T5N-R67W-S24 L02**

Consent Decree Tank System Number: **28**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**							
Valve Coefficent (gpm/psi) (C_v)	**21.25**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**2409**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**271.7**							
Working Flow (Mscfd)[h,i]	**23**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**29**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**11,321**	**11,321**
Oil Tank Working Rate	**955**	**952**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**1,189**	**1,189**
Total	**13,464**	**13,462**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **PHILLIPS T5N-R67W-S24 L02**

Consent Decree Tank System Number: **28**

Audit Notes

-Initial walkdown on 2/3/15 indicates a single Leed 48" burner controlling the tanks. A second walkdown on 5/5/15 indicates two (2) comm burners instead. Aerial phot and videos show 2 burners. Work request indicates two (2) Comm Burners at the facilty with one burner used for the low pressure surge bottle. A COMM burner has a higher capacity than a Leed 48".

-SLR's calculated surge capacity is much higher than that presented in the final evaluation due to the use of a COMM rather than a Leed 48" burner.

"Max Operating Pressure" was originally 80 psi in the original PHILLIPS T5N-R67W-S24 L02_SIGNED EVAL.pdf and was changed to 70 psi in the modified STEM Engineering Evaluation_rev1_PHILLIPS T5N-R67W-S24 L02.xlsm file. Noble confirmed the pressure is 70psi.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **PIONEER HP UPRC HP FARMS T2N-R64W-S7 L01**

Consent Decree Tank System Number: **427**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
PIONEER HP UPRC HP FARMS T2N-R64W-S7 L01_FINAL PACKET	pdf	6/4/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
PIONEER HP UPRC HP FARMS T2N-R64W-S7 L01_SIGNED EVAL	pdf	6/29/2015	Signed Engineering Design Evaluation
STEM Eng Eval_rev1_PIONEER HP UPRC HP FARMS T2N-R64W-S7 L01	xlsm	7/28/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
PIONEER HP UPRC HP FARMS T2N-R64W-S7 L01 WORK REQUEST	pdf	5/4/2015	Work Request
Noble 3rd Party Audi Wave 12 Update Info Request_20170117	pdf	1/17/2017	Information Request Response

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
PIONEER HP UPRC HP FARMS T2N-R64W-S7 L01 WALKDOWN	pdf	6/2/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
PIONEER HP UPRC HP FARMS T2N-R64W-S7 L01_0203_NORMAL	mp4	6/2/2015	IR Video of site during normal operation
PIONEER HP UPRC HP FARMS T2N-R64W-S7 L01_0204_DUMP	mp4	6/2/2015	IR Video of site during separator dump event
PIONEER HP UPRC HP FARMS T2N-R64W-S7 L01_0205_POST	mp4	6/2/2015	IR Video of site post dump event
PIONEER HP UPRC HP FARMS T2N-R64W-S7 L01 IR VERIFICATION	pdf	6/2/2015	IR Camera Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
PIONEER HP UPRC HP FARMS T2N-R64W-S7 L01_SIGNED EVAL	pdf	6/29/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **PIONEER HP UPRC HP FARMS T2N-R64W-S7 L01**

Consent Decree Tank System Number: **427**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**5**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**2**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**		
Man. Capacity (MSCFD)	**140**	**140**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**5,222**	**5,222**	**0%**
Calculated Burner Capacity (scfh	**5,617**	**11,667**	
Headspace Surge Capacity (scfh)	**7,570**	**7,570**	
Total VCS Capacity (scfh)	**13,187**	**19,237**	
VCS Capacity minus PPIVF (scfh)	**7,965**	**14,014**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	4/26/2016 & 11/16/2016 & 2/1/2017 & 4/21/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	4/28/2016 & 12/2/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **PIONEER HP UPRC HP FARMS T2N-R64W-S7 L01**

Consent Decree Tank System Number: **427**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**29**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**3,720**	**3,720**
Oil Tank Working Rate	**314**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**1,189**	**1,189**
Total	**5,222**	**5,222**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **PIONEER HP UPRC HP FARMS T2N-R64W-S7 L01**

Consent Decree Tank System Number: **427**

Audit Notes

-Email from automation in the final packet confirming PSHH installation was not for the correct site. However completion of automation changes was confirmed in the final facility walkdown.

"Max Operating Pressure" was originally 80 psi in the original PIONEER HP UPRC HP FARMS T2N-R64W-S7 L01_SIGNED EVAL.pdf and was changed to 70 psi in the modified STEM Eng Eval_rev1_PIONEER HP UPRC HP FARMS T2N-R64W-S7 L01.xlsm file. Noble confirmed a pressure of 70 ps via a data request, therefore SLR used 70 psi in the calculations.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ROACH BASS T5N-R67W-S14**

Consent Decree Tank System Number: **26**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
ROACH BASS T5N-R67W-S14 L01_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
ROACH BASS T5N-R67W-S14 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation
STEM Engineering Evaluation_Roach	xlsm	5/22/2015	Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
ROACH BASS T5N-R67W-S14 WORK REQUEST	pdf	5/11/2015	Work Request
ROACH BASS T5N-R67W-S14 L01_FINAL PACKET	pdf	No Date	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
ROACH BASS T5N-R67W-S14 L01 WALKDOWN	pdf	4/30/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
ROACH BASS T5N-R67W-S14 L01 IR VERIFICATION	pdf	5/15/2015	IR Camera Verification Sheet
ROACH BASS T5N-R67W-S14 L01_0705_normal	mp4	5/15/2015	IR Camera Video
ROACH BASS T5N-R67W-S14 L01_0706_dump	mp4	5/15/2015	IR Camera Video
ROACH BASS T5N-R67W-S14 L01_0707_post	mp4	5/15/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
ROACH BASS T5N-R67W-S14 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ROACH BASS T5N-R67W-S14**

Consent Decree Tank System Number: **26**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**6**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**60**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**TEC 4-CS (48" Tornado)**	**LEED 48" Gen 1 #7**		
Man. Capacity (MSCFD)	**110.4**	**140**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**9,870**	**4,634**	**53%**
Calculated Burner Capacity (scfh)	**5,959**	**10,433**	
Headspace Surge Capacity (scfh)	**30,628**	**2,891**	
Total VCS Capacity (scfh)	**36,587**	**13,324**	
VCS Capacity minus PPIVF (scfh)	**26,717**	**8,691**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/10/2016 & 5/1/2017
Audit Document Review Verified by:	Angela M. Oberlander & James Van Horne
Audit Document Verification Date:	5/23/2016 & 5/18/2017

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ROACH BASS T5N-R67W-S14**

Consent Decree Tank System Number: **26**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.61**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.72**							
Gas/Oil Ratio (scf/bbl)	**96.4**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**530**							
Vapor Pressure (psia)[c]	**73**							
Critical pressure ratio (F_F) [d]	**0.86**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**727**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**70.1**							
Working Flow (Mscfd)[h,i]	**7**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**34**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**2,919**	**7,569**
Oil Tank Working Rate	**288**	**875**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**1,426**	**1,426**
Total	**4,634**	**9,870**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ROACH BASS T5N-R67W-S14**

Consent Decree Tank System Number: **26**

Audit Notes

-Unable to clearly see the tanks thief hatches and possible emissions points (relief valves, VCS piping, etc.) in IR Camera videos.

-Signed Eval PDF (ROACH BASS T5N-R67W-S14 L01_SIGNED EVAL.pdf) shows the storage tanks are unbanked. The walkdown pdf (ROACH BASS T5N-R67W-S14 L01 WALKDOWN.pdf) shows two (2) banks of tanks, each with three (3) tanks. Noble correct this issue in their revised engineering using a banked configuration with 3 oil tanks in each bank. The revised engineering evaluation does not account for breathing losses from the non-producing bank. The audit verification was completed with a banked configuration. All tanks were included in SLR's Breathing calculations. SLR calculated headspace surge capacity for a bank of 3 tanks. SLR stills consideres the modeling guideline applied correctly due to the PPIVFR calculated still being overestimated due to the engineering evaluation using a larger trim size than what is installed as discussed below.

-The Signed Eval PDF (ROACH BASS T5N-R67W-S14 L01_SIGNED EVAL.pdf) was completed with a dump valve max trim size of 1". Pg 8 of the final packet pdf (ROACH BASS T5N-R67W-S14 L01_FINAL PACKET.pdf) indicated a 1" dump valve with 1/2" trim installed on the separator. The verification audit was completed with a 1" valve and 1/2" trim based on field data and a work order which does not direct for the valve or trim size to be modified.

-Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

UPDATE: Noble agrees that Engineering Evaluation was incorrect. Updated Engineering Evaluation was generated and submitted with Noble's Semi-Annual Report (6th) (January 29, 2018).

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ROTH T6N-R64W-S19 L01**

Consent Decree Tank System Number: **2103**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
ROTH T6N-R64W-S19 L01_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
ROTH T6N-R64W-S19 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation
STEM Engineering Evaluation_Roth	xlsm	4/29/2015	Tank VOC analysis
STEM Engineering Evaluation_ROTH T6N-R64W-S19 L01	xlsm	4/29/2015	Revised Tank VOC analysis
Attachment G - STEM Engineering Evaluation_rev1_ROTH T6N-R64W-S19 L01.xlsm	xlsm	1/17/2017	Revised Tank VOC analysis 2

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
198 - Roth 19 Work Request	pdf	NA	Work Request
ROTH T6N-R64W-S19 L01 DESIGN PACKET	pdf	8/28/2015	Work Request
ROTH T6N-R64W-S19 L01_FINAL PACKET	pdf	No Date	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
ROTH T6N-R64W-S19 L01 WALKDOWN	pdf	4/27/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
ROTH T6N-R64W-S19 L01 IR VERIFICATION	pdf	5/6/2015	IR Camera Verification Sheet
ROTH T6N-R64W-S19 L01_2280_normal	mp4	5/6/2015	IR Camera Video
ROTH T6N-R64W-S19 L01_2283_post no leaking	mp4	5/6/2015	IR Camera Video
ROTH T6N-R64W-S19 L01_2282_post leaking	mp4	5/6/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
ROTH T6N-R64W-S19 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ROTH T6N-R64W-S19 L01**

Consent Decree Tank System Number: **2103**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**2" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**COMM 200 48"**			
Man. Capacity (MSCFD)	**157**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,926**	**4,926**	**0%**
Calculated Burner Capacity (scfh	**4,906**	**6,542**	
Headspace Surge Capacity (scfh)	**1,436**	**1,436**	
Total VCS Capacity (scfh)	**6,342**	**7,978**	
VCS Capacity minus PPIVF (scfh)	**1,416**	**3,051**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/10/2016 & 11/16/2016 & 2/1/2017 & 4/21/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	5/23/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ROTH T6N-R64W-S19 L01**

Consent Decree Tank System Number: **2103**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**							
Valve Coefficent (gpm/psi) (C_v)	**7.20**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**827**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**93.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**17**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**3,885**	**3,885**
Oil Tank Working Rate	**328**	**327**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**713**	**713**
Total	**4,926**	**4,925**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ROTH T6N-R64W-S19 L01**

Consent Decree Tank System Number: **2103**

Audit Notes

Video file "ROTH T6N-R64W-S19 L01_2282_post leaking.mp4" shows visible VOC's on the IR camera. IR Verification form indicates the leak was fixed by Noble personnel and second post dump video (ROTH T6N-R64W0S19 L01_post no leaking. Mp4) shot.

Documentation is unclear as to whether a COMM 200 48" replaced the Cimmarron 48 as the tank VOC controls, or whether it was installed as another burner in conjunction with the LEED burner on the separator. A COMM 200 48" was used in the audit as it appears there are only two combustors on site per the IR Camera videos.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ROTHE TOBY BOBCAT PANTHER T4N-R64W-S2 L01**

Consent Decree Tank System Number: **630**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
ROTHE TOBY BOBCAT PANTHER T4N-R64W-S2 L01_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
ROTHE TOBY BOBCAT PANTHER T4N-R64W-S2 L01_SIGNED EVAL	pdf	5/28/2015	Engineering Evaluation
STEM Engineering Evaluation_Rothe Toby Panther Bobcat	xlsm	4/28/2015	Tank VOC Analysis
STEM Eng Eval_rev1_ROTHE TOBY BOBCAT PANTHER T4N-R64W-S2 L01	xlsm	9/29/2016	Revised Tank VOC Analysis
Evaluation_rev1_ROTHE TOBY BOBCAT PANTHER T4N-R64W-S2 L01.xlsm	xlsm	2/1/2017	Revised Tank VOC Analysis 2

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
ROTHE TOBY BOBCAT PANTHER T4N-R64W-S2 L01 WORK REQUEST	pdf	5/21/2015	Work Request
ROTHE TOBY BOBCAT PANTHER T4N-R64W-S2 L01_FINAL PACKET	pdf	No Date	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
ROTHE TOBY BOBCAT PANTHER T4N-R64W-S2 L01 WALKDOWN	pdf	5/6/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
ROTHE TOBY BOBCAT PANTHER T4N-R64W-S2 L01 IR VERIFICATION	pdf	5/12/2015	IR Camera Verification Sheet
ROTHE TOBY BOBCAT PANTHER T4N-R64W-S2 L01_2359_normal	mp4	5/12/2015	IR Camera Video
ROTHE TOBY BOBCAT PANTHER T4N-R64W-S2 L01_2361_dump	mp4	5/12/2015	IR Camera Video
ROTHE TOBY BOBCAT PANTHER T4N-R64W-S2 L01_2362_post	mp4	5/12/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
ROTHE TOBY BOBCAT PANTHER T4N-R64W-S2 L01_SIGNED EVAL	pdf	5/28/2015	Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ROTHE TOBY BOBCAT PANTHER T4N-R64W-S2 L01**

Consent Decree Tank System Number: **630**

☑ Yes ☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes ☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**10**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**2**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**2**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**	**70**						
Dump Valve Size & Trim Size (in)	**2" & 1/2"**	**1" & 1/2"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**300**	**300**						
Dump Valve Size & Trim Size (in)	**2" & 1/2"**	**1" & 1/2"**						

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**	**Cimarron 48 HV**	
Man. Capacity (MSCFD)	**109.272**	**109.272**	**109.272**	

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**13,763**	**13,765**	**0%**
Calculated Burner Capacity (scfh	**9,304**	**13,659**	
Headspace Surge Capacity (scfh)	**22,922**	**22,922**	
Total VCS Capacity (scfh)	**32,226**	**36,581**	
VCS Capacity minus PPIVF (scfh)	**18,463**	**22,816**	

☑ Yes ☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes ☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes ☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes ☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/10/2016 & 11/16/2016 & 2/1/2017 & 4/21/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	5/20/2016 & 12/6/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ROTHE TOBY BOBCAT PANTHER T4N-R64W-S2 L01**

Consent Decree Tank System Number: **630**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**	**0.77**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**0.89**	**0.89**						
Gas/Oil Ratio (scf/bbl)	**112.8**	**112.8**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor	**0.78**	**0.94**						
Valve Coefficent (gpm/psi) (	**7.20**	**5.72**						
Critical Pressure (psia)[b]	**539**	**539**						
Vapor Pressure (psia)[c]	**83**	**83**						
Critical pressure ratio (F_F) [d]	**0.85**	**0.85**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**827**	**792**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**93.3**	**89.3**						
Working Flow (Mscfd)[h,i]	**8**	**8**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor	**0.78**	**0.94**						
Valve Coefficent (gpm/psi) (	**7.20**	**5.72**						
Critical Pressure (psia)[j]	**3200**	**3200**						
Vapor Pressure (psia)[k]	**1**	**1**						
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bwpd)[f,g]	**3399**	**3254**						

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**14**	**13**						
Working Flow (Mscfd)[l]	**19**	**18**						

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**57**	**11**

Flow Rate Summary	**Flow Rate (scfh)**	
	SLR	**Noble**
Oil Tank Flash Rate	**7,605**	**7,605**
Oil Tank Working Rate	**641**	**640**
Water Tank Flash Rate	**1,109**	**1,109**
Water Tank Working Rate	**1,556**	**1,556**
Tank Breathing Rate	**2,853**	**2,853**
Total	**13,765**	**13,763**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ROTHE TOBY BOBCAT PANTHER T4N-R64W-S2 L01**

Consent Decree Tank System Number: **630**

Audit Notes

IR Camera videos do not clearly show all tanks and potential emissions points (thief hatches, vents, etc.).

The walkdown pdf (ROTH T6N-R64W-S19 L01 WALKDOWN.pdf) was never dated or signed and has a pdf creation date of 5-6-2015.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.
In the original assessment (STEM Engineering Evaluation_Rothe Toby Panther Bobcat.xlsm) and in the walkdown checklist (ROTHE TOBY BOBCAT PANTHER T4N-R64W-S2 L01 WALKDOWN.pdf), the tanks are not in a banked configuration. In the revised assessment (STEM Eng Eval_rev1_ROTHE TOBY BOBCAT PANTHER T4N-R64W-S2 L01.xlsm), the tanks are in a banked configuration. Noble confirmed via a data request that the tanks are not banked onsite

In the original assessment (STEM Engineering Evaluation_Rothe Toby Panther Bobcat.xlsm) and in the work request in the final packet (ROTHE TOBY BOBCAT PANTHER T4N-R64W-S2 L01_FINAL PACKET.pdf), the Maximum Operating Pressure was 80 psig for the oil and water dumps. In the revised assessment (STEM Eng Eval_rev1_ROTHE TOBY BOBCAT PANTHER T4N-R64W-S2 L01.xlsm) the Max Operating Pressure is 70 psig for the oil and 300 psig for the water dumps. Noble confirmed via a data request by SLR that 70psig for oil dumps and 300 psi for water dumps is correct.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **RYANN ST T4N-R64W-S16 L03**

Consent Decree Tank System Number: **658**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
RYANN ST T4N-R64W-S16 L03_FINAL PACKET	pdf	7/2/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
RYANN ST T4N-R64W-S16 L03_SIGNED EVAL	pdf	7/14/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_RYANN ST T4N-R64W-S16 L03	xlsm	7/14/2015	STEM Engineering Evaluation Spreadsheet
STEM Engineering Evaluation_rev1_RYANN ST T4N-R64W-S16 L03	xlsm	7/28/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
RYANN ST T4N-R64W-S16 L03 WORK REQUEST	pdf	6/9/2015	Work Request
Noble 3rd Party Audi Wave 12 Update Info Request_20170117	pdf	1/17/2017	Information Request Response

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
RYANN ST T4N-R64W-S16 L03 WALKDOWN	pdf	7/1/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
RYANN ST T4N-R64W-S16 L03_0017_NORMAL	mp4	7/1/2015	IR Video of site during normal operation
RYANN ST T4N-R64W-S16 L03_0018_DUMP	mp4	7/1/2015	IR Video of site during separator dump event
RYANN ST T4N-R64W-S16 L03_0019_POST	mp4	7/1/2015	IR Video of site post dump event
RYANN ST T4N-R64W-S16 L03 IR VERIFICATION	pdf	7/1/2015	IR Camera Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
RYANN ST T4N-R64W-S16 L03_SIGNED EVAL	pdf	7/14/2015	Signed Engineering Design Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **RYANN ST T4N-R64W-S16 L03**

Consent Decree Tank System Number: **658**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**TEC 4-CS (48" Tornado)**	**TEC 4-CS (48" Tornado)**		
Man. Capacity (MSCFD)	**110.4**	**110.4**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,746**	**4,747**	**0%**
Calculated Burner Capacity (scfh)	**6,946**	**9,200**	
Headspace Surge Capacity (scfh)	**2,504**	**2,504**	
Total VCS Capacity (scfh)	**9,450**	**11,704**	
VCS Capacity minus PPIVF (scfh)	**4,704**	**6,957**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	4/26/2016 & 11/16/2016 & 2/1/2017 & 4/20/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	4/28/2016 & 12/5/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **RYANN ST T4N-R64W-S16 L03**

Consent Decree Tank System Number: **658**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**17**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**3,720**	**3,720**
Oil Tank Working Rate	**314**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**713**	**713**
Total	**4,747**	**4,746**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **RYANN ST T4N-R64W-S16 L03**

Consent Decree Tank System Number: **658**

Audit Notes

-Noble Model uses 2" x 1/2" dump valve with trim for final evaluation. Final Packet states that the converted separator (old Ryann State C16-21,22,24) is equiped with a 1" valve with a 1/2" trim which was used in SLR calculations.
-Facility walkdown did not indicate whether all requested items were completed. Items were confirmed with job sheets and other information in the final packet.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SATER T4N-R63W-S18 L03 & L02**

Consent Decree Tank System Number: **459**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
SATER T4N-R63W-S18 L03 & L02_FINAL PACKET	pdf	7/2/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
SATER T4N-R63W-S18 L03_SIGNED EVAL	pdf	7/9/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_rev1_SATER T4N-R63W-S18 L02 & L03	xlsm	7/28/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
SATER T4N-R63W-S18 L03 WORK REQUEST	pdf	5/28/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
SATER T4N-R63W-S18 L03 WALKDOWN	pdf	7/1/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
SATER T4N-R63W-S18 L03_0023_NORMAL	mp4	7/1/2015	IR Video of site during normal operation
SATER T4N-R63W-S18 L03_0024_DUMP	mp4	7/1/2015	IR Video of site during separator dump event
SATER T4N-R63W-S18 L03_0025_POST	mp4	7/1/2015	IR Video of site post dump event
SATER T4N-R63W-S18 L03 IR VERIFICATION	pdf	7/1/2015	IR Camera Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
SATER T4N-R63W-S18 L03_SIGNED EVAL	pdf	7/9/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SATER T4N-R63W-S18 L03 & L02**

Consent Decree Tank System Number: **459**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**COMM 200 48"**			
Man. Capacity (MSCFD)	**157**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,746**	**4,747**	**0%**
Calculated Burner Capacity (scfh	**5,051**	**6,542**	
Headspace Surge Capacity (scfh)	**3,385**	**3,385**	
Total VCS Capacity (scfh)	**8,436**	**9,927**	
VCS Capacity minus PPIVF (scfh)	**3,690**	**5,180**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	3/25/2016 & 11/16/2016 & 4/26/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	3/25/2016 & 12/7/2016

SLR

LOD ID: **SATER T4N-R63W-S18 L03 & L02**

Consent Decree Tank System Number: **459**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**17**	**0**

Flow Rate Summary	**Flow Rate (scfh)**	
	SLR	**Noble**
Oil Tank Flash Rate	**3,720**	**3,720**
Oil Tank Working Rate	**314**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**713**	**713**
Total	**4,747**	**4,746**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SATER T4N-R63W-S18 L03 & L02**

Consent Decree Tank System Number: **459**

Audit Notes

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SCOOTER T3N-R67W-S18 L01**

Consent Decree Tank System Number: **2367**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
SCOOTER T3N-R64W-S18 L01_SIGNED EVAL	pdf	6/29/2015	Signed Engineering Design Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
SCOOTER T3N-R67W-S18 L01 WORK REQUEST	pdf	5/19/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
SCOOTER T3N-R64W-S18 L01 WALKDOWN	pdf	6/9/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
SCOOTER T3N-R64W-S18 L01_0255_NORMAL	mp4	6/15/2015	IR Video of site during normal operation
SCOOTER T3N-R64W-S18 L01_0256_DUMP	mp4	6/15/2015	IR Video of site during separator dump event
SCOOTER T3N-R64W-S18 L01_0257_POST	mp4	6/15/2015	IR Video of site post dump event
SCOOTER T3N-R64W-S18 L01 IR VERIFICATION	pdf	6/15/2015	IR Camera Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
SCOOTER T3N-R64W-S18 L01_SIGNED EVAL	pdf	6/29/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SCOOTER T3N-R67W-S18 L01**

Consent Decree Tank System Number: **2367**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**9**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**3**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**					
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**					

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**					
Dump Valve Size & Trim Size (in)	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**					

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

Truck Loadout Vapor Collection Installed? ☑ Yes ☐ No

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	
Man. Capacity (MSCFD)	**140**	**140**	**140**	

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**34,078**	**38,052**	**12%**
Calculated Burner Capacity (scfh	**7,238**	**17,500**	
Headspace Surge Capacity (scfh)	**83,087**	**83,087**	
Total VCS Capacity (scfh)	**90,325**	**100,587**	
VCS Capacity minus PPIVF (scfh)	**56,247**	**62,535**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	4/20/2016 & 11/16/2016 & 5/1/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	4/28/2016 & 12/7/2016

SLR

LOD ID: **SCOOTER T3N-R67W-S18 L01**

Consent Decree Tank System Number: **2367**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**	**-1.02**					
Z2	**-0.86**	**-0.86**	**-0.86**					
Z3	**0.98**	**0.98**	**0.98**					
Z	**-0.90**	**-0.90**	**-0.90**					
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**	**22.9**					

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor	**0.77**	**0.77**	**0.77**					
Valve Coefficent (gpm/psi) (	**21.25**	**21.25**	**21.25**					
Critical Pressure (psia)[b]	**833**	**833**	**833**					
Vapor Pressure (psia)[c]	**407**	**407**	**407**					
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**	**0.76**					
Choked Flow?[e]	**Yes**	**Yes**	**Yes**					
Peak Flow (bopd)[f,g]	**6905**	**6905**	**6905**					

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**158.2**	**158.2**	**158.2**					
Working Flow (Mscfd)[h,i]	**66**	**66**	**66**					

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor	**0.78**	**0.78**	**0.78**					
Valve Coefficent (gpm/psi) (	**7.20**	**7.20**	**7.20**					
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**					
Vapor Pressure (psia)[k]	**1**	**1**	**1**					
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**					
Choked Flow?[e]	**Yes**	**Yes**	**Yes**					
Peak Flow (bwpd)[f,g]	**3906**	**3906**	**3906**					

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**16**	**16**	**16**					
Working Flow (Mscfd)[l]	**22**	**22**	**22**					

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**51**	**17**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**19,769**	**19,769**
Oil Tank Working Rate	**8,209**	**8,188**
Water Tank Flash Rate	**1,953**	**1,953**
Water Tank Working Rate	**2,742**	**2,741**
Tank Breathing Rate	**2,853**	**1,426**
Truck Vent Capture Rate	**2,527**	**0**
Total	**38,052**	**34,077**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SCOOTER T3N-R67W-S18 L01**

Consent Decree Tank System Number: **2367**

Audit Notes

-Signed Eval and final walkdown shows Banked Configuration (Bank 1: 3 oil, 3 water. Bank 2: 6 Oil). Noble did not account for breating losses from non-producing bank. SLR included breathing losses from all tanks and used a headspace surge capacity with 6 tanks.

-Field Datasheet Drawing shows truck loading Vapor Return Lines (Final Packet Page 3). Truck loadout losses were not included by Noble in PPIVFR. As a conservative approach SLR included truck vent capture line flow rate based on the information provided by Noble on 4/20/2017.

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original STEM Engineering Evaluation_SCOOTER T3N-R64W-S18 L01.xlsm and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1_SCOOTER T3N-R64W-S18 L01.xlsm file.

UPDATE: Noble revised its PPIVFR determinations to include TLO vapors. Noble completed Engineering Evaluations and submitted a revised COCR with its Semi-Annual Reports (5th) (July 28, 2017) and (6th) (January 29, 2018). Noble provided revised Engineering Evaluation to SLR on May 10, 2018.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SEYLER B10, B15 ECONODE T5N-R64W-S10 L01**

Consent Decree Tank System Number: **2363**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
SEYLER B10, B15 ECONODE T5N-R64W-S10 L01_FINAL PACKET	pdf	No Date	Field Data Sheet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
SEYLER B10, B15 ECONODE T5N-R64W-S10 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation
STEM Engineering Evaluation_Seyler Econode	xlsm	4/15/2015	Tank VOC Analysis
STEM Eng Eval_rev1_SEYLER B10, B15 ECONODE T5N-R64W-S10 L01	xlsm	9/22/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
SEYLER B10, B15 ECONODE T5N-R64W-S10 L01 WALKDOWN	pdf	4/23/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
SEYLER B10, B15 ECONODE T5N-R64W-S10 L01 IR VERIFICATION	pdf	5/12/2015	IR Camera Verification Sheet
SEYLER B10, B15 ECONODE T5N-R64W-S10 L01_2372_normal	mp4	5/12/2015	IR Camera Video
SEYLER B10, B15 ECONODE T5N-R64W-S10 L01_2373_dump	mp4	5/12/2015	IR Camera Video
SEYLER B10, B15 ECONODE T5N-R64W-S10 L01_2374_post	mp4	5/12/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
SEYLER B10, B15 ECONODE T5N-R64W-S10 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SEYLER B10, B15 ECONODE T5N-R64W-S10 L01**

Consent Decree Tank System Number: **2363**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**10**
Oil Tank Capacity (bbl):	**500**
# of Water Tanks:	**4**
Water Tank Capacity (bbl):	**500**
VOC Line Size (in):	**6**
# VOC Lines to KO:	**2**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**	**400**			
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**			

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**	**400**			
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**			

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	
Man. Capacity (MSCFD)	**140**	**140**	**140**	

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**72,958**	**74,975**	**3%**
Calculated Burner Capacity (scfh)	**8,848**	**17,500**	
Headspace Surge Capacity (scfh)	**204,681**	**204,681**	
Total VCS Capacity (scfh)	**213,529**	**222,181**	
VCS Capacity minus PPIVF (scfh)	**140,571**	**147,206**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/10/2016 & 11/16/2016 & 5/1/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	5/20/2016 & 12/7/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SEYLER B10, B15 ECONODE T5N-R64W-S10 L01**

Consent Decree Tank System Number: **2363**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**	**-1.02**	**-1.02**	**-1.02**			
Z2	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**			
Z3	**0.98**	**0.98**	**0.98**	**0.98**	**0.98**			
Z	**-0.90**	**-0.90**	**-0.90**	**-0.90**	**-0.90**			
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**	**22.9**	**22.9**	**22.9**			

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**			
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**	**21.25**	**21.25**			
Critical Pressure (psia)[b]	**833**	**833**	**833**	**833**	**833**			
Vapor Pressure (psia)[c]	**407**	**407**	**407**	**407**	**407**			
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**	**0.76**	**0.76**	**0.76**			
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**			
Peak Flow (bopd)[f,g]	**6905**	**6905**	**6905**	**6905**	**6905**			

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**158.2**	**158.2**	**158.2**	**158.2**	**158.2**			
Working Flow (Mscfd)[h,i]	**66**	**66**	**66**	**66**	**66**			

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**			
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**	**21.25**	**21.25**			
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**	**3200**	**3200**			
Vapor Pressure (psia)[k]	**1**	**1**	**1**	**1**	**1**			
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**			
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**			
Peak Flow (bwpd)[f,g]	**11381**	**11381**	**11381**	**11381**	**11381**			

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**46**	**46**	**46**	**46**	**46**			
Working Flow (Mscfd)[l]	**64**	**64**	**64**	**64**	**64**			

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**500**	**500**
scfh vapor/tank[i]	**396**	**396**
Mscfd	**95**	**38**

Flow Rate Summary	**Flow Rate (scfh)**	
	SLR	**Noble**
Oil Tank Flash Rate	**32,949**	**32,949**
Oil Tank Working Rate	**13,681**	**13,647**
Water Tank Flash Rate	**9,485**	**9,484**
Water Tank Working Rate	**13,313**	**13,312**
Tank Breathing Rate	**5,547**	**3,566**
Total	**74,975**	**72,958**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SEYLER B10, B15 ECONODE T5N-R64W-S10 L01**

Consent Decree Tank System Number: **2363**

Audit Notes

Not able to clearly see all tanks and potential emission point on the IR Camera videos.

The signed eval pdf (SEYLER B10, B15 ECONODE T5N-R64W-S10 L01_SIGNED EVAL.pdf) shows ten (10) oil tanks total onsite. The field data sheet on pg 8 of the final packet pdf (SEYLER B10, B15 ECONODE T5N-R64W-S10 L01_FINAL PACKET.pdf) shows eleven (11) oil tanks being onsite. SLR used the tank confirguation stated in the walkdown and final evaluation.

Noble did not included breathing losses from non-producing bank. SLR calculation sheet includes breathing losses from all tanks.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SHARKEY T4N-R67W-S26 L01**

Consent Decree Tank System Number: **2314**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
SHARKEY T4N-R67W-S26 L01_FINAL PACKET	pdf	7/6/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
SHARKEY T4N-R67W-S26 L01_SIGNED EVAL	pdf	6/29/2015	Engineering Evaluation
SHARKEY T4N-R67W-S26 L01_FINAL PACKET	pdf	7/6/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_SHARKEY T4N-R67W-S26 L01	xlsm	9/22/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
SHARKEY T4N-R67W-S26 L01 WORK REQUEST	pdf	5/20/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
SHARKEY T4N-R67W-S26 L01 WALKDOWN	pdf	6/19/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
SHARKEY T4N-R67W-S26 L01 IR VERIFICATION	pdf	6/19/2015	IR Camera Verification Sheet
SHARKEY T4N-R67W-S26 L01_0280_NORMAL	mp4	6/19/2015	IR Camera Video
SHARKEY T4N-R67W-S26 L01_0281_DUMP	mp4	6/19/2015	IR Camera Video
SHARKEY T4N-R67W-S26 L01_0282_POST	mp4	6/19/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
SHARKEY T4N-R67W-S26 L01_SIGNED EVAL	pdf	6/29/2015	Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SHARKEY T4N-R67W-S26 L01**

Consent Decree Tank System Number: **2314**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**1**
Oil Tank Capacity (bbl):	**315**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**4**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**COMM 200 48"**			
Man. Capacity (MSCFD)	**157**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,283**	**4,283**	**0%**
Calculated Burner Capacity (scfh)	**5,170**	**6,542**	
Headspace Surge Capacity (scfh)	**347**	**347**	
Total VCS Capacity (scfh)	**5,517**	**6,889**	
VCS Capacity minus PPIVF (scfh)	**1,234**	**2,605**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	3/24/2016 & 11/16/2016 & 4/26/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	3/28/2016 &12/7/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SHARKEY T4N-R67W-S26 L01**

Consent Decree Tank System Number: **2314**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**315**	**0**
scfh vapor/tank[i]	**250**	**0**
Mscfd	**6**	**0**

Flow Rate Summary	**Flow Rate (scfh)**	
	SLR	**Noble**
Oil Tank Flash Rate	**3,720**	**3,720**
Oil Tank Working Rate	**314**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**250**	**250**
Total	**4,283**	**4,283**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SHARKEY T4N-R67W-S26 L01**

Consent Decree Tank System Number: **2314**

Audit Notes

-Aerial photos in final packet show two large tanks and one smaller tank. All other documentation, including IR video, shows 1, 315 bbl oil tank and 1, 100 bbl water tank.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SHELTON T4N-R65W-S25 L01**

Consent Decree Tank System Number: **661**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
PLUSS SHELTON T4N-R65W-S25 L02_FINAL PACKET	pdf	7/28/2015	Facility Final Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
SHELTON PLUSS T4N-R65W-S25 L01_SIGNED EVAL	pdf	5/28/2015	Signed Engineering Evaluation
STEM Engineering Evaluation_PLUSS SHELTON T4N-R65W-S25 L02_Banked Update	xlsm	5/27/2015	STEM Engineering Evaluation Worksheet
STEM Engineering Evaluation_rev1_PLUSS SHELTON T4N-R65W-S25 L02	xlsm	9/22/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
PLUSS SHELTON T4N-R65W-S25 L02 WORK REQUEST	xlsx	4/1/2015	Facility Work Request
RE Noble SHELTON T4N-R65W-S25 L01 Consent Decree Tank System 661	msg	7/28/2016	Email from Noble Regarding Tank Banking and Valve Trims

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
SHELTON T4N-R65W-S25 L01 WALKDWON	pdf	5/6/2015	Facility Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
SHELTON T4N-R65W-S25 L01_2363_normal	mp4	5/12/2015	IR Camera Inspection Video During Normal Operations
SHELTON T4N-R65W-S25 L01_2364_dump	mp4	5/12/2015	IR Camera Inspection Video During Dump Event
SHELTON T4N-R65W-S25 L01_2365_post	mp4	5/12/2015	IR Camera Inspection Video Post Dump Event
SHELTON T4N-R65W-S25 L01 IR VERIFICATION	pdf	5/12/2015	IR Inspection Field Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
SHELTON PLUSS T4N-R65W-S25 L01_SIGNED EVAL	pdf	5/28/2015	Signed Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SHELTON T4N-R65W-S25 L01**

Consent Decree Tank System Number: **661**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**6**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**4**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**4"**
# VOC Lines to KO:	**2**
# VOC Lines to Burner:	**2**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**	**400**				
Dump Valve Size & Trim Size (in)	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**				

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1/4"**	**2" & 1/4"**	**2" & 1/4"**	**2" & 1/4"**	**2" & 1/4"**

VRT Installed? ☑ Yes ☐ No Truck Loadout Vapor Collection Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**	**Cimarron 48 HV**	
Man. Capacity (MSCFD)	**109.272**	**109.272**	**109.272**	

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**35,872**	**41,415**	**15%**
Calculated Burner Capacity (scfh)	**9,334**	**13,659**	
Headspace Surge Capacity (scfh)	**34,269**	**34,269**	
Total VCS Capacity (scfh)	**43,603**	**47,928**	
VCS Capacity minus PPIVF (scfh)	**7,731**	**6,513**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	7/29/2016 & 11/16/2016 & 5/1/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	8/2/2016 & 12/7/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SHELTON T4N-R65W-S25 L01**

Consent Decree Tank System Number: **661**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9
Z1	**-1.02**	**-1.02**	**-1.02**	**-1.02**	**-1.02**				
Z2	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**				
Z3	**0.98**	**0.98**	**0.98**	**0.98**	**0.98**				
Z	**-0.90**	**-0.90**	**-0.90**	**-0.90**	**-0.90**				
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**	**22.9**	**22.9**	**22.9**				

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9
Valve Press Recovery Factor	**0.78**	**0.78**	**0.78**	**0.78**	**0.78**				
Valve Coefficent (gpm/psi) (	**7.20**	**7.20**	**7.20**	**7.20**	**7.20**				
Critical Pressure (psia)[b]	**833**	**833**	**833**	**833**	**833**				
Vapor Pressure (psia)[c]	**407**	**407**	**407**	**407**	**407**				
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**	**0.76**	**0.76**	**0.76**				
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**				
Peak Flow (bopd)[f,g]	**2370**	**2370**	**2370**	**2370**	**2370**				

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9
Flash Flow (Mscfd)	**54.3**	**54.3**	**54.3**	**54.3**	**54.3**				
Working Flow (Mscfd)[h,i]	**23**	**23**	**23**	**23**	**23**				

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9
Valve Press Recovery Factor	**0.77**	**0.77**	**0.77**	**0.77**	**0.55**	**0.55**	**0.55**	**0.55**	**0.55**
Valve Coefficent (gpm/psi) (	**21.25**	**21.25**	**21.25**	**21.25**	**2.96**	**2.96**	**2.96**	**2.96**	**2.96**
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**
Vapor Pressure (psia)[k]	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Peak Flow (bwpd)[f,g]	**11381**	**11381**	**11381**	**11381**	**1132**	**1132**	**1132**	**1132**	**1132**

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9
Flash Flow (Mscfd)	**46**	**46**	**46**	**46**	**5**	**5**	**5**	**5**	**5**
Working Flow (Mscfd)[l]	**64**	**64**	**64**	**64**	**6**	**6**	**6**	**6**	**6**

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**34**	**23**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**11,309**	**11,309**
Oil Tank Working Rate	**4,696**	**4,684**
Water Tank Flash Rate	**8,531**	**7,776**
Water Tank Working Rate	**11,975**	**10,915**
Tank Breathing Rate	**2,377**	**1,189**
Truck Vent Capture Rate	**2,527**	**0**
Total	**41,415**	**35,872**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SHELTON T4N-R65W-S25 L01**

Consent Decree Tank System Number: **661**

Audit Notes

-Visible VOC emissions seen around the 0:34 mark in the video file "SHELTON T4N-R65W-S25 L01_2365_post.mp4".

-The walkdown pdf "SHELTON T4N-R65W-S25 L01 WALKDWON.pdf" is not signed or dated. Final walkdown states that "Trims not updated" indicating the valve trim changes requested on the work request were not completed. Bill Obermann of Noble sent an email to SLR on 7/28/2016 confirming dump valve trim sizes were 1/2" on LP oil and 1/4" on HP water dumps.

-Bill Obermann of Noble sent an email to SLR on 7/28/2016 stating "On most locations, the majority of the water is dumped from the HP separator – with the LP separator only dumping a small, residual amount of carryover" Noble did not include water dumps from both the high pressure and low pressure separators onsite in their engineering evaluation. All of the dumps were included in SLR's evaluation.

-The signed eval pdf "SHELTON PLUSS T4N-R65W-S25 L01_SIGNED EVAL.pdf" uses an unbanked configuration of six (6) oil tanks and four (4) water tanks onsite. The walkdown pdf "SHELTON T4N-R65W-S25 L01 WALKDOWN.pdf" indicates a banked configuration with a bank of two (2) oil tanks and two (2) water tanks, and a bank of three (3) oil tanks and two (2) water tanks. Infomation on the tank configuration was requested from Noble. Bill Obermann of Noble sent a email to SLR on 7/28/2016 confirming there are six (6) oil tanks and four (4) water tanks onsite and that the tanks are currently banked. Noble used a banked configuration with a bank of 3 oil and 2 water tanks in their revised engineering analysis. Noble did not account for breating losses from the non-producing bank. SLR used the headspace surge capacity from 3 oil and 2 water tanks and breathing losses from all 6 oil and 4 water tanks.

-Bill Obermann of Noble sent a email to SLR on 7/28/2016 stating that "...they [the tanks] were banked...no later than October 2015 as part of the CD's Appendix C "Installation of Tank Truck Loadout Control Systems (Vapor Balance)" Environmental Mitigation Project. " Noble did not include truck loading vapors in the calculation of PPIVFR. As a conservative approach SLR included truck vent capture line flow rate based on the information provided by Noble on 4/20/2017.

-This facility has the uncontrolled actual VOC emissions greater than 50 tpy. Therefore an IR inspection is required.

"VOC Design Tank Pressure" was originally 11 oz/in^2 in the original STEM Engineering Evaluation_PLUSS SHELTON T4N-R65W-S25 L02_Banked Update.xlsm and was changed to 14 oz/in^2 in the modified STEM Engineering Evaluation_rev1_PLUSS SHELTON T4N-R65W-S25 L02.xlsm file.

UPDATE: Noble revised its PPIVFR determinations to include TLO vapors. Noble completed Engineering Evaluations and submitted a revised COCR with its Semi-Annual Reports (5th) (July 28, 2017) and (6th) (January 29, 2018). Noble provided revised Engineering Evaluation to SLR on May 10, 2018.

UPDATE: Noble agrees that Engineering Evaluation was incorrect. Updated Engineering Evaluation submitted with Noble's Semi-Annual Report (5th) (July 28, 2017).

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE DECHANT ST T3N-R65W-S36 L02**

Consent Decree Tank System Number: **423**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
SPIKE DECHANT ST T3N-R65W-S36 L02_FINAL PACKET	pdf	7/6/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
SPIKE DECHANT ST T3N-R65W-S36 L02_SIGNED EVAL	pdf	7/9/2015	Engineering Evaluation
SPIKE DECHANT ST T3N-R65W-S36 L02_FINAL PACKET	pdf	7/6/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_SPIKE DECHANT ST T3N-R65W-S36 L02	xlsm	9/22/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
SPIKE DECHANT ST T3N-R65W-S36 L02 WORK REQUEST	pdf	5/4/2015	Work Request
Noble 3rd Party Audi Wave 12 Update Info Request_20170117	pdf	1/17/2017	Information Request Response

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
SPIKE DECHANT ST T3N-R65W-S36 L02 WALKDOWN	pdf	6/4/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
SPIKE DECHANT ST T3N-R65W-S36 L02 IR VERIFICATION	pdf	6/4/2015	IR Camera Verification Sheet
SPIKE DECHANT ST T3N-R65W-S36 L02_0222_NORMAL	mp4	6/4/2015	IR Camera Video
SPIKE DECHANT ST T3N-R65W-S36 L02_0223_DUMP	mp4	6/4/2015	IR Camera Video
SPIKE DECHANT ST T3N-R65W-S36 L02_0224_POST	mp4	6/4/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
SPIKE DECHANT ST T3N-R65W-S36 L02_SIGNED EVAL	pdf	7/9/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE DECHANT ST T3N-R65W-S36 L02**

Consent Decree Tank System Number: **423**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**8**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**2**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**	**70**						
Dump Valve Size & Trim Size (in)	**1" & 1/2"**	**1" & 1/2"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	**Cimarron 48 HV**	
Man. Capacity (MSCFD)	**140**	**140**	**109.272**	

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**9,968**	**9,969**	**0%**
Calculated Burner Capacity (scfh)	**8,809**	**16,220**	
Headspace Surge Capacity (scfh)	**11,279**	**10,867**	
Total VCS Capacity (scfh)	**20,088**	**27,087**	
VCS Capacity minus PPIVF (scfh)	**10,120**	**17,117**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	3/24/2016 & 11/16/2016 & 2/1/2017 & 4/26/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	3/24/2016 & 12/7/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE DECHANT ST T3N-R65W-S36 L02**

Consent Decree Tank System Number: **423**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**	**0.77**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**0.89**	**0.89**						
Gas/Oil Ratio (scf/bbl)	**112.8**	**112.8**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**	**0.94**						
Valve Coefficent (gpm/psi) (C_v)	**5.72**	**5.72**						
Critical Pressure (psia)[b]	**539**	**539**						
Vapor Pressure (psia)[c]	**83**	**83**						
Critical pressure ratio (F_F) [d]	**0.85**	**0.85**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**792**	**792**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**	**89.3**						
Working Flow (Mscfd)[h,i]	**8**	**8**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**46**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**7,440**	**7,440**
Oil Tank Working Rate	**627**	**626**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**1,902**	**1,902**
Total	**9,969**	**9,968**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE DECHANT ST T3N-R65W-S36 L02**

Consent Decree Tank System Number: **423**

Audit Notes

-Oil Leg dump valve 1400 model. Valve is 1" w/ 1/2" trim. Data from valve spec sheet.

-Noble Model Input sheet states tank max fill of 68% (page 10 of final packet). Signed Evaluation states tank max fill of 90%. SLR used 90% for Tank Headspace Surge Rate calculations.

-Email from Mike Montoya to Jeff Kennedy indicates the LP Separators' PSHH is set to 70 psi instead of the 80 psi listed in the work order. The 70 psi was used in Noble'e Engineering Evaluation and SLR's verification of the head space surge capacity calculations.

"Production cycles per day" was originally 6.5 in the original SPIKE DECHANT ST T3N-R65W-S36 L02_FINAL PACKET.pdf Tank VOC Analysis and was changed to 12 in the modified STEM Engineering Evaluation_rev1_SPIKE DECHANT ST T3N-R65W-S36 L02.xlsm file. This increased the amount of Tank Headspace Surge Rate. Noble provided data showing the "Production cycles per day" is in fact 12.

VOC line size was originally 3" in the original SPIKE DECHANT ST T3N-R65W-S36 L02_FINAL PACKET.pdf Tank VOC Analysis and was partially changed to 4" in the modified STEM Engineering Evaluation_rev1_SPIKE DECHANT ST T3N-R65W-S36 L02.xlsm file. SLR used 3" pipe in their calculations. Due to this pipe size change, SLR cannot confirm the engineer design standard has been correctly applied.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE GUTTERSEN ST T3N-R64W-S16 L01**

Consent Decree Tank System Number: **527**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
SPIKE GUTTERSEN ST T3N-R64W-S16 L01_FINAL PACKET	pdf	No Date	Field Data Sheet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
SPIKE GUTTERSEN ST T3N-R64W-S16 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation
STEM Engineering Evaluation_Guttersen, Spike State D16	xlms	5/3/2016	Tank VOC Analysis
STEM Engineering Evaluation_rev1_SPIKE GUTTERSEN ST T3N-R64W-S16 L01	xlms	9/22/2016	Revised VOC Analysis
Evaluation_rev1_SPIKE GUTTERSEN ST T3N-R64W-S16 L01.xlsm	xlms	1/17/2017	Revised VOC Analysis 2

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
0131 - Guttersen Spike St Work Request	pdf	No Date	Work Request
SPIKE GUTTERSEN ST T3N-R64W-S16 L01 REWORK PACKET	pdf	9/22/2015	Rework Request
Noble 3rd Party Audi Wave 12 Update Info Request_20170117	pdf	1/17/2017	Information Request Response

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
SPIKE GUTTERSEN ST T3N-R64W-S16 L01 WALKDOWN	pdf	4/30/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
SPIKE GUTTERSEN ST T3N-R64W-S16 L01 IR VERIFICATION	pdf	5/11/2015	IR Camera Verification Sheet
SPIKE GUTTERSEN ST T3N-R64W-S16 L01_2319_normal	mp4	5/11/2015	IR Camera Video
SPIKE GUTTERSEN ST T3N-R64W-S16 L01_2321_dump	mp4	5/11/2015	IR Camera Video
SPIKE GUTTERSEN ST T3N-R64W-S16 L01_2322_post	mp4	5/11/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
SPIKE GUTTERSEN ST T3N-R64W-S16 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE GUTTERSEN ST T3N-R64W-S16 L01**

Consent Decree Tank System Number: **527**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**7**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**2**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**2**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**65**	**65**	**65**					
Dump Valve Size & Trim Size (in)	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**					

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**65**	**65**	**65**					
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**					

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**Cimarron 48 HV**		
Man. Capacity (MSCFD)	**140**	**109.272**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**19,341**	**19,345**	**0%**
Calculated Burner Capacity (scfh)	**6,673**	**10,386**	
Headspace Surge Capacity (scfh)	**19,835**	**19,835**	
Total VCS Capacity (scfh)	**26,508**	**30,221**	
VCS Capacity minus PPIVF (scfh)	**7,167**	**10,877**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	5/11/2016 & 11/16/2016 & 2/1/2017 & 5/1/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	5/20/2016 & 12/7/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE GUTTERSEN ST T3N-R64W-S16 L01**

Consent Decree Tank System Number: **527**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.69**	**0.69**	**0.69**					
Z2	**-0.86**	**-0.86**	**-0.86**					
Z3	**0.98**	**0.98**	**0.98**					
Z	**0.81**	**0.81**	**0.81**					
Gas/Oil Ratio (scf/bbl)	**104.5**	**104.5**	**104.5**					

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor	**0.78**	**0.78**	**0.78**					
Valve Coefficent (gpm/psi) (	**7.20**	**7.20**	**7.20**					
Critical Pressure (psia)[b]	**535**	**535**	**535**					
Vapor Pressure (psia)[c]	**78**	**78**	**78**					
Critical pressure ratio (F_F) [d]	**0.85**	**0.85**	**0.85**					
Choked Flow?[e]	**Yes**	**Yes**	**Yes**					
Peak Flow (bopd)[f,g]	**794**	**794**	**794**					

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**82.9**	**82.9**	**82.9**					
Working Flow (Mscfd)[h,i]	**8**	**8**	**8**					

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor	**0.77**	**0.77**	**0.77**					
Valve Coefficent (gpm/psi) (	**21.25**	**21.25**	**21.25**					
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**					
Vapor Pressure (psia)[k]	**1**	**1**	**1**					
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**					
Choked Flow?[e]	**Yes**	**Yes**	**Yes**					
Peak Flow (bwpd)[f,g]	**4910**	**4910**	**4910**					

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**20**	**20**	**20**					
Working Flow (Mscfd)[l]	**28**	**28**	**28**					

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**40**	**11**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**10,361**	**10,361**
Oil Tank Working Rate	**943**	**941**
Water Tank Flash Rate	**2,455**	**2,454**
Water Tank Working Rate	**3,446**	**3,445**
Tank Breathing Rate	**2,140**	**2,140**
Total	**19,345**	**19,341**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE GUTTERSEN ST T3N-R64W-S16 L01**

Consent Decree Tank System Number: **527**

Audit Notes

- The Work Request (FINAL PACKET p. 5) indicates that oil and water dump valves are to be changed to valves with 1/2" trim. The Final Walkdown (FINAL PACKET p. 3) indicates that the work request was incomplete; the LP water dumps and HP oil dumps were left with valves that have 1" trim. The follow up data request indicates the water dump valves remained with 1" trims. Noble confirmed the oil dump trim size to be 1/2" and the water dump trim size to be 1".

Facility has emissions greater than 50 tpy VOC, and as such a IR Camera Inspection is required.

"VOC Design Tank Pressure" was originally 11 oz/in^2 in the original STEM Engineering Evaluation_Guttersen, Spike State D16.xlsm and was changed to 12 oz/in^2 in the modified SPIKE GUTTERSEN ST T3N-R64W-S16 L01 - Tank System Audit Checklist Rev 1.xlsx file.

-The modified SPIKE GUTTERSEN ST T3N-R64W-S16 L01 - Tank System Audit Checklist Rev 1.xlsx file had water dump valves with 1/2" trims, despite followup information SPIKE GUTTERSEN ST T3N-R64W-S16 L01 2016 Audit Document Request.pdf (4/29/2016) which verified water dump valve trims remained at 1". Noble provided an updated revised engineering evaluation correct the water trim size to 1" on 1/17/2017.

UPDATE: Noble agrees that Engineering Evaluation was incorrect. An updated Engineering Evaluation was completed and a revised COCR submitted with Noble's Semi-Annual Report (5th) (July 28, 2017).

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE GUTTERSEN ST T3N-R64W-S16 L02**

Consent Decree Tank System Number: **528**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
SPIKE GUTTERSEN ST T3N-R64W-S16 L02_FINAL PACKET	pdf	7/6/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
SPIKE GUTTERSEN ST T3N-R64W-S16 L02_SIGNED EVAL	pdf	7/16/2015	Engineering Evaluation
SPIKE GUTTERSEN ST T3N-R64W-S16 L02_FINAL PACKET	pdf	7/6/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_SPIKE GUTTERSEN ST T3N-R64W-S16 L02	xlsm	9/22/2016	Revised Tank VOC Analysis
Attachment J - STEM Engineering Evaluation_rev1_SPIKE GUTTERSEN ST T3N-R64W-S16 L02.xlsm	xlsm	1/17/2017	Revised Tank VOC Analysis 2

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
SPIKE GUTTERSEN ST T3N-R64W-S16 L02 WORK REQUEST	pdf	5/28/2015	Work Request
Noble 3rd Party Audi Wave 12 Update Info Request_20170117	pdf	1/17/2017	Information Request Response

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
SPIKE GUTTERSEN ST T3N-R64W-S16 L02 WALKDOWN	pdf	6/18/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
SPIKE GUTTERSEN ST T3N-R64W-S16 L02 IR VERIFICATION	pdf	6/18/2015	IR Camera Verification Sheet
SPIKE GUTTERSEN ST T3N-R64W-S16 L02_0271_NORMAL	mp4	6/18/2015	IR Camera Video
SPIKE GUTTERSEN ST T3N-R64W-S16 L02_0272_DUMP	mp4	6/18/2015	IR Camera Video
SPIKE GUTTERSEN ST T3N-R64W-S16 L02_0273_POST	mp4	6/18/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
SPIKE GUTTERSEN ST T3N-R64W-S16 L02_SIGNED EVAL	pdf	7/16/2015	Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE GUTTERSEN ST T3N-R64W-S16 L02**

Consent Decree Tank System Number: **528**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**2" to 4"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**2" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**			
Man. Capacity (MSCFD)	**140**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,926**	**4,926**	**0%**
Calculated Burner Capacity (scfh	**2,647**	**5,833**	
Headspace Surge Capacity (scfh)	**4,510**	**4,510**	
Total VCS Capacity (scfh)	**7,157**	**10,343**	
VCS Capacity minus PPIVF (scfh)	**2,231**	**5,417**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	3/23/2016 & 11/16/2016 & 2/1/2017 & 4/26/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	3/28/2016 & 12/7/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE GUTTERSEN ST T3N-R64W-S16 L02**

Consent Decree Tank System Number: **528**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**							
Valve Coefficent (gpm/psi) (C_v)	**7.20**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**827**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**93.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**17**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**3,885**	**3,283**
Oil Tank Working Rate	**328**	**327**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**713**	**713**
Total	**4,926**	**4,323**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE GUTTERSEN ST T3N-R64W-S16 L02**

Consent Decree Tank System Number: **528**

Audit Notes

-"VOC Design Tank Pressure" was originally 11 oz/in^2 in the original SPIKE GUTTERSEN ST T3N-R64W-S16 L02_SIGNED EVAL.pdf and was changed to 13 oz/in^2 in the Attachment J - STEM Engineering Evaluation_rev1_SPIKE GUTTERSEN ST T3N-R64W-S16 L02.xlsm file.

-The VOC line size was 3" in the original SSPIKE GUTTERSEN ST T3N-R64W-S16 L02_SIGNED EVAL.pdf and was changed to a 2" from the tanks to the knockout and 4" from the knockout to the control device in the modified Attachment J - STEM Engineering Evaluation_rev1_SPIKE GUTTERSEN ST T3N-R64W-S16 L02.xlsmfile. SLR confirmed via field data, work requests and walkdown documents that the VOC line is 2" from the tanks to the knockout and 4" from the knockout to the control device.

-The dump valve size was 2" in the original SPIKE GUTTERSEN ST T3N-R64W-S16 L02_FINAL PACKET.pdf Tank VOC Analysis and was changed to a 1" in the modified Attachment J - STEM Engineering Evaluation_rev1_SPIKE GUTTERSEN ST T3N-R64W-S16 L02.xlsm file. Noble confirmed there is a 2" valve with 1/2" trim onsite.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE GUTTERSEN ST T3N-R64W-S28 L02**

Consent Decree Tank System Number: **550**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
SPIKE GUTTERSEN ST T3N-R64W-S28 L02_FINAL PACKET	pdf	6/30/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
SPIKE GUTTERSEN ST T3N-R64W-S28 L02_SIGNED EVAL	pdf	7/16/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_rev1_SPIKE GUTTERSEN ST T3N-R64W-S28 L02	xlsm	7/28/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
SPIKE GUTTERSEN ST T3N-R64W-S28 L02 WORK REQUEST	pdf	6/11/2015	Work Request
Noble 3rd Party Audi Wave 12 Update Info Request_20170117	pdf	1/17/2017	Information Request Response

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
SPIKE GUTTERSEN ST T3N-R64W-S28 L02 WALKDOWN	pdf	6/29/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
SPIKE GUTTERSEN ST T3N-R64W-S28 L02_0300_NORMAL	mp4	6/29/2015	IR Video of site during normal operation
SPIKE GUTTERSEN ST T3N-R64W-S28 L02_0301_DUMP	mp4	6/29/2015	IR Video of site during separator dump event
SPIKE GUTTERSEN ST T3N-R64W-S28 L02_0302_POST	mp4	6/29/2015	IR Video of site post dump event
SPIKE GUTTERSEN ST T3N-R64W-S28 L02 IR VERIFICATION	pdf	6/29/2015	IR Camera Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
SPIKE GUTTERSEN ST T3N-R64W-S28 L02_SIGNED EVAL	pdf	7/16/2015	Signed Engineering Design Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE GUTTERSEN ST T3N-R64W-S28 L02**

Consent Decree Tank System Number: **550**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**5**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**4" to 3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**65**	**65**						
Dump Valve Size & Trim Size (in)	**1" & 1/2"**	**2" & 1/2"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**TEC 4-CS (48" Tornado)**		
Man. Capacity (MSCFD)	**140**	**110.4**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**9,434**	**8,564**	**9%**
Calculated Burner Capacity (scfh	**6,011**	**10,433**	
Headspace Surge Capacity (scfh)	**6,865**	**6,786**	
Total VCS Capacity (scfh)	**12,876**	**17,219**	
VCS Capacity minus PPIVF (scfh)	**3,442**	**8,655**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	3/22/2016 & 11/16/2016 & 2/1/2017 & 4/26/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	5/11/2016 & 12/7/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE GUTTERSEN ST T3N-R64W-S28 L02**

Consent Decree Tank System Number: **550**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.69**	**0.69**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**0.81**	**0.81**						
Gas/Oil Ratio (scf/bbl)	**104.5**	**104.5**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**	**0.78**						
Valve Coefficent (gpm/psi) (C_v)	**5.72**	**7.20**						
Critical Pressure (psia)[b]	**535**	**535**						
Vapor Pressure (psia)[c]	**78**	**78**						
Critical pressure ratio (F_F) [d]	**0.85**	**0.85**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**760**	**794**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**79.4**	**82.9**						
Working Flow (Mscfd)[h,i]	**7**	**8**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**29**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**6,760**	**7,605**
Oil Tank Working Rate	**615**	**640**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**1,189**	**1,189**
Total	**8,564**	**9,434**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE GUTTERSEN ST T3N-R64W-S28 L02**

Consent Decree Tank System Number: **550**

Audit Notes

-Email correspondence in Final Packet states LP separator set to 65 psi instead of the 70 psi stated in the work order. 65 psi was used in SLR's calculations. SLR still considers the modeling guideline applied correctly because the pressure used by Noble results in higher PPIVFR than calculated using the actual pressure.

-The initial total oil production in the orginal Tank VOC Analysis on pg 16 of SPIKE GUTTERSEN ST T3N-R64W-S28 L02_FINAL PACKET.pdf was 22 bopd from a single separator. The modified Tank VOC Analysis in STEM Engineering Evaluation_rev1_SPIKE GUTTERSEN ST T3N-R64W-S28 L02.xlsm now shows 19 bopd from two separators, a LP and a HLP. Noble confirmed a production of 19 bopd from both separators.

-The modified STEM Engineering Evaluation_rev1_SPIKE GUTTERSEN ST T3N-R64W-S28 L02.xlsm workbook shows 3" VOC line sizes where the original SPIKE GUTTERSEN ST T3N-R64W-S28 L02 - STEM Engineering Evaluation Check.xlsm shows 4" VOC lines. SLR confimed via field data that the line is 4" from the tanks to the knockout and 3" from the knockout to the control device. SLR still considers the engineering design standard applied correctly because the 3" causes more back pressure resulting in less burner capacity than a 4" line.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE ST T4N-R63W-S30 L01**

Consent Decree Tank System Number: **1223**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
SPIKE ST T4N-R63W-S30 L01_FINAL PACKET	pdf	7/9/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
SPIKE ST T4N-R63W-S30 L01_SIGNED EVAL	pdf	7/16/2015	Engineering Evaluation
SPIKE ST T4N-R63W-S30 L01_FINAL PACKET	pdf	7/9/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_SPIKE ST T4N-R63W-S30 L01	xlsm	11/16/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
SPIKE ST T4N-R63W-S30 L01 WORK REQUEST	pdf	5/11/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
SPIKE ST T4N-R63W-S30 L01 WALKDOWN	pdf	7/2/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
SPIKE ST T4N-R63W-S30 L01 IR VERIFICATION	pdf	7/2/2015	IR Camera Verification Sheet
SPIKE ST T4N-R63W-S30 L01_0029_NORMAL	mp4	7/2/2015	IR Camera Video
SPIKE ST T4N-R63W-S30 L01_0030_DUMP	mp4	7/2/2015	IR Camera Video
SPIKE ST T4N-R63W-S30 L01_0031_POST	mp4	7/2/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
SPIKE ST T4N-R63W-S30 L01_SIGNED EVAL	pdf	7/16/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE ST T4N-R63W-S30 L01**

Consent Decree Tank System Number: **1223**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**1**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**TEC 4-CS (48" Tornado**			
Man. Capacity (MSCFD)	**110.4**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,508**	**4,271**	**5%**
Calculated Burner Capacity (scfh)	**4,089**	**4,600**	
Headspace Surge Capacity (scfh)	**2,230**	**503**	
Total VCS Capacity (scfh)	**6,319**	**5,103**	
VCS Capacity minus PPIVF (scfh)	**1,811**	**832**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	4/20/2016 & 11/16/2016 & 5/1/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	4/28/2016 & 12/7/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE ST T4N-R63W-S30 L01**

Consent Decree Tank System Number: **1223**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor	**0.94**							
Valve Coefficent (gpm/psi) (	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor								
Valve Coefficent (gpm/psi) (								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**6**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**3,720**	**3,143**
Oil Tank Working Rate	**314**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**238**	**475**
Total	**4,271**	**3,931**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE ST T4N-R63W-S30 L01**

Consent Decree Tank System Number: **1223**

Audit Notes

Work request file provided for this site is for a different well location (Spike State CC 30 - 11J1213142021). Utilized the work request in SPIKE ST T4N-R63W-S30 L01_FINAL PACKET.pdf to complete the audit.

SPIKE ST T4N-R63W-S30 L01_SIGNED EVAL.pdf indicates there are 2-300 bbl storage tanks included in the engineering evaluations. The field notes, job sheet and walkdown in SPIKE ST T4N-R63W-S30 L01_FINAL PACKET.pdf (pgs. 5, 14, 19) indicate only one tank in service. A single tank was used in the engineering evaluation audit.

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original SPIKE ST T4N-R63W-S30 L01_SIGNED EVAL.pdf and was changed to 12 oz/in^2 in the modified STEM Engineering Evaluation_rev1_SPIKE ST T4N-R63W-S30 L01.xlsm file.

UPDATE: Noble agrees that the Engineering Evaluation was incorrect and the site did not meet the Performance Standards. A PCCM was completed on July 26, 2017. Updated Engineering Evaluation was submitted with Noble's Semi-Annual Report (5th) (July 28, 2017).

UPDATE: After reviewing SLR's Draft Report, Noble contacted Tornado to confirm that its burners can handle capacities beyond the published specification or 10 oz/in2. Tornado confirmed that the published burner curve can be hydraulically extrapolated beyond 10 oz/in2. Moreover, Tornado noted the stated capacity is based on heat release (86.4 MSCFD at 2,300 BTU/scf). Noble's typical flash gas is lighter in composition (1,800 BTU/scf) such that the Tornado burner would be capable of handling up to 110.4 MSCFD at the published heat release limit. The Tornado specification sheet notes the maximum flow is dependent on heating value of the gas, consistent with Noble's conversation.

UPDATE: Noble agrees that the Engineering Evaluation was incorrect and the site did not meet the Performance Standards. A PCCM was completed on July 26, 2017. Updated Engineering Evaluation was completed and a revised COCR submitted with Noble's Semi-Annual Report (5th) (July 28, 2017).

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE ST T4N-R63W-S30 L02**

Consent Decree Tank System Number: **1481**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
SPIKE ST T4N-R63W-S30 L02_FINAL PACKET	pdf	7/9/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
SPIKE ST T4N-R63W-S30 L02_SIGNED EVAL	pdf	7/22/2015	Engineering Evaluation
SPIKE ST T4N-R63W-S30 L02_FINAL PACKET	pdf	7/9/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_SPIKE ST T4N-R63W-S30 L02	xlsm	9/23/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
SPIKE ST T4N-R63W-S30 L02 WORK REQUEST	pdf	10/20/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
SPIKE ST T4N-R63W-S30 L02 WALKDOWN	pdf	7/6/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
SPIKE ST T4N-R63W-S30 L02 IR VERIFICATION	pdf	7/6/2015	IR Camera Verification Sheet
SPIKE ST T4N-R63W-S30 L02_0032_NORMAL	mp4	7/6/2015	IR Camera Video
SPIKE ST T4N-R63W-S30 L02_0033_DUMP	mp4	7/6/2015	IR Camera Video
SPIKE ST T4N-R63W-S30 L02_0034_POST	mp4	7/6/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
SPIKE ST T4N-R63W-S30 L02_SIGNED EVAL	pdf	7/22/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE ST T4N-R63W-S30 L02**

Consent Decree Tank System Number: **1481**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**2**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**4**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**TEC 4-CS (48" Tornado)**			
Man. Capacity (MSCFD)	**110.4**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,508**	**4,509**	**0%**
Calculated Burner Capacity (scfh)	**4,181**	**4,600**	
Headspace Surge Capacity (scfh)	**2,407**	**2,407**	
Total VCS Capacity (scfh)	**6,588**	**7,007**	
VCS Capacity minus PPIVF (scfh)	**2,080**	**2,498**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	3/22/2016 & 11/16/2016 & 5/1/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	3/29/2016 & 12/7/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE ST T4N-R63W-S30 L02**

Consent Decree Tank System Number: **1481**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**11**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**3,720**	**3,720**
Oil Tank Working Rate	**314**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**475**	**475**
Total	**4,509**	**4,508**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE ST T4N-R63W-S30 L02**

Consent Decree Tank System Number: **1481**

Audit Notes

-3-300 bbl oil tanks used in Noble calculation input sheet found in "Final Packet". All other documentation states 2-300 bbl tanks. Used 2-300 bbl tanks for audit. Noble corrected this error and used 2 tanks in their revised engineering evaluation.

The Tank VOC Analysis provided in the SPIKE ST T4N-R63W-S30 L02_FINAL PACKET.pdf is for a different site. Could not confirm production information for Spike St T4N-R63W-S30 L02.

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original SSPIKE ST T4N-R63W-S30 L02_SIGNED EVAL.pdf and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1_SPIKE ST T4N-R63W-S30 L02.xlsm file.

UPDATE: After reviewing SLR's Draft Report, Noble contacted Tornado to confirm that its burners can handle capacities beyond the published specification or 10 oz/in2. Tornado confirmed that the published burner curve can be hydraulically extrapolated beyond 10 oz/in2. Moreover, Tornado noted the stated capacity is based on heat release (86.4 MSCFD at 2,300 BTU/scf). Noble's typical flash gas is lighter in composition (1,800 BTU/scf) such that the Tornado burner would be capable of handling up to 110.4 MSCFD at the published heat release limit. The Tornado specification sheet notes the maximum flow is dependent on heating value of the gas, consistent with Noble's conversation.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE ST T4N-R63W-S30 L03**

Consent Decree Tank System Number: **1217**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
SPIKE ST T4N-R63W-S30 L03_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
SPIKE ST T4N-R63W-S30 L03_SIGNED EVAL	pdf	5/26/2015	Engineering Evaluation
STEM Engineering Evaluation_Spike State	xlsm	4/29/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_SPIKE ST T4N-R63W-S30 L03	xlsm	9/22/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
SPIKE ST T4N-R63W-S30 L03_FINAL PACKET	pdf	No Date	Work Request
Noble 3rd Party Audi Wave 12 Update Info Request_20170117	pdf	1/17/2017	Information Request Response

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
SPIKE ST T4N-R63W-S30 L03 WALKDOWN	pdf	4/30/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
SPIKE ST T4N-R63W-S30 L03 IR VERIFICATION	pdf	5/8/2015	IR Camera Verification Sheet
SPIKE ST T4N-R63W-S30 L03_2330_normal	mp4	5/8/2015	IR Camera Video
SPIKE ST T4N-R63W-S30 L03_2331_dump	mp4	5/8/2015	IR Camera Video
SPIKE ST T4N-R63W-S30 L03_2333_post	mp4	5/8/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
SPIKE ST T4N-R63W-S30 L03_SIGNED EVAL	pdf	5/26/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE ST T4N-R63W-S30 L03**

Consent Decree Tank System Number: **1217**

☑ Yes ☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes ☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**2**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**60**							
Dump Valve Size & Trim Size (in)	**2" & 3/4"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**TEC 4-CS (48" Tornado)**			
Man. Capacity (MSCFD)	**110.4**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**6,296**	**6,297**	**0%**
Calculated Burner Capacity (scfh)	**4,149**	**4,600**	
Headspace Surge Capacity (scfh)	**4,976**	**4,976**	
Total VCS Capacity (scfh)	**9,125**	**9,576**	
VCS Capacity minus PPIVF (scfh)	**2,829**	**3,279**	

☑ Yes ☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes ☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes ☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes ☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	5/11/2016 & 11/16/2016 &2/1/2017 & 5/1/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	5/19/2016 & 12/7/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE ST T4N-R63W-S30 L03**

Consent Decree Tank System Number: **1217**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.61**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.72**							
Gas/Oil Ratio (scf/bbl)	**96.4**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.80**							
Valve Coefficent (gpm/psi) (C_v)	**12.20**							
Critical Pressure (psia)[b]	**530**							
Vapor Pressure (psia)[c]	**73**							
Critical pressure ratio (F_F) [d]	**0.86**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**1320**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**127.2**							
Working Flow (Mscfd)[h,i]	**13**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**11**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**5,299**	**5,299**
Oil Tank Working Rate	**523**	**522**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**475**	**475**
Total	**6,297**	**6,296**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **SPIKE ST T4N-R63W-S30 L03**

Consent Decree Tank System Number: **1217**

Audit Notes

- A hand written note on the work request (FINAL PACKET p. 17) indicates that the separator still needs the oil dump valve replacement. Facility walkdown checklist (FINAL PACKET p. 3) indicates that all work in the work request was completed.

-Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

-"VOC Design Tank Pressure" was originally 11 oz/in^2 in the original SPIKE ST T4N-R63W-S30 L03_SIGNED EVAL.pdf and was changed to 12 oz/in^2 in the modified STEM Engineering Evaluation_rev1_SPIKE ST T4N-R63W-S30 L03.xlsm file.

-The combustor in the original SPIKE ST T4N-R63W-S30 L03_SIGNED EVAL.pdf is a TEC 4-CS (48" Tornado) and was changed to a Cimmaron 48HV in the modified STEM Engineering Evaluation_rev1_SPIKE ST T4N-R63W-S30 L03.xlsm file. Noble confirmed that the combustor onsite is a TEC 4-CS (48" Tornado). SLR considers the engineering guideline applied correctly because the the cimarron 48HV and TEC 4-CS have similar capacities.

UPDATE: Noble confirmed accuracy of existing Engineering Evaluation. Evaluation specifies a maximum allowable oil dump trim of ¾". Initial work request (Attachment S) specified a combination of ½" and ¾" valve trims, which do not exceed the maximum specification. This Tank System was recently modified (Attachment T), so that all oil dumps are ¾" for operational reasons. Since the existing Engineering Evaluation already considered all oil dump trims to a maximum of ¾", the field change does not impact the Engineering Evaluation.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ST BOOTH T4N-R64W-S36 L01**

Consent Decree Tank System Number: **503**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
ST BOOTH T4N-R64W-S36 L01_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
ST BOOTH T4N-R64W-S36 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation
STEM Engineering Evaluation_Booth State	xlsm	4/28/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_ST BOOTH T4N-R64W-S36 L01	xlsm	2/24/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
ST BOOTH T4N-R64W-S36 L01 WORK REQUEST	xlsx	4/14/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
ST BOOTH T4N-R64W-S36 L01 WALKDOWN	pdf	4/30/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
ST BOOTH T4N-R64W-S36 L01 IR VERIFICATION	pdf	5/8/2015	IR Camera Verification Sheet
ST BOOTH T4N-R64W-S36 L01_2327_normal	mp4	5/8/2015	IR Camera Video
ST BOOTH T4N-R64W-S36 L01_2328_dump	mp4	5/8/2015	IR Camera Video
ST BOOTH T4N-R64W-S36 L01_2329_post	mp4	5/8/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
ST BOOTH T4N-R64W-S36 L01_SIGNED EVAL	pdf	5/22/2015	Signed Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ST BOOTH T4N-R64W-S36 L01**

Consent Decree Tank System Number: **503**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**13**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**4**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**	**400**			
Dump Valve Size & Trim Size (in)								

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**	**400**			
Dump Valve Size & Trim Size (in)								

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**	**Cimarron 48 HV**	
Man. Capacity (MSCFD)	**109.272**	**109.272**	**109.272**	

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**31,964**	**Unknown**	**Unknown**
Calculated Burner Capacity (scfh	**7,799**	**13,659**	
Headspace Surge Capacity (scfh)	**60,910**		
Total VCS Capacity (scfh)	**68,709**	**13,659**	
VCS Capacity minus PPIVF (scfh)	**36,745**	**Unknown**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Justin Frahm/Tom Kussard
Audit Document Review Date:	6/26/2016 & 11/17/2016
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	8/5/2016 & 12/7/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ST BOOTH T4N-R64W-S36 L01**

Consent Decree Tank System Number: **503**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	-1.02	-1.02	-1.02	-1.02	-1.02			
Z2	-0.86	-0.86	-0.86	-0.86	-0.86			
Z3	0.98	0.98	0.98	0.98	0.98			
Z	-0.90	-0.90	-0.90	-0.90	-0.90			
Gas/Oil Ratio (scf/bbl)	22.9	22.9	22.9	22.9	22.9			

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	#N/A	#N/A	#N/A	#N/A	#N/A			
Valve Coefficent (gpm/psi) (C_v)	#N/A	#N/A	#N/A	#N/A	#N/A			
Critical Pressure (psia)[b]	833	833	833	833	833			
Vapor Pressure (psia)[c]	407	407	407	407	407			
Critical pressure ratio (F_F) [d]	0.76	0.76	0.76	0.76	0.76			
Choked Flow?[e]	#N/A	#N/A	#N/A	#N/A	#N/A			
Peak Flow (bopd)[f,g]	#N/A	#N/A	#N/A	#N/A	#N/A			

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	#N/A	#N/A	#N/A	#N/A	#N/A			
Working Flow (Mscfd)[h,i]	#N/A	#N/A	#N/A	#N/A	#N/A			

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	#N/A	#N/A	#N/A	#N/A	#N/A			
Valve Coefficent (gpm/psi) (C_v)	#N/A	#N/A	#N/A	#N/A	#N/A			
Critical Pressure (psia)[j]	3200	3200	3200	3200	3200			
Vapor Pressure (psia)[k]	1	1	1	1	1			
Critical pressure ratio (F_F)[d]	0.96	0.96	0.96	0.96	0.96			
Choked Flow?[e]	#N/A	#N/A	#N/A	#N/A	#N/A			
Peak Flow (bwpd)[f,g]	#N/A	#N/A	#N/A	#N/A	#N/A			

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	#N/A	#N/A	#N/A	#N/A	#N/A			
Working Flow (Mscfd)[l]	#N/A	#N/A	#N/A	#N/A	#N/A			

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	300	300
scfh vapor/tank[i]	238	238
Mscfd	74	23

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	#N/A	19,653
Oil Tank Working Rate	#N/A	8,140
Water Tank Flash Rate	#N/A	944
Water Tank Working Rate	#N/A	1,325
Tank Breathing Rate	4,042	1,902
Total	#N/A	31,964

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ST BOOTH T4N-R64W-S36 L01**

Consent Decree Tank System Number: **503**

Audit Notes

-Facility walkdown checklist (ST BOOTH T4N-R64W-S36 L01 WALKDOWN.pdf) has no indication that requested work (ST BOOTH T4N-R64W-S36 L01 WORK REQUEST.pdf) was completed. SLR cannot confirm that valve trims were changed as request. SLR cannot confirm the valve size or trim size and cannot as a result determine the PPIVFR and if the facility is designed and sized to handle the PPIVFR.

-Work request (ST BOOTH T4N-R64W-S36 L01 WORK REQUEST.pdf) indicates that the STATE separator oil dump valve should be changed out to a 1/2" trim. The STEM calculations use a 3/4" trim.

-The engineering evaluation (ST BOOTH T4N-R64W-S36 L01_SIGNED EVAL) was completed with a bank configuration with each bank containing 6 oil production tanks and 2 water tanks. Based on the final walkdown checklist (ST BOOTH T4N-R64W-S36 L01 WALKDOWN.pdf), one of the banks is configured with 6 oil production tanks and 2 water tanks and the other with 7 oil and 2 water tanks.

-Noble did not account for breathing losses from the non-producing tank bank.

-Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

-"VOC Design Tank Pressure" was originally 11 oz/in^2 in the originalST BOOTH T4N-R64W-S36 L01_SIGNED EVAL.pdf and was changed to 12 oz/in^2 in the modified STEM Engineering Evaluation_rev1_ST BOOTH T4N-R64W-S36 L01.xlsm file.

UPDATE: Noble confirmed accuracy of existing Engineering Evaluation. Evaluation specifies a maximum allowable oil dump trim of ¾". Initial work request (Attachment S) specified a combination of ½" and ¾" valve trims, which do not exceed the maximum specification. This Tank System was recently modified (Attachment T), so that all oil dumps are ¾" for operational reasons. Since the existing Engineering Evaluation already considered all oil dump trims to a maximum of ¾", the field change does not impact the Engineering Evaluation.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ST T8N-R60W-S16 L01**

Consent Decree Tank System Number: **2034**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
ST T8N-R60W-S16 L01 _SIGNED EVAL	pdf	5/26/2015	Signed Engineering Design Evaluation
ST T8N-R60W-S16 L01 _FINAL PACKET	pdf	2/5/2016	Pre Evaluation Documents / Field Datasheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
ST T8N-R60W-S16 L01 WORK REQUEST	xlsx	5/11/2015	Work Request
STEM Engineering Evaluation_rev1_ST T8N-R60W-S16 L01	xlsm	9/28/2016	Revised Engineering Evaluation
STEM Engineering Evaluation_State 8-60 16-1H	xlsm	5/22/2015	Engineering Evaluation
Attachment L - STEM Engineering Evaluation_rev1_ST T8N-R60W-S16 L01.xlsm	xlsm	5/23/2015	Revised Engineering Evaluation 2

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
ST T8N-R60W-S16 L01 WALKDOWN	pdf	5/6/2015	Facility Walkdown
Noble 3rd Party Audi Wave 12 Update Info Request_20170117	pdf	1/17/2017	Information Request Response

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
ST T8N-R60W-S16 L01 WALKDOWN	pdf	5/6/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
ST T8N-R60W-S16 L01 _0743_normal	mp4	5/20/2015	IR Inspection Video
ST T8N-R60W-S16 L01 _0744_dump	mp4	5/20/2015	IR Inspection Video
ST T8N-R60W-S16 L01 _0745_post	mp4	5/20/2015	IR Inspection Video
ST T8N-R60W-S16 L01 IR VERIFICATION	pdf	5/22/2015	IR Camera Verification Documentation and Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
ST T8N-R60W-S16 L01 _SIGNED EVAL	pdf	5/26/2015	Signed Engineering Design Evaluation
ST T8N-R60W-S16 L01 2016 Audit Document Request	pdf	4/29/2016	Additional Information Provided

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ST T8N-R60W-S16 L01**

Consent Decree Tank System Number: **2034**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**4**
Oil Tank Capacity (bbl):	**400**
# of Water Tanks:	**1**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**50**							
Dump Valve Size & Trim Size (in)	**2" & 2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**50**							
Dump Valve Size & Trim Size (in)	**2" & 2"**							

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**			
Man. Capacity (MSCFD)	**109.272**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**26,220**	**26,147**	**0%**
Calculated Burner Capacity (scfh	**3,740**	**4,553**	
Headspace Surge Capacity (scfh)	**81,747**	**60,900**	
Total VCS Capacity (scfh)	**85,487**	**65,453**	
VCS Capacity minus PPIVF (scfh)	**59,267**	**39,306**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Angela M. Oberlander/Tom Kussard
Audit Document Review Date:	5/17/2016 & 11/18/2016 & 2/1/2017 & 5/1/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	5/24/2016 & 12/7/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ST T8N-R60W-S16 L01**

Consent Decree Tank System Number: **2034**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.41**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.52**							
Gas/Oil Ratio (scf/bbl)	**80.7**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.76**							
Valve Coefficent (gpm/psi) (C_v)	**57.00**							
Critical Pressure (psia)[b]	**521**							
Vapor Pressure (psia)[c]	**63**							
Critical pressure ratio (F_F) [d]	**0.86**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**5313**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**428.8**							
Working Flow (Mscfd)[h,i]	**51**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.76**							
Valve Coefficent (gpm/psi) (C_v)	**57.00**							
Critical Pressure (psia)[j]	**3200**							
Vapor Pressure (psia)[k]	**1**							
Critical pressure ratio (F_F)[d]	**0.96**							
Choked Flow?[e]	**Yes**							
Peak Flow (bwpd)[f,g]	**11657**							

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**47**							
Working Flow (Mscfd)[l]	**65**							

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**400**	**300**
scfh vapor/tank[i]	**317**	**238**
Mscfd	**30**	**6**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**17,867**	**17,867**
Oil Tank Working Rate	**2,105**	**2,100**
Water Tank Flash Rate	**1,943**	**1,942**
Water Tank Working Rate	**2,727**	**2,726**
Tank Breathing Rate	**1,506**	**1,506**
Total	**26,147**	**26,141**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ST T8N-R60W-S16 L01**

Consent Decree Tank System Number: **2034**

Audit Notes

The field datasheet on ST T8N-R60W-S16 L01_FINAL PACKET.pdf(pg 8) only indicates a 2" valve with a 1" trim. Information request regarding the water dump valve indicated the valve was a model with a mechanical actuator. The valve coefficient was revised to the Noble provided 36.5 in the flow calculations. The water and oil "Dump Valve Trim" was changed in the modified STEM Engineering Evaluation_rev1_ST T8N-R60W-S16 L01.xlsm file to the correct valve based on the valve coefficient provided by Noble.

Work Request document, ST T8N-R60W-S16 L01_WORK REQUEST.pdf, indicates that separator shut in pressure to be set to 50 psig while engineering evaluation, ST T8N-R60W-S16 L01_SIGNED EVAL.pdf, was completed at 75 psig. The water and oil "Max Operating Pressure" was changed to 50 psi in the modified STEM Engineering in revised engineering evaluation Evaluation_rev1_ST T8N-R60W-S16 L01.xlsm file. The confirmed 50 psig shut in pressure was used in the verification audit.

IR Camera inspection video, ST T8N-R60W-S16 L01_0743_normal.mp4, shows five tanks, 4 tanks are the same size and 1 tank is smaller. All tanks in the engineering evaluation are stated to be 400 bbl tanks. The field data sheet, ST T8N-R60W-S16 L01_FINAL PACKET.pdf(pg 11), indicates the water tank on site is a 300 bbl tank.

IR Camera inspection video, ST T8N-R60W-S16 L01_0743_dump.mp4, captures a potential leak from a thief hatch on one of the tanks. The video does not pan to any other tank views. The camera inspection document, ST T8N-R60W-S16 L01 IR VERIFICATION.pdf, made note of a leak on a 400 bbl, crude tank, ID 10335507905 and stated that "Noble personnel cleand and resealed gasket, emissions no longer detectable."

STEM Engineering Evalatuion_State 8-60-16-1H.xlsm was not solved as provided.

Facility has over 50 tpy VOC, and as such, will have an IR Camera inspection.

"Tank PRV Set Pressure" was originally 14 oz/in^2 in the original STEM Engineering Evaluation_State 8-60 16-1H.xlsm and was changed to 16 oz/in^2 in the STEM Engineering Evaluation_rev1_ST T8N-R60W-S16 L01.xlsm file. Confirmed PRV setpoint in walkdown is 14 oz/in^2.

UPDATE: Noble agrees that Engineering Evaluation was incorrect. An updated Engineering Evaluation was completed and a revised COCR submitted with Noble's Semi-Annual Report (5th) (July 28, 2017).

UPDATE: Noble agrees that Engineering Evaluation was incorrect. Updated Engineering Evaluation was generated and submitted with Noble's Semi-Annual Report (6th) (January 29, 2018).

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ST T8N-R60W-S16 L02**

Consent Decree Tank System Number: **2035**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
ST T8N-R60W-S16 L02 _FINAL PACKET	pdf	2/5/2016	Pre-Evaluation Documents / Field Datasheet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
ST T8N-R60W-S16 L02 _SIGNED EVAL	pdf	5/26/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_State 8-60, 16-2H	xlsm	4/28/2015	STEM Engineering Evaluation Spreadsheet
STEM Engineering Evaluation_rev1_ST T8N-R60W-S16 L02	xlsm	9/28/2016	Revised Tank VOC Analysis
Attachment M - STEM Engineering Evaluation_rev1_ST T8N-R60W-S16 L02.xlsm	xlsm	1/17/2017	Revised Tank VOC Analysis 2

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
ST T8N-R60W-S16 L02 WORK REQUEST	xlsx	5/11/2015	Work Request
Noble 3rd Party Audit Wave 12 Update Info Request_20170117	pdf	1/17/2017	Information Request Response

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
ST T8N-R60W-S16 L02 WALKDOWN	pdf	5/6/2015	Facility Walkdown
ST T8N-R60W-S16 L02 2016 Audit Document Request	pdf	5/3/2016	Confirmation of valve and shut-in pressure
St 2h	msg	5/3/2016	Confirmation of shut-in pressure

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
ST T8N-R60W-S16 L01 _0746_normal	mp4	5/20/2015	IR Inspection Video
ST T8N-R60W-S16 L01 _0747_dump	mp4	5/20/2015	IR Inspection Video
ST T8N-R60W-S16 L01 _0748_post	mp4	5/20/2015	IR Inspection Video
ST T8N-R60W-S16 L02 IR VERIFICATION	pdf	5/22/2015	IR Camera Verification Documentation and Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
ST T8N-R60W-S16 L02 _SIGNED EVAL	pdf	5/26/2015	Signed Engineering Design Evaluation
ST T8N-R60W-S16 L02 2016 Audit Document Request	pdf	5/3/2016	Additional Information Document

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ST T8N-R60W-S16 L02**

Consent Decree Tank System Number: **2035**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity (bbl):	**400**
# of Water Tanks:	**1**
Water Tank Capacity (bbl):	**400**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**50**							
Dump Valve Size & Trim Size (in)	**2" & 2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**50**							
Dump Valve Size & Trim Size (in)	**2" & 2"**							

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**			
Man. Capacity (MSCFD)	**109.272**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**25,903**	**25,910**	**0%**
Calculated Burner Capacity (scfh	**3,740**	**4,553**	
Headspace Surge Capacity (scfh)	**63,325**	**63,325**	
Total VCS Capacity (scfh)	**67,065**	**67,878**	
VCS Capacity minus PPIVF (scfh)	**41,162**	**41,968**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Angela M. Oberlander/Tom Kussard
Audit Document Review Date:	5/17/2016 & 11/18/2016 & 2/1/2017 & 5/1/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	5/24/2016 &12/8/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ST T8N-R60W-S16 L02**

Consent Decree Tank System Number: **2035**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.41**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.52**							
Gas/Oil Ratio (scf/bbl)	**80.7**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.76**							
Valve Coefficent (gpm/psi) (C_v)	**57.00**							
Critical Pressure (psia)[b]	**521**							
Vapor Pressure (psia)[c]	**63**							
Critical pressure ratio (F_F) [d]	**0.86**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**5313**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**428.8**							
Working Flow (Mscfd)[h,i]	**51**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.76**							
Valve Coefficent (gpm/psi) (C_v)	**57.00**							
Critical Pressure (psia)[j]	**3200**							
Vapor Pressure (psia)[k]	**1**							
Critical pressure ratio (F_F)[d]	**0.96**							
Choked Flow?[e]	**Yes**							
Peak Flow (bwpd)[f,g]	**11657**							

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**47**							
Working Flow (Mscfd)[l]	**65**							

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**400**	**400**
scfh vapor/tank[i]	**317**	**317**
Mscfd	**23**	**8**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**17,867**	**1,867**
Oil Tank Working Rate	**2,105**	**2,100**
Water Tank Flash Rate	**1,943**	**1,942**
Water Tank Working Rate	**2,727**	**2,726**
Tank Breathing Rate	**1,268**	**1,268**
Total	**25,910**	**9,903**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **ST T8N-R60W-S16 L02**

Consent Decree Tank System Number: **2035**

Audit Notes

The field datasheet on ST T8N-R60W-S16 L02_FINAL PACKET.pdf(pg 10) only indicates one valve on the separator as a 1" w/ 1/2" trim. Valve used in the engineering evaluation, , indicated a 1" trim. A Kimray 2" valve with a 1" trim was used in the verification audit for the oil dump valve as it is the only 1" trim valve manufactured by Kimray. a* - Information request regarding the water dump valve indicated the valve was a model with a mechanical actuator. The valve coeficient was revised to the Noble provided 36.5 in the flow calculations.

Work Request document, ST T8N-R60W-S16 L02_WORK REQUEST.pdf, indicates that separator shut in pressure to be set to 50 psig while engineering evaluation, ST T8N-R60W-S16 L02_SIGNED EVAL.pdf, was completed at 75 psig. The confirmed 50 psig shut in pressure was used in the verification audit.

The walkdown form, ST T8N-R60W-S16 L02_WALKDOWN.pdf, indicated that the LP shut in was incorrectly installed on the treater, which is out of service. Additional information provided indicated the treater is used at the LP Sep on site and the shutdown is tied to the HP vessel which in turn would prevent the LP Sep from exceeding 75 psi.

Facility has over 50 tpy VOC, and as such, will have an IR Camera inspection.

The "Max Operating Pressure" for oil Vessel 1 was 75 psi in the original ST T8N-R60W-S16 L02 _SIGNED EVAL.pdf and was changed to 50 psi in the modified STEM Engineering Evaluation_rev1_ST T8N-R60W-S16 L02.xlsm file. Noble confirmed the 50psi pressure to be accurate

2/1/2017 - Noble provided the update STEM Calcs "Attachment M - STEM Engineering Evaluation_rev1_ST T8N-R60W-S16 L02.xlsm" which use a 2" dump valve with a 2" trim for both the oil and water dumps. Noble provided documentation showing the "max operating pressure" is 50psig.

UPDATE: Noble agrees that Engineering Evaluation was incorrect. An updated Engineering Evaluation was completed and a revised COCR submitted with Noble's Semi-Annual Report (5th) (July 28, 2017).

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **STROH T3N-R65W-S12 L02**

Consent Decree Tank System Number: **700**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
STROH T3N-R65W-S12 L01 AND L02_FINAL PACKET	pdf	7/20/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
STROH T3N-R65W-S12 L01 AND L02_SIGNED EVAL	pdf	7/20/2015	Engineering Evaluation
STROH T3N-R65W-S12 L01 AND L02_FINAL PACKET	pdf	7/20/2015	Tank VOC Analysis
STROH T3N-R65W-S12 L02 - Tank System Audit Checklist Rev 1	xlsm	7/28/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
STROH T3N-R65W-S12 L02 WORK REQUEST	pdf	6/10/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
STROH T3N-R65W-S12 L02 WALKDOWN	pdf	7/15/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
STROH T3N-R65W-S12 L01 IR VERIFICATION	pdf	7/15/2015	IR Camera Verification Sheet
STROH T3N-R65W-S12 L01, L02_0071_NORMAL	mp4	7/15/2015	IR Camera Video
STROH T3N-R65W-S12 L01, L02_0072_DUMP	mp4	7/15/2015	IR Camera Video
STROH T3N-R65W-S12 L01, L02_0073_POST	mp4	7/15/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
STROH T3N-R65W-S12 L01 AND L02_SIGNED EVAL	pdf	7/20/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **STROH T3N-R65W-S12 L02**

Consent Decree Tank System Number: **700**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**	**70**						
Dump Valve Size & Trim Size (in)	**2" & 1/2"**	**2" & 1/2"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**TEC 4-CS (48" Tornado**	**LEED 48" Gen 1 #7**		
Man. Capacity (MSCFD)	**86.4**	**140**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**8,779**	**9,139**	**4%**
Calculated Burner Capacity (scfh	**6,231**	**9,433**	
Headspace Surge Capacity (scfh)	**21,210**	**22,336**	
Total VCS Capacity (scfh)	**27,441**	**31,769**	
VCS Capacity minus PPIVF (scfh)	**18,662**	**22,630**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	4/20/2016 & 11/18/2016 & 5/1/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	4/28/2016 & 12/8/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **STROH T3N-R65W-S12 L02**

Consent Decree Tank System Number: **700**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**	**0.77**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**0.89**	**0.89**						
Gas/Oil Ratio (scf/bbl)	**112.8**	**112.8**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**	**0.78**						
Valve Coefficent (gpm/psi) (C_v)	**7.20**	**7.20**						
Critical Pressure (psia)[b]	**539**	**539**						
Vapor Pressure (psia)[c]	**83**	**83**						
Critical pressure ratio (F_F) [d]	**0.85**	**0.85**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**827**	**827**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**93.3**	**93.3**						
Working Flow (Mscfd)[h,i]	**8**	**8**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**17**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**7,771**	**7,440**
Oil Tank Working Rate	**655**	**626**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**713**	**713**
Total	**9,139**	**8,779**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **STROH T3N-R65W-S12 L02**

Consent Decree Tank System Number: **700**

Audit Notes

Field data sheets in STROH T3N-R65W-S12 L02 and L02_FINAL PACKET.pdf indicate the L01 Separators are 1" (1400 SMA) and 2" (212 SMA), but no indication of which separator unit remain in service and which were removed. The dump valve size of 2" was utilized for both separators in the evaluation as a conservative approach.

STROH T3N-R65W-S12 L02 and L02_SIGNED EVAL.pdf indicates there are 3-300 bbl tanks on site, but one of the three is used only as vapor space accumulation. The TANK VOC ANALYSIS in the STROH T3N-R65W-S12 L02 and L02_FINAL PACKET.pdf incorrectly uses 2-300bbl tanks with 63% full volume; while the use of 2-300bbl tanks is more conservative for head space surge capacity it underestimates PPIVFR, 3-300 bbl at 63% full is a more correct representation of conditions at the site.

"Tank % Full" was originally 63% in the original STROH T3N-R65W-S12 L01 AND L02_SIGNED EVAL.pdf and was changed to 60% in the modified STEM Engineering Evaluation_rev1_STROH T3N-R65W-S12 L01 & L02.xlsm file. 60% full accurately represents two 300 bbl tanks at 90% full and one 300 bbl tank at 0% full.

Two (2) LEED 48" Gen 1 #7 combustors are present in the original STROH T3N-R65W-S12 L01 AND L02_SIGNED EVAL.pdf, a combustor was changed to a TEC 4-CS (48" Tornado) and a LEED 48" Gen 1 #7 in the modified STEM Engineering Evaluation_rev1_STROH T3N-R65W-S12 L01 & L02.xlsm file. The LEED 48" and TEC 4-CS configuration was confirmed by the field documentation.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **THISTLE DOWN T5N-R64W-S31 L01**

Consent Decree Tank System Number: **325 & 326**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
THISTLE DOWN T5N-R64W-S31 L01_FINAL PACKET	pdf	5/6/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
THISTLE DOWN T5N-R64W-S31 L01_SIGNED EVAL	pdf	7/14/2015	Signed Engineering Evaluation
STEM Engineering Evaluation_THISTLE DOWN T5N-R64W-S31 L01	xlsm	4/28/2015	STEM Engineering Evaluation Spreadsheet
Attachment N - STEM Engineering Evaluation_rev1_THISTLE DOWN T5N-R64W-S31 L01.xlsm	xlsm	1/17/2017	Revised Engineering Evaluation 2

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
THISTLE DOWN T5N-R64W-S31 L01 WORK REQUEST	pdf	6/4/2015	Work Request Form
Noble 3rd Party Audi Wave 12 Update Info Request_20170117	pdf	1/17/2017	Information Request Response

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
THISTLE DOWN T5N-R64W-S31 L01 WALKDOWN	pdf	6/29/2015	Final Facility Walkdown
THISTLE DOWN T5N-R64W-S31 L01_FINAL PACKET	pdf	5/6/2015	Final Facility Packet

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
THISTLE DOWN T5N-R64W-S31 L01_0013_NORMAL	mp4	7/1/2015	IR Camera Video during Normal Operations
THISTLE DOWN T5N-R64W-S31 L01_0014_DUMP	mp4	7/1/2015	IR Camera Video during Dump Event
THISTLE DOWN T5N-R64W-S31 L01_0015_POST	mp4	7/1/2015	IR Camera Video after Dump Event
THISTLE DOWN T5N-R64W-S31 L01 IR VERIFICATION	pdf	7/1/2015	IR Verification Field Form

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
THISTLE DOWN T5N-R64W-S31 L01_SIGNED EVAL	pdf	7/14/2015	Signed Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **THISTLE DOWN T5N-R64W-S31 L01**

Consent Decree Tank System Number: **325 & 326**

☑ Yes ☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes ☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**7**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**300**							
Dump Valve Size & Trim Size (in)	**1" & 1/4"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**TEC 4-CS (48" Tornado)**	**TEC 4-CS (48" Tornado)**	
Man. Capacity (MSCFD)	**140**	**110.4**	**110.4**	

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**21,103**	**21,103**	**0%**
Calculated Burner Capacity (scfh)	**3,707**	**15,033**	
Headspace Surge Capacity (scfh)	**36,060**	**36,060**	
Total VCS Capacity (scfh)	**39,767**	**51,093**	
VCS Capacity minus PPIVF (scfh)	**18,664**	**29,990**	

☑ Yes ☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes ☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes ☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes ☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	7/21/2016 & 11/18/2016 & 2/1/2017 & 4/26/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	8/5/2016 & 12/8/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **THISTLE DOWN T5N-R64W-S31 L01**

Consent Decree Tank System Number: **325 & 326**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**2.19**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**2.31**							
Gas/Oil Ratio (scf/bbl)	**780.9**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**							
Valve Coefficent (gpm/psi) (C_v)	**2.17**							
Critical Pressure (psia)[b]	**744**							
Vapor Pressure (psia)[c]	**313**							
Critical pressure ratio (F_F) [d]	**0.78**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**590**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**460.9**							
Working Flow (Mscfd)[h,i]	**6**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**40**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**19,205**	**19,205**
Oil Tank Working Rate	**234**	**233**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**1,664**	**1,664**
Total	**21,103**	**21,102**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **THISTLE DOWN T5N-R64W-S31 L01**

Consent Decree Tank System Number: **325 & 326**

Audit Notes

-Signed evaluation (THISTLE DOWN T5N-R64W-S31 L01_SIGNED EVAL.pdf) states "Automation controls ensure that only 1 separator train can operate at a time." Work Request (THISTLE DOWN T5N-R64W-S31 L01 WORK REQUEST.pdf) indicates a request under the Automation section to "modify wellhead automation so that all 7 wells are grouped together." It is assumed that the statements in the signed evaluation and work request are synonymous.

-Walk down (THISTLE DOWN T5N-R64W-S31 L01 WALKDOWN.pdf) does not indicate that all the modifications to the facility were completed. Job Sheets and emails in final packet (THISTLE DOWN T5N-R64W-S31 L01_FINAL PACKET.pdf) were used to confirm that all of the requested modifications in the work request (THISTLE DOWN T5N-R64W-S31 L01 WORK REQUEST.pdf) was completed.

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original THISTLE DOWN T5N-R64W-S31 L01_SIGNED EVAL.pdf and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1_THISTLE DOWN T5N-R64W-S31 L01.xlsm file.

"Tank % Full" was 67% in the original THISTLE DOWN T5N-R64W-S31 L01_SIGNED EVAL.pdf and was changed to 64% in the modified STEM Engineering Evaluation_rev1_THISTLE DOWN T5N-R64W-S31 L01.xlsm file. 64% is representative of five 300 bbl tanks at 90% full and two 300 bbl at 0% full as confirmed in the jobsheets

Oil production and average cycle time in the original STEM Engineering Evaluation_THISTLE DOWN T5N-R64W-S31 L01.xlsm is different than that seen in the modified STEM Engineering Evaluation_rev1_THISTLE DOWN T5N-R64W-S31 L01.xlsm file.

VOC line size was originally 3" in the original THISTLE DOWN T5N-R64W-S31 L01 - STEM Engineering Evaluation Check.xlsm STEM book and was changed to 2" from the tanks to the knockout and 4" from the knockout to to the control device in the modified STEM Engineering Evaluation_rev1_THISTLE DOWN T5N-R64W-S31 L01.xlsm STEM book. SLR is able to confirm the line size is 2" from the tanks to the knockout and 4" from the knockout to the control device.

1/17/2017 - From Noble - "Noble acknowledges that the revised (Rev1) evaluation had the same production/rates/cycle times as the original (Rev0) but did not consider the worse case scenario of the 7 separators. There was no material change to this Tank System engineering evaluation. Please see the updated Rev1 engineering evaluation in Attachment N.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **TIMMERMAN PLATTE VALLEY T4N-R65W-S13 L01**

Consent Decree Tank System Number: **147**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
TIMMERMAN PLATTE VALLEY T4N-R65W-S13 L01_FINAL PACKET	pdf	4/30/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
TIMMERMAN PLATTE VALLEY T4N-R65W-S13 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation
STEM Engineering Evaluation_Platte Valley Timmerman	xlsm	4/28/2015	Tank VOC Analysis
STEM Eng Eval_rev1_TIMMERMAN PLATTE VALLEY T4N-R65W-S13 L01	xlsm	7/28/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
TIMMERMAN PLATTE VALLEY T4N-R65W-S13 L01 WORK REQUEST	xlsx	4/1/2015	Work Request
TIMMERMAN PLATTE VALLEY T4N-R65W-S13 L01_FINAL PACKET	pdf	4/30/2015	Work Request
Noble 3rd Party Audit Wave 12 Update Info Request_20170117	pdf	1/17/2017	Information Request Response

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
TIMMERMAN PLATTE VALLEY T4N-R65W-S13 L01 WALKDOWN	pdf	4/30/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
TIMMERMAN PLATTE VALLEY T4N-R65W-S13 L01 IR VERIFICATION	pdf	5/14/2015	IR Camera Verification Sheet
TIMMERMAN PLATTE VALLEY T4N-R65W-S13 L01_0688_normal	mp4	5/14/2015	IR Camera Video
TIMMERMAN PLATTE VALLEY T4N-R65W-S13 L01_0689_dump	mp4	5/14/2015	IR Camera Video
TIMMERMAN PLATTE VALLEY T4N-R65W-S13 L01_0690_post	mp4	5/14/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
TIMMERMAN PLATTE VALLEY T4N-R65W-S13 L01_SIGNED EVAL	pdf	5/22/2015	Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **TIMMERMAN PLATTE VALLEY T4N-R65W-S13 L01**

Consent Decree Tank System Number: **147**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**2" & 1"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**COMM 200 48"**		
Man. Capacity (MSCFD)	**109.272**	**157**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**12,986**	**12,988**	**0%**
Calculated Burner Capacity (scfh	**7,416**	**11,095**	
Headspace Surge Capacity (scfh)	**20,253**	**20,253**	
Total VCS Capacity (scfh)	**27,669**	**31,348**	
VCS Capacity minus PPIVF (scfh)	**14,683**	**18,359**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Tom Kussard
Audit Document Review Date:	5/10/2016 & 11/18/2016 & 2/1/2017 & 4/26/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	5/19/2016 & 12/8/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **TIMMERMAN PLATTE VALLEY T4N-R65W-S13 L01**

Consent Decree Tank System Number: **147**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**							
Valve Coefficent (gpm/psi) (C_v)	**21.25**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**2409**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**271.7**							
Working Flow (Mscfd)[h,i]	**23**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**17**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**11,321**	**11,321**
Oil Tank Working Rate	**955**	**952**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**713**	**713**
Total	**12,988**	**12,986**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **TIMMERMAN PLATTE VALLEY T4N-R65W-S13 L01**

Consent Decree Tank System Number: **147**

Audit Notes

Facility has greater than 50 tpy VOC emissions, as such the facility is selected for an IR Camera Inspection. "Max Operating Pressure" was originally 75 psi in the original STEM Engineering Evaluation_Platte Valley Timmerman.xlsm and was changed to 70 psi in the modified STEM Eng Eval_rev1_TIMMERMAN PLATTE VALLEY T4N-R65W-S13 L01.xlsm file. Noble confirmed the pressure to be 70 psi.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **TREBOR JENKINS LEEROY T5N-R64W-S11 L01**

Consent Decree Tank System Number: **2064**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
TREBOR JENKINS LEEROY T5N-R64W-S11 L01_FINAL PACKET	pdf	Unknown	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
TREBOR JENKINS LEEROY T5N-R64W-S11 L01_SIGNED EVAL	pdf	5/26/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_Trebor Leeroy Jenkins	.xlsm	4/28/2015	STEM Engineering Evaluation for 3 oil & 3 water tanks
STEM Engineering Evaluation_rev1_TREBOR JENKINS LEEROY T5N-R64W-S11 L01	xlsm	9/23/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
TREBOR JENKINS LEEROY T5N-R64W-S11 L01_FINAL PACKET	pdf	7/29/2015	Work Request (in Final Packet)

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
TREBOR JENKINS LEEROY T5N-R64W-S11 L01 WALKDOWN	pdf	4/23/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
TREBOR JENKINS LEEROY T5N-R64W-S11 L01_2356_normal	mp4	5/11/2015	IR Video of site during normal operation
TREBOR JENKINS LEEROY T5N-R64W-S11 L01__2357_dump	mp4	5/11/2015	IR Video of site during separator dump event
TREBOR JENKINS LEEROY T5N-R64W-S11 L01__2358_post	mp4	5/11/2015	IR Video of site post dump event
TREBOR JENKINS LEEROY T5N-R64W-S11 L01 IR VERIFICATION	pdf	5/11/2015	IR Camera Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
TREBOR JENKINS LEEROY T5N-R64W-S11 L01_SIGNED EVAL	pdf	5/26/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **TREBOR JENKINS LEEROY T5N-R64W-S11 L01**

Consent Decree Tank System Number: **2064**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**10**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**3**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**2**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**					
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**					

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**					
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**					

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**		
Man. Capacity (MSCFD)	**140**	**140**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**43,062**	**44,747**	**4%**
Calculated Burner Capacity (scfh	**5,384**	**11,667**	
Headspace Surge Capacity (scfh)	**85,665**	**85,665**	
Total VCS Capacity (scfh)	**91,049**	**97,332**	
VCS Capacity minus PPIVF (scfh)	**47,987**	**52,584**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	6/2/2016 & 11/18/2016 & 5/1/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	7/1/2016 & 12/8/2016

SLR

LOD ID: **TREBOR JENKINS LEEROY T5N-R64W-S11 L01**

Consent Decree Tank System Number: **2064**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**	**-1.02**					
Z2	**-0.86**	**-0.86**	**-0.86**					
Z3	**0.98**	**0.98**	**0.98**					
Z	**-0.90**	**-0.90**	**-0.90**					
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**	**22.9**					

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**					
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**					
Critical Pressure (psia)[b]	**833**	**833**	**833**					
Vapor Pressure (psia)[c]	**407**	**407**	**407**					
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**	**0.76**					
Choked Flow?[e]	**Yes**	**Yes**	**Yes**					
Peak Flow (bopd)[f,g]	**6905**	**6905**	**6905**					

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**158.2**	**158.2**	**158.2**					
Working Flow (Mscfd)[h,i]	**66**	**66**	**66**					

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**					
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**					
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**					
Vapor Pressure (psia)[k]	**1**	**1**	**1**					
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**					
Choked Flow?[e]	**Yes**	**Yes**	**Yes**					
Peak Flow (bwpd)[f,g]	**11381**	**11381**	**11381**					

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**46**	**46**	**46**					
Working Flow (Mscfd)[l]	**64**	**64**	**64**					

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**57**	**17**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**19,769**	**19,769**
Oil Tank Working Rate	**8,209**	**8,188**
Water Tank Flash Rate	**5,691**	**5,690**
Water Tank Working Rate	**7,988**	**7,987**
Tank Breathing Rate	**3,091**	**1,426**
Total	**44,747**	**43,060**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **TREBOR JENKINS LEEROY T5N-R64W-S11 L01**

Consent Decree Tank System Number: **2064**

Audit Notes

-The facility consists of two banks of tanks, one with 7 oil tanks and one with 3 oil and 3 water tanks. The bank of 3 oil and 3 water tanks was found to have smallest margin between PPIVFR and system capacity.

-To account for breathing from all tanks 10 oil and 3 water tanks were included in SLR calculations.

-Facility has the uncontrolled actual VOC emission greater than 50 tons per year. Therefore an IR inspection is required.

"VOC Design Tank Pressure" was originally 11 oz/in^2 in the original STEM Engineering Evaluation_Trebor Leeroy Jenkins.xlsm and was changed to 12 oz/in^2 in the modified STEM Engineering Evaluation_rev1_TREBOR JENKINS LEEROY T5N-R64W-S11 L01.xlsm file.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **TREBOR T5N-R64W-S11 L02**

Consent Decree Tank System Number: **2065**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
TREBOR T5N-R64W-S11 L02_FINAL PACKET	pdf	7/29/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
TREBOR T5N-R64W-S11 L02_SIGNED EVAL	pdf	5/26/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_Trebor B11	xlsm	4/29/2015	STEM Engineering Evaluation
STEM Engineering Evaluation_rev1_TREBOR T5N-R64W-S11 L02	xlsm	9/22/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
TREBOR T5N-R64W-S11 L02_FINAL PACKET	pdf	7/29/2015	Work Request (in Final Packet)

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
TREBOR T5N-R64W-S11 L02 WALKDOWN	pdf	4/27/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
TREBOR T5N-R64W-S11 L02_2353_normal	mp4	5/11/2015	IR Video of site during normal operation
TREBOR T5N-R64W-S11 L02__2354_dump	mp4	5/11/2015	IR Video of site during separator dump event
TREBOR T5N-R64W-S11 L02__2355_post	mp4	5/11/2015	IR Video of site post dump event
TREBOR T5N-R64W-S11 L02 IR VERIFICATION	pdf	5/11/2015	IR Camera Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
TREBOR T5N-R64W-S11 L02_SIGNED EVAL	pdf	5/26/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **TREBOR T5N-R64W-S11 L02**

Consent Decree Tank System Number: **2065**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**6**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**2**
Water Tank Capacity (bbl):	**300**
VOC Line Size (in):	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**				
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**				

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**				
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**				

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**COMM 200 48"**		
Man. Capacity (MSCFD)	**109.272**	**157**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**57,416**	**57,444**	**0%**
Calculated Burner Capacity (scfh	**6,920**	**11,095**	
Headspace Surge Capacity (scfh)	**114,045**	**114,045**	
Total VCS Capacity (scfh)	**120,965**	**125,140**	
VCS Capacity minus PPIVF (scfh)	**63,549**	**67,696**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	6/2/2016 & 11/18/2016 & 4/26/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	6/9/2016 & 12/8/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **TREBOR T5N-R64W-S11 L02**

Consent Decree Tank System Number: **2065**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**	**-1.02**	**-1.02**				
Z2	**-0.86**	**-0.86**	**-0.86**	**-0.86**				
Z3	**0.98**	**0.98**	**0.98**	**0.98**				
Z	**-0.90**	**-0.90**	**-0.90**	**-0.90**				
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**	**22.9**	**22.9**				

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor	**0.77**	**0.77**	**0.77**	**0.77**				
Valve Coefficent (gpm/psi) (	**21.25**	**21.25**	**21.25**	**21.25**				
Critical Pressure (psia)[b]	**833**	**833**	**833**	**833**				
Vapor Pressure (psia)[c]	**407**	**407**	**407**	**407**				
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**	**0.76**	**0.76**				
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**				
Peak Flow (bopd)[f,g]	**6905**	**6905**	**6905**	**6905**				

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**158.2**	**158.2**	**158.2**	**158.2**				
Working Flow (Mscfd)[h,i]	**66**	**66**	**66**	**66**				

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor	**0.77**	**0.77**	**0.77**	**0.77**				
Valve Coefficent (gpm/psi) (	**21.25**	**21.25**	**21.25**	**21.25**				
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**	**3200**				
Vapor Pressure (psia)[k]	**1**	**1**	**1**	**1**				
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**	**0.96**				
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**				
Peak Flow (bwpd)[f,g]	**11381**	**11381**	**11381**	**11381**				

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**46**	**46**	**46**	**46**				
Working Flow (Mscfd)[l]	**64**	**64**	**64**	**64**				

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**300**
scfh vapor/tank[i]	**238**	**238**
Mscfd	**34**	**11**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**26,359**	**26,359**
Oil Tank Working Rate	**10,945**	**10,918**
Water Tank Flash Rate	**7,588**	**7,587**
Water Tank Working Rate	**10,650**	**10,650**
Tank Breathing Rate	**1,902**	**1,902**
Total	**57,444**	**57,416**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **TREBOR T5N-R64W-S11 L02**

Consent Decree Tank System Number: **2065**

Audit Notes

-Page 12 of the final packet pdf (TREBOR T5N-R64W-S11 L02_FINAL PACKET.pdf) lists one (1) Cimmaron combustor onsite. An additional combustor is listed on the facility drawing, page 7 of the final packet (TREBOR T5N-R64W-S11 L02_FINAL PACKET.pdf) with a note "no p/n not connected to system."pg 7 of the final packet pdf. The work request workbook (TREBOR T5N-R64W-S11 L02 WORK REQUEST.xlsx) shows a old style COMM combustor being replaced by a new style COMM combustor meaning a Cimmaron combustor and a COMM combustor were onsite.

-The site has uncontrolled actual VOC emissions greater than 50 tpy. Therefore an IR inspection is required.

Tanks are in a banked configuration. Noble calculations do not account for breathing from non-producing bank. Modified audit spreadsheet to accommodate a banked configuration for breathing losses and surge capacity for two banks, each with 6-300 bbl oil tanks and 2-300 bbl water tanks.

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original STEM Engineering Evaluation_Trebor B11.xlsm and was changed to 12 oz/in^2 in the modified STEM Engineering Evaluation_rev1_TREBOR T5N-R64W-S11 L02.xlsm file.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **UPRC BRANDON SEBASTYEN T4N-R67W-S23 L01**

Consent Decree Tank System Number: **168**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
UPRC BRANDON SEBASTYEN T4N-R67W-S23 L01_FINAL PACKET	pdf	8/26/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
UPRC BRANDON SEBASTYEN T4N-R67W-S23 L01_SIGNED EVAL	pdf	5/27/2015	Engineering Evaluation
STEM Engineering Evaluation_Sebastyen PC O23_Oil	xlsm	4/28/2015	Tank VOC Analysis
STEM Eng Eval_rev1_UPRC BRANDON SEBASTYEN T4N-R67W-S23 L01_Oil.xlsm	xlsm	9/23/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
UPRC BRANDON SEBASTYEN T4N-R67W-S23 L01_FINAL PACKET	pdf	8/26/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
UPRC BRANDON SEBASTYEN T4N-R67W-S23 L01 WALKDWON	pdf	5/6/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
UPRC BRANDON SEBASTYEN T4N-R67W-S23 L01 IR VERIFICATION	pdf	5/21/2015	IR Camera Verification Sheet
UPRC BRANDON SEBASTYEN T4N-R67W-S23 L01_0764_normal	mp4	5/21/2015	IR Camera Video
UPRC BRANDON SEBASTYEN T4N-R67W-S23 L01_0765_dump	mp4	5/21/2015	IR Camera Video
UPRC BRANDON SEBASTYEN T4N-R67W-S23 L01_0766_post	mp4	5/21/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
UPRC BRANDON SEBASTYEN T4N-R67W-S23 L01_SIGNED EVAL	pdf	5/27/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **UPRC BRANDON SEBASTYEN T4N-R67W-S23 L01**

Consent Decree Tank System Number: **168**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**8**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**						
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**TEC 4-CS (48" Tornado)**		
Man. Capacity (MSCFD)	**109.272**	**110.4**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**19,589**	**20,554**	**5%**
Calculated Burner Capacity (scfh)	**6,659**	**9,153**	
Headspace Surge Capacity (scfh)	**58,722**	**58,722**	
Total VCS Capacity (scfh)	**65,381**	**67,875**	
VCS Capacity minus PPIVF (scfh)	**45,792**	**47,321**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	6/2/2016 & 11/18/2016 & 5/1/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	6/20/2016 &12/8/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **UPRC BRANDON SEBASTYEN T4N-R67W-S23 L01**

Consent Decree Tank System Number: **168**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**-0.90**	**-0.90**						
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**						
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**						
Critical Pressure (psia)[b]	**833**	**833**						
Vapor Pressure (psia)[c]	**407**	**407**						
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**6905**	**6905**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**158.2**	**158.2**						
Working Flow (Mscfd)[h,i]	**66**	**66**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**46**	**0**

Flow Rate Summary	**Flow Rate (scfh)**	
	SLR	**Noble**
Oil Tank Flash Rate	**13,179**	**13,179**
Oil Tank Working Rate	**5,473**	**5,459**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**1,902**	**951**
Total	**20,554**	**19,589**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **UPRC BRANDON SEBASTYEN T4N-R67W-S23 L01**

Consent Decree Tank System Number: **168**

Audit Notes

The water storage tanks and the oil storage tanks have independent VCS.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

Noble did not include breathing losses from non-producing tank bank. SLR included all oil tanks to account for breathing losses from all tanks. Configuration has two banks - each with 4 oil tanks.

There are two (2) "VOC Lines Tanks to KO" in the original STEM Engineering Evaluation_Sebastyen PC O23_Oil.xlsm and was changed to one (1) "VOC Lines Tanks to KO" in the modified STEM Eng Eval_rev1_UPRC BRANDON SEBASTYEN T4N-R67W-S23 L01_Oil.xlsm file. SLR still considers the engineering standard followed since one line results in a lower burner capacity than two lines.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **UPV SATER T4N-R64W-S23 L01**

Consent Decree Tank System Number: **562**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
UPRC HP FARMS T2N-R64W-S17 L01_FINAL PACKET	pdf	7/6/2015	Final Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
UPRC HP FARMS T2N-R64W-S17 L01_SIGNED EVAL	pdf	7/20/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_UPRC HP FARMS T2N-R64W-S17 L01	xlsm	4/28/2015	STEM Engineering Evaluation Spreadsheet
STEM Engineering Evaluation_rev1_UPRC HP FARMS T2N-R64W-S17 L01	xlsm	11/21/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
UPRC HP FARMS T2N-R64W-S17 L01 WORK REQUEST	pdf	5/29/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
UPRC HP FARMS T2N-R64W-S17 L01 WALKDOWN	pdf	7/14/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
UPRC HP FARMS T2N-R64W-S17 L01_0206_NORMAL	mp4	7/16/2015	IR Video of site during normal operation
UPRC HP FARMS T2N-R64W-S17 L01_0207_DUMP	mp4	7/16/2015	IR Video of site during separator dump event
UPRC HP FARMS T2N-R63W-S17 L01_0208_POST	mp4	7/16/2015	IR Video of site post dump event
UPRC HP FARMS T2N-R64W-S17 L01 IR VERIFICATION	pdf	7/16/2015	IR Camera Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
UPRC HP FARMS T2N-R64W-S17 L01_SIGNED EVAL	pdf	7/20/2015	Signed Engineering Design Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **UPV SATER T4N-R64W-S23 L01**

Consent Decree Tank System Number: **562**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**3**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**60**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**			
Man. Capacity (MSCFD)	**140**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**3,920**	**3,920**	**0%**
Calculated Burner Capacity (scfh	**2,945**	**5,833**	
Headspace Surge Capacity (scfh)	**3,495**	**3,495**	
Total VCS Capacity (scfh)	**6,440**	**9,328**	
VCS Capacity minus PPIVF (scfh)	**2,520**	**5,408**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	4/20/2016 & 12/2/2016 & 4/26/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	4/20/2016 & 12/12/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **UPV SATER T4N-R64W-S23 L01**

Consent Decree Tank System Number: **562**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.61**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.72**							
Gas/Oil Ratio (scf/bbl)	**96.4**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**530**							
Vapor Pressure (psia)[c]	**73**							
Critical pressure ratio (F_F) [d]	**0.86**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**727**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**70.1**							
Working Flow (Mscfd)[h,i]	**7**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**17**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**2,919**	**2,919**
Oil Tank Working Rate	**288**	**287**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**713**	**713**
Total	**3,920**	**3,919**

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **UPV SATER T4N-R64W-S23 L01**

Consent Decree Tank System Number: **562**

Audit Notes

"VOC Design Tank Pressure" was 11 oz/in^2 in the original STEM Engineering Evaluation_UPRC HP FARMS T2N-R64W-S17 L01.xlsm and was changed to 12 oz/in^2 in the modified STEM Engineering Evaluation_rev1_UPRC HP FARMS T2N-R64W-S17 L01.xlsm file.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **UPV SATER T4N-R64W-S23 L01**

Consent Decree Tank System Number: **463**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
UPV SATER T4N-R64W-S23 L01 AND L02_FINAL PACKET	pdf	7/6/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
UPV SATER T4N-R64W-S23 L01 AND L02_SIGNED EVAL	pdf	7/20/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_UPV SATER T4N-R64W-S23 L01 & L02	xlsm	7/17/2015	STEM Engineering Evaluation Spreadsheet
STEM Engineering Evaluation_rev1_UPV SATER T4N-R64W-S23 L01 & L02	xlsm	9/22/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
UPV SATER T4N-R64W-S23 L01 WORK REQUEST	pdf	5/29/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
UPV SATER T4N-R64W-S23 L01 WALKDOWN	pdf	7/14/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
UPV SATER T4N-R64W-S23 L01, L02_0169_NORMAL	mp4	7/16/2015	IR Video of site during normal operation
UPV SATER T4N-R64W-S23 L01, L02_0170_DUMP	mp4	7/16/2015	IR Video of site during separator dump event
UPV SATER T4N-R64W-S23 L01, L02_0171_POST	mp4	7/16/2015	IR Video of site post dump event
UPV SATER T4N-R64W-S23 L01 IR VERIFICATION	pdf	7/16/2015	IR Camera Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
UPV SATER T4N-R64W-S23 L01 AND L02_SIGNED EVAL	pdf	7/20/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **UPV SATER T4N-R64W-S23 L01**

Consent Decree Tank System Number: **463**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**5**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**	**70**						
Dump Valve Size & Trim Size (in)	**1" & 1/2"**	**1" & 1/2"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**TEC 4-CS (48" Tornado)**	**TEC 4-CS (48" Tornado)**		
Man. Capacity (MSCFD)	**110.4**	**110.4**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**9,255**	**9,256**	**0%**
Calculated Burner Capacity (scfh)	**6,639**	**9,200**	
Headspace Surge Capacity (scfh)	**7,162**	**7,162**	
Total VCS Capacity (scfh)	**13,801**	**16,362**	
VCS Capacity minus PPIVF (scfh)	**4,546**	**7,106**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	7/21/2016 & 11/18/2016 & 4/26/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	8/5/2016 & 12/12/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **UPV SATER T4N-R64W-S23 L01**

Consent Decree Tank System Number: **463**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**	**0.77**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**0.89**	**0.89**						
Gas/Oil Ratio (scf/bbl)	**112.8**	**112.8**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor	**0.94**	**0.94**						
Valve Coefficent (gpm/psi) (	**5.72**	**5.72**						
Critical Pressure (psia)[b]	**539**	**539**						
Vapor Pressure (psia)[c]	**83**	**83**						
Critical pressure ratio (F_F) [d]	**0.85**	**0.85**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**792**	**792**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**	**89.3**						
Working Flow (Mscfd)[h,i]	**8**	**8**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor								
Valve Coefficent (gpm/psi) (								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**29**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**7,440**	**7,440**
Oil Tank Working Rate	**627**	**626**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**1,189**	**1,189**
Total	**9,256**	**9,255**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **UPV SATER T4N-R64W-S23 L01**

Consent Decree Tank System Number: **463**

Audit Notes

-Walk Down (UPV SATER T4N-R64W-S23 L01 WALKDOWN.pdf) does not indicated if the items in the work request (UPV SATER T4N-R64W-S23 L01 WORK REQUEST.pdf) were completed. Completion of the modifications in the work request were confirmed with the job sheets, marked up work request form, and QC STEM Checkout form on pages 23-31 of the final packet (UPV SATER T4N-R64W-S23 L01 AND L02_FINAL PACKET.pdf)

-"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original STEM Engineering Evaluation_UPV SATER T4N-R64W-S23 L01 & L02.xlsm and was changed to 12 oz/in^2 in the modified STEM Engineering Evaluation_rev1_UPV SATER T4N-R64W-S23 L01 & L02.xlsm file.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WACKER T5N-R64W-S11 L01**

Consent Decree Tank System Number: **298**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
WACKER T5N-R64W-S11 L01_FINAL PACKET	pdf	4/24/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
WACKER T5N-R64W-S11 L01_SIGNED EVAL	pdf	5/27/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_Wacker B01	xlsm	5/27/2015	STEM Engineering Design Evaluation Spreadsheet
STEM Engineering Evaluation_rev1_WACKER T5N-R64W-S11 L01	xlsm	11/21/2016	Revised STEM Engineering Evaluation
Attachment O - STEM Engineering Evaluation_rev1_WACKER T5N-R64W-S11 L01.xlsm	xlsm	1/17/2017	Revised STEM Engineering Evaluation 2

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
WACKER T5N-R64W-S11 L01_FINAL PACKET	pdf	4/24/2015	Work Request (in Final Packet)
Request_20170117	pdf	1/17/2017	Information Request Response

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
WACKER T5N-R64W-S11 L01 WALKDOWN	pdf	8/4/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
WACKER T5N-R64W-S11 L01_2342_normal	mp4	5/11/2015	IR Video of site during normal operation
WACKER T5N-R64W-S11 L01_2344_dump	mp4	5/11/2015	IR Video of site during separator dump event
WACKER T5N-R64W-S11 L01_2348_post	mp4	5/11/2015	IR Video of site post dump event
WACKER T5N-R64W-S11 L01 IR VERIFICATION	pdf	5/11/2015	IR Camera Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
WACKER T5N-R64W-S11 L01_SIGNED EVAL	pdf	5/27/2015	Signed Engineering Design Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WACKER T5N-R64W-S11 L01**

Consent Decree Tank System Number: **298**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**8**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3"**
# VOC Lines to KO:	**2**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**	**70**						
Dump Valve Size & Trim Size (in)	**2" & 1/2"**	**2" & 1/2"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**		
Man. Capacity (MSCFD)	**140**	**140**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**10,327**	**10,328**	**0%**
Calculated Burner Capacity (scfh	**5,216**	**11,667**	
Headspace Surge Capacity (scfh)	**9,828**	**9,828**	
Total VCS Capacity (scfh)	**15,044**	**21,495**	
VCS Capacity minus PPIVF (scfh)	**4,717**	**11,166**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	3/29/2016 & 12/2/2016 & 2/1/2017 & 4/26/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	6/9/2016 & 12/12/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WACKER T5N-R64W-S11 L01**

Consent Decree Tank System Number: **298**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**	**0.77**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**0.89**	**0.89**						
Gas/Oil Ratio (scf/bbl)	**112.8**	**112.8**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**	**0.78**						
Valve Coefficent (gpm/psi) (C_v)	**7.20**	**7.20**						
Critical Pressure (psia)[b]	**539**	**539**						
Vapor Pressure (psia)[c]	**83**	**83**						
Critical pressure ratio (F_F) [d]	**0.85**	**0.85**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**827**	**827**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**93.3**	**93.3**						
Working Flow (Mscfd)[h,i]	**8**	**8**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**46**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**7,771**	**7,771**
Oil Tank Working Rate	**655**	**654**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**1,902**	**1,902**
Total	**10,328**	**10,327**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WACKER T5N-R64W-S11 L01**

Consent Decree Tank System Number: **298**

Audit Notes

-Venting seen in "Normal" IR Video. Notes on IR Verification document state "Noble Personnel cleaned, resealed TH Gasket, leaking no longer detected." No venting can be seen in the "Dump" and "Post" videos, following the described maintenance.

-There are 3 low pressure separators onsite that dump to the storage tanks. Automation is used to only allow 2 separators to dump at one time.

-This facility has uncontrolled actual VOC emissions greater than 50 tpy. Therefore an IR Camera Inspection is required.

"VOC Design Tank Pressure" was originally 11 oz/in^2 in the original STEM Engineering Evaluation_Wacker B01.xlsm and was changed to 14 oz/in^2 in the modified STEM Engineering Evaluation_rev1_WACKER T5N-R64W-S11 L01.xlsm file.

The "Dump Valve Size" was 2" in the original STEM Engineering Evaluation_Wacker B01.xlsm and was changed to a 1" in the modified STEM Engineering Evaluation_rev1_WACKER T5N-R64W-S11 L01.xlsm file. Noble confirmed it is a 2" valve with a 1/2" trim.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WALKER T4N-R65W-S4 L01**

Consent Decree Tank System Number: **1710**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
WALKER T4N-R65W-S4 L01_FINAL PACKET	pdf	7/6/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
WALKER T4N-R65W-S4 L01_SIGNED EVAL	pdf	6/29/2015	Engineering Evaluation
WALKER T4N-R65W-S4 L01_FINAL PACKET	pdf	7/6/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_WALKER T4N-R65W-S4 L01	xlsm	11/21/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
WALKER T4N-R65W-S4 L01 WORK REQUEST	pdf	5/29/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
WALKER T4N-R65W-S4 L01 WALKDOWN	pdf	6/18/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
WALKER T4N-R65W-S4 L01 IR VERIFICATION	pdf	6/18/2015	IR Camera Verification Sheet
WALKER T4N-R65W-S4 L01_0277_NORMAL	mp4	6/18/2015	IR Camera Video
WALKER T4N-R65W-S4 L01_0278_DUMP	mp4	6/18/2015	IR Camera Video
WALKER T4N-R65W-S4 L01_0279_POST	mp4	6/18/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
WALKER T4N-R65W-S4 L01_SIGNED EVAL	pdf	6/29/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WALKER T4N-R65W-S4 L01**

Consent Decree Tank System Number: **1710**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**1**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**60**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**			
Man. Capacity (MSCFD)	**140**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**3,444**	**3,445**	**0%**
Calculated Burner Capacity (scfh	**2,938**	**5,833**	
Headspace Surge Capacity (scfh)	**1,084**	**1,084**	
Total VCS Capacity (scfh)	**4,022**	**6,917**	
VCS Capacity minus PPIVF (scfh)	**578**	**3,473**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	3/18/2016 & 12/2/2016 & 4/26/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	3/29/2016 & 12/12/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WALKER T4N-R65W-S4 L01**

Consent Decree Tank System Number: **1710**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.61**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.72**							
Gas/Oil Ratio (scf/bbl)	**96.4**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**530**							
Vapor Pressure (psia)[c]	**73**							
Critical pressure ratio (F_F) [d]	**0.86**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**727**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**70.1**							
Working Flow (Mscfd)[h,i]	**7**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**6**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**2,919**	**2,919**
Oil Tank Working Rate	**288**	**287**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**238**	**238**
Total	**3,445**	**3,444**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WALKER T4N-R65W-S4 L01**

Consent Decree Tank System Number: **1710**

Audit Notes

"VOC Design Tank Pressure" was originally 11 oz/in^2 in the original WALKER T4N-R65W-S4 L01_SIGNED EVAL.pdf and was changed to 13 oz/in^2 in the modified STEM Engineering Evaluation_rev1_WALKER T4N-R65W-S4 L01.xlsm file.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WELLS RANCH AA12, AE07, AA12 ECONODE T6N-R63W-S12 L01**

Consent Decree Tank System Number: **1973**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
WELLS RANCH AA12, AE07, AA12 ECONODE T6N-R63W-S12 L01_FINAL PACKET	pdf	4/23/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH AA12, AE07, AA12 ECONODE T6N-R63W-S12 L01_SIGNED EVAL	pdf	5/26/2015	Engineering Evaluation
STEM Eng Eval_rev1_WELLS RANCH AA12, AE07,T6N-R63W-S12 L01	xlsm	7-28-20016	Revised Tank VOC Analysis
STEM Engineering Evaluation_WR AE07,AA12 Econode	xlsm	4/28/2015	Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
N/A			

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH AA12, AE07, AA12 ECONODE T6N-R63W-S12 L01 IR VERIFICATION	pdf	4/23/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH AA12, AE07, AA12 ECONODE T6N-R63W-S12 L01 WALKDOWN	pdf	5/13/2015	IR Camera Verification Sheet
WELLS RANCH AA12, AE07, AA12 ECONODE T6N-R63W-S12 L01_0666_normal	mp4	5/13/2015	IR Camera Video
WELLS RANCH AA12, AE07, AA12 ECONODE T6N-R63W-S12 L01_0667_dump	mp4	5/13/2015	IR Camera Video
WELLS RANCH AA12, AE07, AA12 ECONODE T6N-R63W-S12 L01_0668_post	mp4	5/13/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH AA12, AE07, AA12 ECONODE T6N-R63W-S12 L01_SIGNED EVAL	pdf	5/26/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WELLS RANCH AA12, AE07, AA12 ECONODE T6N-R63W-S12 L01**

Consent Decree Tank System Number: **1973**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**18**
Oil Tank Capacity (bbl):	**500**
# of Water Tanks:	**6**
Water Tank Capacity (bbl):	**500**
VOC Line Size (in):	**4**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**						
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10	Vessel 11	Vessel 12
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**		
Dump Valve Size & Trim Size (in)	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 3/4"**	**2" & 3/4"**		

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig) 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**	**Cimarron 48 HV**	**Cimarron 48 HV**
Man. Capacity (MSCFD)	**109.272**	**109.272**	**109.272**	**109.272**

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**41,351**	**48,498**	**17%**
Calculated Burner Capacity (scfh)	**12,600**	**18,212**	
Headspace Surge Capacity (scfh)	**199,207**	**0**	
Total VCS Capacity (scfh)	**211,807**	**18,212**	
VCS Capacity minus PPIVF (scfh)	**170,456**	**-30,286**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	6/6/2016 & 12/2/2016 & 5/1/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	6/17/2016 & 12/13/2016

LOD ID: **WELLS RANCH AA12, AE07, AA12 ECONODE T6N-R63W-S12 L01**
Consent Decree Tank System Number: **1973**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**-0.90**	**-0.90**						
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**						
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**						
Critical Pressure (psia)[b]	**833**	**833**						
Vapor Pressure (psia)[c]	**407**	**407**						
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**6905**	**6905**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**158.2**	**158.2**						
Working Flow (Mscfd)[h,i]	**66**	**66**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10	Vessel 11	Vessel 12
Valve Press Recovery Factor (C_f)	**0.78**	**0.78**	**0.78**	**0.78**	**0.78**	**0.78**	**0.78**	**0.78**	**0.80**	**0.80**		
Valve Coefficent (gpm/psi) (C_v)	**7.20**	**7.20**	**7.20**	**7.20**	**7.20**	**7.20**	**7.20**	**7.20**	**12.20**	**12.20**		
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**		
Vapor Pressure (psia)[k]	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**		
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**		
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**		
Peak Flow (bwpd)[f,g]	**3906**	**3906**	**3906**	**3906**	**3906**	**3906**	**3906**	**3906**	**6789**	**6789**		

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10	Vessel 11	Vessel 12
Flash Flow (Mscfd)	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**27**	**27**		
Working Flow (Mscfd)[l]	**22**	**22**	**22**	**22**	**22**	**22**	**22**	**22**	**38**	**38**		

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**500**	**500**
scfh vapor/tank[i]	**396**	**396**
Mscfd	**171**	**114**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**13,179**	**10,812**
Oil Tank Working Rate	**5,473**	**5,459**
Water Tank Flash Rate	**7,471**	**7,471**
Water Tank Working Rate	**10,487**	**10,487**
Tank Breathing Rate	**11,887**	**9,510**
Total	**48,498**	**43,739**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WELLS RANCH AA12, AE07, AA12 ECONODE T6N-R63W-S12 L01**

Consent Decree Tank System Number: **1973**

Audit Notes

-File names of "walkdown" and "IR Verification" switched.

-Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

-Final walkdown indicates that the tanks are not banked. Signed evaluation indicates that the tanks are banked. SLR used the confirmed configuration in the final walkdown.

-Noble did not account for breathing losses from all tanks. SLR used an unbanked confirguration per the final walkdown.

-The resulting headspace surge capacity is 0 when the correct number and configuration of tanks is used in Noble's STEM Engineering Evaluation Spreadsheet.

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original STEM Engineering Evaluation_WR AE07,AA12 Econode.xlsm and was changed to 11 oz/in^2 in the modified STEM Eng Eval_rev1_WELLS RANCH AA12, AE07,T6N-R63W-S12 L01.xlsm file.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

UPDATE: Noble confirmed accuracy of existing Engineering Evaluation that the tanks are banked and is provided in the attached email correspondence (Attachment N).

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WELLS RANCH AA14, AA16 ECONODE T6N-R63W-S14 L01**

Consent Decree Tank System Number: **1966**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
WELLS RANCH AA14, AA16 ECONODE T6N-R63W-S14 L01_FINAL PACKET	pdf	7/29/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH AA14, AA16 ECONODE T6N-R63W-S14 L01_SIGNED EVAL	pdf	5/26/2015	Engineering Evaluation
STEM Eng Eval_rev1_WELLS RANCH AA14, AA16 T6N-R63W-S14 L01	xlsm	11/21/2016	Revised Tank VOC Analysis
STEM Engineering Evaluation_WR AA 14,16 Econode	xlsm	5/22/2015	Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH AA14, AA16 ECONODE T6N-R63W-S14 L01_FINAL PACKET	pdf	7/29/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH AA14, AA16 ECONODE T6N-R63W-S14 L01 WALKDOWN	pdf	4/30/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH AA24, AA23 BOB AA24 ECONODE T6N-R63W-S24 L01 IR VERIFICATION	pdf	5/13/2015	IR Camera Documentation Field Data Sheet
WELLS RANCH AA14, AA16 ECONODE T6N-R63W-S14 L01_0669_normal	mp4	5/13/2015	IR Video of site during normal operation
WELLS RANCH AA14, AA16 ECONODE T6N-R63W-S14 L01_0670_dump	mp4	5/13/2015	IR Video of site during separator dump event
WELLS RANCH AA14, AA16 ECONODE T6N-R63W-S14 L01_0671_post	mp4	5/13/2015	IR Video of site post dump event

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH AA14, AA16 ECONODE T6N-R63W-S14 L01_SIGNED EVAL	pdf	5/26/2015	Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WELLS RANCH AA14, AA16 ECONODE T6N-R63W-S14 L01**

Consent Decree Tank System Number: **1966**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**18**
Oil Tank Capacity (bbl):	**500**
# of Water Tanks:	**6**
Water Tank Capacity (bbl):	**500**
VOC Line Size (in):	**6**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**						
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig) 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**	**COMM 200 48"**	**COMM 200 48"**
Man. Capacity (MSCFD)	**109.272**	**109.272**	**157**	**157**

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**70,175**	**73,757**	**5%**
Calculated Burner Capacity (scfh)	**13,123**	**22,189**	
Headspace Surge Capacity (scfh)	**188,181**	**239,625**	
Total VCS Capacity (scfh)	**201,304**	**261,814**	
VCS Capacity minus PPIVF (scfh)	**131,129**	**188,057**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	6/6/2016 & 12/2/2016 & 5/1/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	6/20/2016 & 12/13/2016

SLR

LOD ID: **WELLS RANCH AA14, AA16 ECONODE T6N-R63W-S14 L01**
Consent Decree Tank System Number: **1966**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**-0.90**	**-0.90**						
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**						
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**						
Critical Pressure (psia)[b]	**833**	**833**						
Vapor Pressure (psia)[c]	**407**	**407**						
Critical pressure ratio (F_F)[d]	**0.76**	**0.76**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**6905**	**6905**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**158.2**	**158.2**						
Working Flow (Mscfd)[h,i]	**66**	**66**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10	Vessel 11	Vessel 12
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**		
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**	**21.25**	**21.25**	**21.25**	**21.25**	**21.25**	**21.25**	**21.25**		
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**		
Vapor Pressure (psia)[k]	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**		
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**		
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**		
Peak Flow (bwpd)[f,g]	**11381**	**11381**	**11381**	**11381**	**11381**	**11381**	**11381**	**11381**	**11381**	**11381**		

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10	Vessel 11	Vessel 12
Flash Flow (Mscfd)	**46**	**46**	**46**	**46**	**46**	**46**	**46**	**46**	**46**	**46**		
Working Flow (Mscfd)[l]	**64**	**64**	**64**	**64**	**64**	**64**	**64**	**64**	**64**	**64**		

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**500**	**500**
scfh vapor/tank[i]	**396**	**396**
Mscfd	**171**	**57**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**13,179**	**13,179**
Oil Tank Working Rate	**5,473**	**5,459**
Water Tank Flash Rate	**18,969**	**18,968**
Water Tank Working Rate	**26,626**	**26,625**
Tank Breathing Rate	**9,510**	**5,994**
Total	**73,757**	**70,225**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WELLS RANCH AA14, AA16 ECONODE T6N-R63W-S14 L01**

Consent Decree Tank System Number: **1966**

Audit Notes

-Venting in "dump" and "post" IR videos.

The walkdown pdf (WELLS RANCH AA14, AA16 ECONODE T6N-R63W-S14 L01 WALKDOWN.pdf) and the field data sheets (WELLS RANCH AA14, AA16 ECONODE T6N-R63W-S14 L01_FINAL PACKET.pdf) shows nine (9) oil production tanks and three (3) produced water tanks per bank. The signed evaluation pdf (WELLS RANCH AA14, AA16 ECONODE T6N-R63W-S14 L01_SIGNED EVAL.pdf) shows twelve (12) oil production tanks and three (3) produced water tanks per bank. The review of IR Videos indicates there are 12 tanks per bank/row (24 tanks total).

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

Noble did not include breathing losses from the non-producing tank bank. All tanks were included in SLR's calculations to account for breathing losses from all tanks.

"VOC Design Tank Pressure" was originally 11 oz/in^2 in the original STEM Engineering Evaluation_WR AA 14,16 Econode.xlsm and was changed to 13 oz/in^2 in the modified STEM Eng Eval_rev1_WELLS RANCH AA14, AA16 T6N-R63W-S14 L01.xlsm file.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

UPDATE: Noble agrees that Engineering Evaluation was incorrect. Updated Engineering Evaluation was generated and submitted with Noble's Semi-Annual Report (6th) (January 29, 2018).

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WELLS RANCH AA24, AA23, BOB AA24 ECONODE T6N-R63W-S24 L01**

Consent Decree Tank System Number: **1980**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
WELLS RANCH AA24, AA23, BOB AA24 ECONODE T6N-R63W-S24 L01_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH AA24, AA23, BOB AA24 ECONODE T6N-R63W-S24 L01_SIGNED EVAL	pdf	5/26/2015	Engineering Evaluation
STEM Eng Eval_rev1_WELLS RANCH AA24 T6N-R63W-S24 L01	xlsm	11/21/2016	Revised Tank VOC Analysis
STEM Engineering Evaluation_WR AA23,24 Econode	xlsm	4/15/2015	Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
N/A			

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH AA24, AA23 BOB AA24 ECONODE T6N-R63W-S24 L01 WALKDOWN	pdf	4/23/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH AA24, AA23 BOB AA24 ECONODE T6N-R63W-S24 L01 IR VERIFICATION	pdf	5/13/2015	IR Camera Verification Sheet
WELLS RANCH AA24, AA23 BOB AA24 ECONODE T6N-R63W-S24 L01_0672_normal	mp4	5/13/2015	IR Camera Video
WELLS RANCH AA24, AA23 BOB AA24 ECONODE T6N-R63W-S24 L01_0673_dump	mp4	5/13/2015	IR Camera Video
WELLS RANCH AA24, AA23 BOB AA24 ECONODE T6N-R63W-S24 L01_0674_post	mp4	5/13/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH AA24, AA23, BOB AA24 ECONODE T6N-R63W-S24 L01_SIGNED EVAL	pdf	5/26/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WELLS RANCH AA24, AA23, BOB AA24 ECONODE T6N-R63W-S24 L01**

Consent Decree Tank System Number: **1980**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**18**
Oil Tank Capacity (bbl):	**500**
# of Water Tanks:	**6**
Water Tank Capacity (bbl):	**500**
VOC Line Size (in):	**6**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**						
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig) 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**	**Cimarron 48 HV**	**Cimarron 48 HV**
Man. Capacity (MSCFD)	**109.272**	**109.272**	**109.272**	**109.272**

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**68,986**	**73,757**	**7%**
Calculated Burner Capacity (scfh)	**12,600**	**18,212**	
Headspace Surge Capacity (scfh)	**250,666**	**250,666**	
Total VCS Capacity (scfh)	**263,266**	**268,878**	
VCS Capacity minus PPIVF (scfh)	**194,280**	**195,121**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	6/6/2016 & 12/2/2016 & 5/1/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	6/20/2016 & 12/13/2016

SLR

LOD ID: **WELLS RANCH AA24, AA23, BOB AA24 ECONODE T6N-R63W-S24 L01**
Consent Decree Tank System Number: **1980**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**-0.90**	**-0.90**						
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**						
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**						
Critical Pressure (psia)[b]	**833**	**833**						
Vapor Pressure (psia)[c]	**407**	**407**						
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**6905**	**6905**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**158.2**	**158.2**						
Working Flow (Mscfd)[h,i]	**66**	**66**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10	Vessel 11	Vessel 12
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**		
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**	**21.25**	**21.25**	**21.25**	**21.25**	**21.25**	**21.25**	**21.25**		
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**		
Vapor Pressure (psia)[k]	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**		
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**		
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**		
Peak Flow (bwpd)[f,g]	**11381**	**11381**	**11381**	**11381**	**11381**	**11381**	**11381**	**11381**	**11381**	**11381**		

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10	Vessel 11	Vessel 12
Flash Flow (Mscfd)	**46**	**46**	**46**	**46**	**46**	**46**	**46**	**46**	**46**	**46**		
Working Flow (Mscfd)[l]	**64**	**64**	**64**	**64**	**64**	**64**	**64**	**64**	**64**	**64**		

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**500**	**500**
scfh vapor/tank[i]	**396**	**396**
Mscfd	**171**	**57**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**13,179**	**13,179**
Oil Tank Working Rate	**5,473**	**5,459**
Water Tank Flash Rate	**18,969**	**18,968**
Water Tank Working Rate	**26,626**	**26,625**
Tank Breathing Rate	**9,510**	**4,755**
Total	**73,757**	**68,986**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WELLS RANCH AA24, AA23, BOB AA24 ECONODE T6N-R63W-S24 L01**

Consent Decree Tank System Number: **1980**

Audit Notes

Venting observed in the "dump" and "post" IR Camera videos.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

Noble did not include breathing losses from non-producing tank bank. SLR included breathing losses from all tanks in its calculations. Configuration has two banks - each with 9 oil tanks and 3 water tanks.

Engineering Evaluation Audit conservatively used 2" valve w/ 1" trim size for all separator dumps. Matches the Signed Engineering Evaluation (WELLS RANCH AA24, AA23, BOB AA24 ECONODE T6N-R63W-S24 L01_SIGNED EVAL.pdf).

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WELLS RANCH AA25 & 26 T6N-R63W-S25 L01**

Consent Decree Tank System Number: **346**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
WELLS RANCH AA25 & 26 ECONODE T6N-R63W-S25 L01_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH AA25 & 26 ECONODE T6N-R63W-S25 L01_Signed eval 2	pdf	6/29/2015	Engineering Evaluation
STEM Engineering Evaluation_WR 25,26 Econode_06-12-15 Update	xlsm	6/12/2016	Tank VOC Analysis
STEM Eng Eval_rev1_WELLS RANCH AA25 & 26 ECONODE T6N-R63W-S25 L01	xlsm	7/28/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
0015 - Wells Ranch 25,26 Econode Work Request	xlsx	4/8/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH AA25 & 26 T6N-R63W-S25 L01 WALKDOWN	pdf	4/29/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH AA25 & 26 T6N-R63W-S25 L01 IR VERIFICATION	pdf	5/12/2015	IR Camera Verification Sheet
WELLS RANCH AA25 & 26 T6N-R63W-S25 L01_0675_normal	mp4	5/13/2015	IR Camera Video
WELLS RANCH AA25 & 26 T6N-R63W-S25 L01_0676_dump	mp4	5/13/2015	IR Camera Video
WELLS RANCH AA25 & 26 T6N-R63W-S25 L01_0678_post	mp4	5/13/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH AA25 & 26 ECONODE T6N-R63W-S25 L01_Signed eval 2	pdf	6/29/2015	Signed Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WELLS RANCH AA25 & 26 T6N-R63W-S25 L01**

Consent Decree Tank System Number: **346**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**18**
Oil Tank Capacity (bbl):	**500**
# of Water Tanks:	**6**
Water Tank Capacity (bbl):	**500**
VOC Line Size (in):	**4**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10	Vessel 11	Vessel 12	Vessel 13
Max Operating Pressure (psig)	**125**	**125**	**125**	**125**	**125**	**125**	**125**	**125**	**125**	**125**	**125**	**125**	**125**
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**3" & 2"**	**2" & 1"**

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10	Vessel 11	Vessel 12	Vessel 13	Vessel 14	Vessel 15	Vessel 16	Vessel 17
Max Operating Pressure (psig)	**125**	**125**	**125**	**125**	**125**	**125**	**125**	**125**	**125**	**125**	**125**	**125**	**125**	**400**	**400**	**400**	**400**
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**

VRT Installed?	☑ Yes ☐ No
VRT Shut in Pressure (psig)	12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**	**Cimarron 48 HV**	**Cimarron 48 HV**
Man. Capacity (MSCFD)	**109.272**	**109.272**	**109.272**	**109.272**

	Noble	SLR	Percent Difference
Calculated PPIVF (scfh)	**144,023**	**155,246**	**8%**
Calculated Burner Capacity (scfh)	**12,600**	**18,212**	
Headspace Surge Capacity (scfh)	**271,406**	**292,027**	
Total VCS Capacity (scfh)	**284,006**	**310,239**	
VCS Capacity minus PPIVF (scfh)	**139,983**	**154,993**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	7/6/2016 & 12/2/2016 & 5/1/2017
Audit Document Review Verified by:	Angela M. Oberlander & James Van Horne
Audit Document Verification Date:	8/5/2016 & 12/14/2016 & 5/25/2017

SLR

LOD ID: **WELLS RANCH AA25 & 26 T6N-R63W-S25 L01**

Consent Decree Tank System Number: **346**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10	Vessel 11	Vessel 12	Vessel 13	Vessel 14	Vessel 15	Vessel 16	Vessel 17
Z1	-1.02	-1.02	-1.02	-1.02	-1.02	-1.02	-1.02	-1.02	-1.02	-1.02	-1.02	-1.02	1.39				
Z2	-0.86	-0.86	-0.86	-0.86	-0.86	-0.86	-0.86	-0.86	-0.86	-0.86	-0.86	-0.86	-0.86				
Z3	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98				
Z	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	1.50				
Gas/Oil Ratio (scf/bbl)	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	221.0				

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10	Vessel 11	Vessel 12	Vessel 13	Vessel 14	Vessel 15	Vessel 16	Vessel 17
Valve Press Recovery Factor (C_f)	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.75	0.77				
Valve Coefficent (gpm/psi) (C_v)	21.25	21.25	21.25	21.25	21.25	21.25	21.25	21.25	21.25	21.25	21.25	52.60	21.25				
Critical Pressure (psia)[b]	588	588	588	588	588	588	588	588	588	588	588	588	588				
Vapor Pressure (psia)[c]	138	138	138	138	138	138	138	138	138	138	138	138	138				
Critical pressure ratio (F_F) [d]	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82				
Choked Flow?[e]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes				
Peak Flow (bopd)[f,g]	3368	3368	3368	3368	3368	3368	3368	3368	3368	3368	3368	8121	3368				

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10	Vessel 11	Vessel 12	Vessel 13	Vessel 14	Vessel 15	Vessel 16	Vessel 17
Flash Flow (Mscfd)	77.1	77.1	77.1	77.1	77.1	77.1	77.1	77.1	77.1	77.1	77.1	186.0	744.3				
Working Flow (Mscfd)[h,i]	32	32	32	32	32	32	32	32	32	32	32	77	32				

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10	Vessel 11	Vessel 12	Vessel 13	Vessel 14	Vessel 15	Vessel 16	Vessel 17
Valve Press Recovery Factor (C_f)	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77
Valve Coefficent (gpm/psi) (C_v)	21.25	21.25	21.25	21.25	21.25	21.25	21.25	21.25	21.25	21.25	21.25	21.25	21.25	21.25	21.25	21.25	21.25
Critical Pressure (psia)[j]	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200	3200
Vapor Pressure (psia)[k]	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Critical pressure ratio (F_F)[d]	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Choked Flow?[e]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Peak Flow (bwpd)[f,g]	6557	6557	6557	6557	6557	6557	6557	6557	6557	6557	6557	6557	6557	11381	11381	11381	11381

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10	Vessel 11	Vessel 12	Vessel 13	Vessel 14	Vessel 15	Vessel 16	Vessel 17
Flash Flow (Mscfd)	26	26	26	26	26	26	26	26	26	26	26	26	26	46	46	46	46
Working Flow (Mscfd)[i]	37	37	37	37	37	37	37	37	37	37	37	37	37	64	64	64	64

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	500	500
scfh vapor/tank[i]	396	396
Mscfd	171	57

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	74,118	69,583
Oil Tank Working Rate	19,233	17,307
Water Tank Flash Rate	21,794	21,791
Water Tank Working Rate	30,591	30,587
Tank Breathing Rate	9,510	4,755
Total	155,246	144,023

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WELLS RANCH AA25 & 26 T6N-R63W-S25 L01**

Consent Decree Tank System Number: **346**

Audit Notes

IR Camera videos do not clearly show all tanks.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

The engineering evaluation (WELLS RANCH AA25 & 26 ECONODE T6N-R63W-S25 L01_Signed eval 2.pdf) was completed with a oil dump valve size on the Bulk LP Separator of 2" with a 1" trim. The field data sheets (WELLS RANCH AA25 & 26 ECONODE T6N-R63W-S25 L01_FINAL PACKET.pdf) indicate it is a 3" valve with a 2" trim.

Noble modeled the 25-69 separator as dumping directly to the tanks (i.e. it does not go through the VRT). SLR utilized the same approach in our calculations.

-Noble did not include breathing losses from non-producing tank bank. SLR included breathing losses from all tanks in its calculations. Configuration has two banks - each with 9 oil tanks and 3 water tanks.

"VOC Design Tank Pressure" was originally 11 oz/in^2 in the original STEM Engineering Evaluation_WR 25,26 Econode_06-12-15 Update.xlsm and was changed to 13 oz/in^2 in the modified STEM Eng Eval_rev1_WELLS RANCH AA25 & 26 ECONODE T6N-R63W-S25 L01.xlsm file.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

UPDATE: Noble confirmed accuracy of existing Engineering Evaluation. Although the dump valve is 3" body with 2" trim, there is an orifice plate downstream of the valve to further restrict flow. Facility P&ID (Attachment K) documents the restriction orifice location and size.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WELLS RANCH AE05, 06 ECONODE T6N-R62W-S6 L01**

Consent Decree Tank System Number: **1967**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
WELLS RANCH AE05, 06 ECONODE T6N-R62W-S6 L01_FINAL PACKET	pdf	7/29/2015	Final Facility Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH AE05, 06 ECONODE T6N-R62W-S6 L01_SIGNED EVAL	pdf	5/26/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_WR 5-6	xlsm	4/30/2015	STEM Engineering Evaluation Spreadsheet
STEM Eng Eval_rev1_WELLS RANCH AE05, 06 ECONODE T6N-R62W-S6 L01	xlsm	11/22/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH AE05, 06 ECONODE T6N-R62W-S6 L01_FINAL PACKET	pdf	7/29/2015	Work Request (In Final Packet)

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH AE05, 06 ECONODE T6N-R62W-S6 L01 WALKDOWN	pdf	4/29/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH AE05, 06 ECONODE T6N-R62W-S6 L01_0660_normal	mp4	5/13/2015	IR Video of site during normal operation
WELLS RANCH AE05, 06 ECONODE T6N-R62W-S6 L01_0661_normal	mp4	5/13/2015	IR Video of site during normal operation (2)
WELLS RANCH AE05, 06 ECONODE T6N-R62W-S6 L01_0662_dump	mp4	5/13/2015	IR Video of site during separator dump event
WELLS RANCH AE05, 06 ECONODE T6N-R62W-S6 L01_0663_dump	mp4	5/13/2015	IR Video of site during separator dump event (2)
WELLS RANCH AE05, 06 ECONODE T6N-R62W-S6 L01_0664_post	mp4	5/13/2015	IR Video of site post dump event
WELLS RANCH AE05, 06 ECONODE T6N-R62W-S6 L01_0665_post	mp4	5/13/2015	IR Video of site post dump event (2)
WELLS RANCH CPF T6N-R63W-S21 L01 IR VERIFICATION	pdf	5/13/2015	IR Camera Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH AE05, 06 ECONODE T6N-R62W-S6 L01_SIGNED EVAL	pdf	5/26/2015	Signed Engineering Design Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WELLS RANCH AE05, 06 ECONODE T6N-R62W-S6 L01**

Consent Decree Tank System Number: **1967**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**9**
Oil Tank Capacity (bbl):	**500**
# of Water Tanks:	**3**
Water Tank Capacity (bbl):	**500**
VOC Line Size (in):	**6"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**100**	**100**	**100**	**100**	**100**		
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**		

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**		
Man. Capacity (MSCFD)	**109.272**	**109.272**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**470,396**	**470,418**	**0%**
Calculated Burner Capacity (scfh	**7,393**	**9,106**	
Headspace Surge Capacity (scfh)	**1,512,751**	**1,512,751**	
Total VCS Capacity (scfh)	**1,520,144**	**1,521,857**	
VCS Capacity minus PPIVF (scfh)	**1,049,748**	**1,051,439**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	4/19/2016 & 12/2/2016 & 4/26/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	5/13/2016 & 12/14/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WELLS RANCH AE05, 06 ECONODE T6N-R62W-S6 L01**

Consent Decree Tank System Number: **1967**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**2.42**	**1.16**	**1.16**	**1.16**	**1.16**	**1.16**		
Z2	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**	**-0.86**		
Z3	**0.98**	**0.98**	**0.98**	**0.98**	**0.98**	**0.98**		
Z	**2.53**	**1.27**	**1.27**	**1.27**	**1.27**	**1.27**		
Gas/Oil Ratio (scf/bbl)	**1229.6**	**167.8**	**167.8**	**167.8**	**167.8**	**167.8**		

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**	**0.77**		
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**	**21.25**	**21.25**	**21.25**	**21.25**		
Critical Pressure (psia)[b]	**833**	**566**	**566**	**566**	**566**	**566**		
Vapor Pressure (psia)[c]	**407**	**113**	**113**	**113**	**113**	**113**		
Critical pressure ratio (F_F) [d]	**0.76**	**0.84**	**0.84**	**0.84**	**0.84**	**0.84**		
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**		
Peak Flow (bopd)[f,g]	**6905**	**2954**	**2954**	**2954**	**2954**	**2954**		

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**8491.3**	**495.7**	**495.7**	**495.7**	**495.7**	**495.7**		
Working Flow (Mscfd)[h,i]	**66**	**28**	**28**	**28**	**28**	**28**		

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**500**	**500**
scfh vapor/tank[i]	**396**	**396**
Mscfd	**86**	**29**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**457,075**	**457,075**
Oil Tank Working Rate	**8,588**	**8,567**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**4,755**	**4,755**
Total	**470,418**	**470,397**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WELLS RANCH AE05, 06 ECONODE T6N-R62W-S6 L01**

Consent Decree Tank System Number: **1967**

Audit Notes

-Provided Engineering Evaluation states that "Only the Sales Gas Scrubber and compressor scrubbers dump to the tanks"

-Tank Venting during all 6 IR videos. Videos only captured venting, not entire facility.

-Facility has 2 banks of tanks each with 9 oil and 3 water tanks. Each bank has it's own set of 2 cimarron 48" combustors.

Engineering Evaluation Verification Audit
Consent Decree (90-5-2-1-10811) – 1:15-cv-00841 RBJ
LOD ID: Wells Ranch Central Processing Facility (CPF) [T6N-R63W-S21 L01]
Consent Decree Tank System Number: 2376

The Wells Ranch Central Processing Facility (CPF) engineering design review of the Vapor Control System (VCS) was completed by determining the volume of vapors generated from the facility produced water and processed oil storage tanks. These vapors included flashing for the twelve (12) facility oil storage tanks and working and breathing for both the oil and the four (4) water storage tanks. The vapors were summed and safety factors applied and input into the Aspen HYSYS® steady state process model. The model was used to determine pressure losses of the vapor flow within the VCS and verify the pressures feeding the Vapor Recover Unit (VRU) re-compression system could be met without causing the tank pressures to exceed pressure relief settings.

Determination of Flashing Vapors

Flashing vapors were evaluated for the facility oil storage tanks only. A facility Aspen HYSYS® process model for Phase 1 or 2 with a raw oil input of 22,000 bpd, and an associated oil composition, as well as inlet water input of 6,820 bpd was utilized to determine flashing vapors. The model equation of state (EOS) was provided as Peng-Robinson, which is appropriate for modeling organic compounds. The model results determine flash vapors resulting from each facility Phase of 1.70 MMSCFD (3.4 MMSCFD facility total) which equates to 0.2839 MMSCFD/tank or 11,829 scf/hr/tank.

Determination of Working Vapors

Tank working losses were assessed for all facility bulk storage tanks through a volume displacement calculation which assumes any liquids entering a tank will displace an equal volume of tank vapors. For the oil tanks, a production rate of 59,400 bpd, which exceeds the facility capacity of 44,000 bpd by 35%, was used by Noble to determine displacement vapors. For the water tanks, a production rate of 6,820 bpd, which is the inlet water rate with no safety factor, was used by Noble to determine displacement vapors. The HYSYS® process model indicates the produced water production rate throughput of the water storage tank is 6,933 bpd, indicating water in the raw oil is stripped from the oil and coalesced with the processing water. Working vapors from the oil storage tanks were estimated by Noble to be 0.02779 MMSCFD/tank or 1,158 scf/hr/tank. Working vapors from the water storage tanks were estimated by Noble to be 0.01915 MMSCFD/tank or 798 scf/hr/tank.

SLR estimated the working vapors based on the storage tank liquid throughputs predicted by the HYSYS® model. The model sales oil was predicted to be 20,498 bpd, resulting in an oil storage tank vapor displacement of 799 scf/hr/tank. The model produced water was predicted to be 6,933 bpd, resulting in a water storage tank vapor displacement of 811 scf/hr/tank.

Determination of Breathing Vapors

Tank breathing vapors were assessed for all facility bulk storage tanks but the method applied by Noble to evaluate such breathing losses was not a recognized methodology such as API STD 2000 or AP-42 Chapter 7. All facility oil and water storage tanks were documented as 8,000 bbl capacity and by applying API STD 2000, as Noble has done to determine breathing losses for other wellsite facilities, estimated vapors from both water and oil storage tanks were determined to be 0.1522 MMSCFD/tank or 6,340 scf/hr/tank.

Peak Potential Instantaneous Vapor Flow Rate (PPIVFR)

The PPIVFR was determined by summing the flashing, working, and breathing vapors from the oil storage tanks and the working and breathing vapors from the water storage tanks. The Noble design evaluation documents do not indicate any additional sources of vapor, such as loading systems, controlled pneumatics, etc., are introduced into or captured by the VCS which would need to be included in the PPIVFR determination. Noble's determined PPIVFR was 200,503 scfh, whereas SLR determined the PPIVFR to be 255,940 scfh. The discrepancy is largely due to the applied methods for calculating tank breathing losses.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

Vapor Control System Capacity

In follow up communication with Noble personnel, information was provided which indicated there are three VRU units for each phase resulting in a total of six VRUs capturing vapor from the facility storage tanks. It was indicated that each VRU unit capacity was 1.045 MMSCFD resulting in a total of 3.14 MMSCFD/phase or 6.27 MMCSFD/facility. VRU manufacturer information was not specified and could not be verified, but the provided written Engineering Design Review Summary indicated the minimum VRU suction pressure of 3 oz-gauge is required for operation. Additionally, the Aspen HYSYS® design hydraulic model outputs utilized a storage tank operating pressure of 12.9 oz-gauge with the resulting VRU suction pressures ranging from 3.364 – 4.221 oz-gauge and VRU feed flowrates of 0.8041 MMSCFD/VRU for Phase 1. The Phase 2 hydraulic model resulted in VRU suction pressures ranging from 8.940-9.083 oz-gauge and VRU feed flowrates of 0.8020 MMSCFD/VRU. Each design case evaluated would indicate the current Phase 1 and Phase 2 VCS systems are adequately sized to handle the PPIVFR.

A maximum hydraulic model was completed for both Phase 1 and Phase 2 where the storage tank operating pressure of 16 oz-gauge, the storage tank thief hatch setting, was entered in Aspen HYSYS®. The maximum hydraulic model included higher PPIVFRs for both Phases. The increased model flowrates did not correlate to the percentages indicated in the written Engineering Design Review Summary, and as such, SLR did not have another means to verify their correctness. While the Phase 1 model increased PPVFR was below the provided VRU capacity at 3 oz-guage, the Phase 2 model increased PPIVFR exceeded the provided VRU capacity, indicating a possibly inadequate VCS capacity at the higher tank operating pressures.

Engineering Evaluation Verification Audit
Consent Decree (90-5-2-1-10811) – 1:15-cv-00841 RBJ
LOD ID: Wells Ranch Central Processing Facility (CPF) [T6N-R63W-S21 L01]
Consent Decree Tank System Number: 2376

Wells Ranch CPF VCS Engineering Evaluation
Hysys Design Throughput Model Summary

Vapor Source	Units	Per Phase
PPIVFR (Phase 1)	scfh	100,513
VCS (Total Capacity - Phase 1)	scfh	130,625
VCS Capacity minus PPIVF	scfh	**30,113**
PPIVFR (Phase 2)	scfh	100,250
VCS (Total Capacity - Phase 2))	scfh	130,625
VCS Capacity minus PPIVF	scfh	**30,375**

Wells Ranch CPF VCS Engineering Evaluation
Hysys Max Throughput Model Summary

Vapor Source	Units	Per Phase
PPIVFR (Phase 1)	scfh	116,288
VCS (Total Capacity - Phase 1)	scfh	130,625
VCS Capacity minus PPIVF	scfh	**14,338**
PPIVFR (Phase 2)	scfh	140,000
VCS (Total Capacity - Phase 2))	scfh	130,625
VCS Capacity minus PPIVF	scfh	**-9,375**

PPVFR and VCS Capacity Summary

Wells Ranch CPF VCS Engineering Evaluation Comparison

Vapor Source	Units	Noble			SLR			Difference
		Per Tank	Per Phase	Total	Per Tank	Per Phase	Total	
Flashing Losses (oil tanks only)	scfh	11,829	70,975	141,950	11,806	70,833	141,667	---
Working Losses (oil tanks)	scfh	1,158	6,948	13,895	799	4,795	9,591	45%
Working Losses (water tanks)	scfh	798	1,596	3,192	811	1,622	3,244	-2%
Breathing Losses (water & oil tanks)	scfh	2,592	20,733	41,467	6,340	50,719	101,439	-59%
PPIVFR	scfh	---	100,252	200,503	---	127,970	255,940	-22%
VCS (Total Capacity)	scfh	---	130,625	261,250	---	130,625	261,250	---
VCS Capacity minus PPIVF	scfh		30,373	**60,747**		2,655	**5,310**	1044%

Verification Audit Summary

☒ Yes ☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☒ Yes ☐ No	VCS Engineering Evaluation includes applicable emissions sources?
☒ Yes ☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☒ Yes ☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☒ Yes ☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☒ Yes ☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by: Angela M. Oberlander

Audit Document Review Date: 8/30/2016

Audit Document Review Verified by: James Van Horne

Audit Document Verification Date: 12/30/2016

Engineering Evaluation Verification Audit
Consent Decree (90-5-2-1-10811) – 1:15-cv-00841 RBJ
LOD ID: Wells Ranch Central Processing Facility (CPF) [T6N-R63W-S21 L01]
Consent Decree Tank System Number: 2376

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WELLS RANCH USX AE18, AA13 ECONODE T6N-R62W-S18 L0**

Consent Decree Tank System Number: **1981**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
WELLS RANCH USX AE18, AA13 ECONODE T6N-R62W-S18 L0_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH USX AE18, AA13 ECONODE T6N-R62W-S18 L0_SIGNED EVAL	pdf	5/26/2015	Engineering Evaluation
STEM Engineering Evaluation_WR AE18,AA13 Econode	xlsm	4/15/2015	Tank VOC Analysis
STEM Eng Eval_rev1_WELLS RANCH USX AE18 T6N-R62W-S18 L0	xlsm	7/28/2016	Revised Tank VOC Analysis
Attachmnet P - STEM Eng Eval_rev1_WELLS RANCH USX AE18, AA13.xlsm	xlsm	2/2/2017	Revised Tank VOC Analysis 2

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
Noble 3rd Party Audi Wave 12 Update Info Request_20170117	pdf	1/17/2017	Information Request Response

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH USX AE18 AA13 ECONODE T6N-R62W-S18 L01 WALKDOWN	pdf	4/23/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH USX AE18 AA13 ECONODE T6N-R62W-S18 L01 IR VERIFICATION	pdf	5/19/2015	IR Camera Verification Sheet
WELLS RANCH USX AE18 AA13 ECONODE T6N-R62W-S18 L01_0657_normal	mp4	5/13/2015	IR Camera Video
WELLS RANCH USX AE18 AA13 ECONODE T6N-R62W-S18 L01_0658_dump	mp4	5/13/2015	IR Camera Video
WELLS RANCH USX AE18 AA13 ECONODE T6N-R62W-S18 L01_0659_post	mp4	5/13/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
WELLS RANCH USX AE18, AA13 ECONODE T6N-R62W-S18 L0_SIGNED EVAL	pdf	5/26/2015	Signed Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WELLS RANCH USX AE18, AA13 ECONODE T6N-R62W-S18 L0**

Consent Decree Tank System Number: **1981**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**18**
Oil Tank Capacity (bbl):	**500**
# of Water Tanks:	**6**
Water Tank Capacity (bbl):	**500**
VOC Line Size (in):	**4**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**						
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**
Dump Valve Size & Trim Size (in)	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**	**2" & 3/4"**	**2" & 3/4"**

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**	**Cimarron 48 HV**	**Cimarron 48 HV**
Man. Capacity (MSCFD)	**109.272**	**109.272**	**109.272**	**109.272**

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**41,351**	**46,121**	**12%**
Calculated Burner Capacity (scfh)	**12,600**	**18,212**	
Headspace Surge Capacity (scfh)	**156,715**	**156,715**	
Total VCS Capacity (scfh)	**169,315**	**174,927**	
VCS Capacity minus PPIVF (scfh)	**127,964**	**128,806**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	8/5/2016 & 12/2/2016 & 5/2/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	8/26/2016 & 12/14/2016

SLR

LOD ID: **WELLS RANCH USX AE18, AA13 ECONODE T6N-R62W-S18 L0**

Consent Decree Tank System Number: **1981**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**-1.02**	**-1.02**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**-0.90**	**-0.90**						
Gas/Oil Ratio (scf/bbl)	**22.9**	**22.9**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**	**0.77**						
Valve Coefficent (gpm/psi) (C_v)	**21.25**	**21.25**						
Critical Pressure (psia)[b]	**833**	**833**						
Vapor Pressure (psia)[c]	**407**	**407**						
Critical pressure ratio (F_F) [d]	**0.76**	**0.76**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**6905**	**6905**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**158.2**	**158.2**						
Working Flow (Mscfd)[h,i]	**66**	**66**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10
Valve Press Recovery Factor (C_f)	**0.78**	**0.78**	**0.78**	**0.78**	**0.78**	**0.78**	**0.78**	**0.78**	**0.80**	**0.80**
Valve Coefficent (gpm/psi) (C_v)	**7.20**	**7.20**	**7.20**	**7.20**	**7.20**	**7.20**	**7.20**	**7.20**	**12.20**	**12.20**
Critical Pressure (psia)[j]	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**	**3200**
Vapor Pressure (psia)[k]	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
Critical pressure ratio (F_F)[d]	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**	**0.96**
Choked Flow?[e]	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
Peak Flow (bwpd)[f,g]	**3906**	**3906**	**3906**	**3906**	**3906**	**3906**	**3906**	**3906**	**6789**	**6789**

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8	Vessel 9	Vessel 10
Flash Flow (Mscfd)	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**16**	**27**	**27**
Working Flow (Mscfd)[l]	**22**	**22**	**22**	**22**	**22**	**22**	**22**	**22**	**38**	**38**

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**500**	**500**
scfh vapor/tank[i]	**396**	**396**
Mscfd	**171**	**57**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**13,179**	**13,179**
Oil Tank Working Rate	**5,473**	**5,459**
Water Tank Flash Rate	**7,471**	**7,471**
Water Tank Working Rate	**10,487**	**10,487**
Tank Breathing Rate	**9,510**	**4,755**
Total	**46,121**	**41,351**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WELLS RANCH USX AE18, AA13 ECONODE T6N-R62W-S18 L0**

Consent Decree Tank System Number: **1981**

Audit Notes

IR Camera videos do not clearly show all tanks. Videographer walks along one bank of tanks, second bank is not visible behind first bank.

Letter from Bill Obermann, dated 7-13-2016 confirmed banked model.

Altered Audit Checklist to allow for 10 water separators.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

-Noble did not include breathing losses from non-producing tank bank. SLR included breathing losses from all tanks in its calculations. Configuration has two banks - each with 9 oil tanks and 3 water tanks.

"VOC Design Tank Pressure" was originally 11 oz/in^2 in the original STEM Engineering Evaluation_WR AE18,AA13 Econode.xlsm and was changed to 12 oz/in^2 in the modified STEM Eng Eval_rev1_WELLS RANCH USX AE18 T6N-R62W-S18 L0.xlsm file.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WIEDEMANT5N-R66W-S5 L01**

Consent Decree Tank System Number: **2104**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
WIEDEMANT5N-R66W-S5 L01_FINAL PACKET	pdf	7/29/2015	Final Facilty Packet

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
WIEDEMANT5N-R66W-S5 L01_SIGNED EVAL	pdf	5/26/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_Wiedeman 3	xlsm	4/29/2015	STEM Engineering Evaluation Spreadsheet
STEM Engineering Evaluation_rev1_WIEDEMANT5N-R66W-S5 L01	xlsm	9/22/2016	Revised Engineering Evaluation

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
WIEDEMANT5N-R66W-S5 L01_FINAL PACKET	pdf	7/29/2015	Work Request (From Final Packet)

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
WIEDEMANT5N-R66W-S5 L01 WALKDOWN	pdf	4/30/2015	Facility Walkdown

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
WIEDEMAN T5N-R66W-S5 L01_2230_normal	mp4	5/4/2015	IR Video of site during normal operation
WIEDEMAN T5N-R66W-S5 L01_2231_dump	mp4	5/4/2015	IR Video of site during separator dump event
WIEDEMAN T5N-R66W-S5 L01_2232_post	mp4	5/4/2015	IR Video of site post dump event
WIEDEMANT5N-R66W-S5 L01 IR VERIFICATION	pdf	5/4/2015	IR Camera Documentation Field Data Sheet

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
WIEDEMANT5N-R66W-S5 L01_SIGNED EVAL	pdf	5/26/2015	Signed Engineering Design Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WIEDEMANT5N-R66W-S5 L01**

Consent Decree Tank System Number: **2104**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**4**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3"**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**65**	**65**						
Dump Valve Size & Trim Size (in)	**2" & 1/2"**	**2" & 1/2"**						

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**Cimarron 48 HV**		
Man. Capacity (MSCFD)	**109.272**	**109.272**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**8,486**	**8,486**	**0%**
Calculated Burner Capacity (scfh	**6,520**	**6,520**	
Headspace Surge Capacity (scfh)	**5,524**	**5,524**	
Total VCS Capacity (scfh)	**12,044**	**12,044**	
VCS Capacity minus PPIVF (scfh)	**3,558**	**3,558**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	4/18/2016 & 11/18/2016 & 4/26/2017
Audit Document Review Verified by:	James Van Horne / Angela M. Oberlander
Audit Document Verification Date:	4/22/2016 & 12/13/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WIEDEMANT5N-R66W-S5 L01**

Consent Decree Tank System Number: **2104**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.69**	**0.69**						
Z2	**-0.86**	**-0.86**						
Z3	**0.98**	**0.98**						
Z	**0.81**	**0.81**						
Gas/Oil Ratio (scf/bbl)	**104.5**	**104.5**						

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**	**0.78**						
Valve Coefficent (gpm/psi) (C_v)	**7.20**	**7.20**						
Critical Pressure (psia)[b]	**535**	**535**						
Vapor Pressure (psia)[c]	**78**	**78**						
Critical pressure ratio (F_F) [d]	**0.85**	**0.85**						
Choked Flow?[e]	**Yes**	**Yes**						
Peak Flow (bopd)[f,g]	**794**	**794**						

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**82.9**	**82.9**						
Working Flow (Mscfd)[h,i]	**8**	**8**						

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**23**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**6,907**	**6,907**
Oil Tank Working Rate	**629**	**627**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**951**	**951**
Total	**8,487**	**8,485**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WIEDEMANT5N-R66W-S5 L01**

Consent Decree Tank System Number: **2104**

Audit Notes

-Filming location in IR inspection videos does not allow viewer to see all four tanks.

-The facility has the potential to emit more than 50 tpy of uncontrolled VOC emissions. Therfore an IR camera inspection is required.

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original WIEDEMANT5N-R66W-S5 L01_SIGNED EVAL.pdf and was changed to 12 oz/in^2 in the modified STEM Engineering Evaluation_rev1_WIEDEMANT5N-R66W-S5 L01.xlsm file.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WILMOTH BUROUGH T4N-R64W-S14 L01**

Consent Decree Tank System Number: **467**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
WILMOTH BUROUGH T4N-R64W-S14 L01_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
WILMOTH BUROUGH T4N-R64W-S14 L01_SIGNED EVAL	pdf	5/26/2015	Engineering Evaluation
STEM Engineering Evaluation_Wilmoth Burough	xlsm	4/28/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_WILMOTH BUROUGH T4N-R64W-S14 L01	xlsm	11/21/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
WILMOTH BUROUGH T4N-R64W-S14 L01 WORK REQUEST	xlsx	4/17/2015	Work Request
Noble 3rd Party Audit Wave 12 Update Info Request_20170117	pdf	1/17/2017	Information Request Response

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
WILMOTH BUROUGH T4N-R64W-S14 L01 WALKDOWN	pdf	4/30/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
WILMOTH BUROUGH T4N-R64W-S14 L01 IR VERIFICATION	pdf	5/20/2015	IR CameraVerification Sheet
WILMOTH BUROUGH T4N-R64W-S14 L01_0739_normal	mp4	5/20/2015	IR Camera Video
WILMOTH BUROUGH T4N-R64W-S14 L01_0741_dump	mp4	5/20/2015	IR Camera Video
WILMOTH BUROUGH T4N-R64W-S14 L01_0742_post	mp4	5/20/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
WILMOTH BUROUGH T4N-R64W-S14 L01_SIGNED EVAL	pdf	5/26/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WILMOTH BUROUGH T4N-R64W-S14 L01**

Consent Decree Tank System Number: **467**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**5**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**2**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**		
Man. Capacity (MSCFD)	**140**	**140**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**5,222**	**5,222**	**0%**
Calculated Burner Capacity (scfh	**5,617**	**11,667**	
Headspace Surge Capacity (scfh)	**7,048**	**1,647**	
Total VCS Capacity (scfh)	**12,665**	**13,314**	
VCS Capacity minus PPIVF (scfh)	**7,443**	**8,091**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	4/19/2016 & 12/2/2016 & 2/2/2017 & 5/2/2017
Audit Document Review Verified by:	Angela M. Oberlander & James Van Horne
Audit Document Verification Date:	4/21/2016 & 12/13/2016 & 5/25/2017

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WILMOTH BUROUGH T4N-R64W-S14 L01**

Consent Decree Tank System Number: **467**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor	**0.94**							
Valve Coefficent (gpm/psi) (	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor								
Valve Coefficent (gpm/psi) (								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**29**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**3,720**	**3,720**
Oil Tank Working Rate	**314**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**1,189**	**1,189**
Total	**5,222**	**5,222**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WILMOTH BUROUGH T4N-R64W-S14 L01**

Consent Decree Tank System Number: **467**

Audit Notes

-VOC Venting in all three IR Videos. Videos only capture one tank; viewpoint does not move throughout videos. IF Verification Document states that a work order is required to replace leaking PRV.

-Noble used an Unbanked configuration in the Signed Evaluation. A Banked configuration noted in facility walkthrough with one bank of 2 oil tanks and another of 3 oil tanks. SLR used the confirmed banked configuration in its calculations.

-Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

-All tanks were included in SLR's calculations to account for breathing losses from all tanks.
-Noble confirmed the "max operating pressure" to be 70 psi.

UPDATE: Noble confirmed accuracy of existing Engineering Evaluation. Noble Verification Form improperly identified the Tank System as being banked. TLO walkdown documentation (Attachment O) confirms that the Tank System is not banked.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WILMOTH T4N-R64W-S14 L01**

Consent Decree Tank System Number: **466**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
WILMOTH T4N-R64W-S14 L01_FINAL PACKET	pdf	7/6/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
WILMOTH T4N-R64W-S14 L01_SIGNED EVAL	pdf	7/14/2015	Engineering Evaluation
WILMOTH T4N-R64W-S14 L01_FINAL PACKET	pdf	7/6/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1 WILMOTH T4N-R64W-S14 L01	xlsm	9/26/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
WILMOTH T4N-R64W-S14 L01 WORK REQUEST	pdf	5/29/2015	Work Request
Noble 3rd Party Audit Wave 12 Update Info Request_20170117	pdf	1/17/2017	Information Request Response

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
WILMOTH T4N-R64W-S14 L01 WALKDOWN	pdf	7/6/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
WILMOTH T4N-R64W-S14 L01 IR VERIFICATION	pdf	6/25/2015	IR Camera Verification Sheet
WILMOTH T4N-R64W-S14 L01_0297_NORMAL	mp4	6/25/2015	IR Camera Video
WILMOTH T4N-R64W-S14 L01_0298_DUMP	mp4	6/25/2015	IR Camera Video
WILMOTH T4N-R64W-S14 L01_0299_POST	mp4	6/25/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
WILMOTH T4N-R64W-S14 L01_SIGNED EVAL	pdf	7/14/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WILMOTH T4N-R64W-S14 L01**

Consent Decree Tank System Number: **466**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**2**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**1" & 1/2"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**TEC 4-CS (48" Tornado)**			
Man. Capacity (MSCFD)	**110.4**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,508**	**4,509**	**0%**
Calculated Burner Capacity (scfh	**4,088**	**4,600**	
Headspace Surge Capacity (scfh)	**2,529**	**2,529**	
Total VCS Capacity (scfh)	**6,617**	**7,129**	
VCS Capacity minus PPIVF (scfh)	**2,109**	**2,620**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	3/18/2016 & 11/18/2016 & 2/2/2017 & 4/26/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	3/28/2016 & 12/13/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WILMOTH T4N-R64W-S14 L01**

Consent Decree Tank System Number: **466**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.94**							
Valve Coefficent (gpm/psi) (C_v)	**5.72**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**792**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**89.3**							
Working Flow (Mscfd)[h,i]	**8**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**11**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**3,720**	**3,720**
Oil Tank Working Rate	**314**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**475**	**475**
Total	**4,509**	**4,508**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WILMOTH T4N-R64W-S14 L01**

Consent Decree Tank System Number: **466**

Audit Notes

-Email from automation group indicated that the 14-29 motor valve was not functioning properly at the time automation completed the LP separator PSHH installation and testing. Estop signal was received, but motor valve was not receiving gas to actuate. Walkdown checklist indicated that the PSHH-101 and PSHH-102 were installed and set according to the design.

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the original WILMOTH T4N-R64W-S14 L01_SIGNED EVAL.pdf and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1 WILMOTH T4N-R64W-S14 L01.xlsm file.

The "production cycles per day" was 37.2 in the original Tank VOC Analysis in the WILMOTH T4N-R64W-S14 L01_FINAL PACKET.pdf and was changed to 18.6 in the modified STEM Engineering Evaluation_rev1 WILMOTH T4N-R64W-S14 L01.xlsm file. From Noble on 1/17/2017 - Based on Noble's review of the records associated with the Tank System, it appears that both the original (Rev0) and revised (Rev1) evaluations show 18.6 cycles per day. 37.2 cycles per day were documented prior to commingling because one separator cycled 9.2 times and the other separator cycled 28 times for a total of 37.2 cycles. Once commingled through a single LP separaror, the cycles are averaged to 18.6 cycles per day, which was documented in the Rev0 and Rev1 evaluations.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WINTERS T5N-R65W-S3 L01**

Consent Decree Tank System Number: **2208**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
WINTERS T5N-R65W-S3 L01_FINAL PACKET	pdf	7/29/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
WINTERS T5N-R65W-S3 L01_SIGNED EVAL	pdf	5/26/2015	Engineering Evaluation
STEM Engineering Evaluation_Winters	xlsm	5/22/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1 WINTERS T5N-R65W-S3 L01	xlsm	9/26/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
WINTERS T5N-R65W-S3 L01_FINAL PACKET	pdf	7/29/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
WINTERS T5N-R65W-S3 L01 WALKDOWN	pdf	4/27/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
WINTERS T5N-R65W-S3 L01 IR VERIFICATION	pdf	5/12/2015	IR Camera Verification Sheet
WINTERS T5N-R65W-S3 L01_2366_normal	mp4	5/12/2015	IR Camera Video
WINTERS T5N-R65W-S3 L01_2367_dump	mp4	5/12/2015	IR Camera Video
WINTERS T5N-R65W-S3 L01_2368_post	mp4	5/12/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
WINTERS T5N-R65W-S3 L01_SIGNED EVAL	pdf	5/26/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WINTERS T5N-R65W-S3 L01**

Consent Decree Tank System Number: **2208**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**5**
Oil Tank Capacity (bbl):	**300**
# of Water Tanks:	**0**
Water Tank Capacity (bbl):	**0**
VOC Line Size (in):	**3**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**55**	**55**	**55**					
Dump Valve Size & Trim Size (in)	**2" & 1/2"**	**2" & 1/2"**	**2" & 1/2"**					

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**Cimarron 48 HV**	**COMM 200 48"**		
Man. Capacity (MSCFD)	**109.272**	**157**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**10,058**	**10,060**	**0%**
Calculated Burner Capacity (scfh	**7,452**	**11,095**	
Headspace Surge Capacity (scfh)	**7,468**	**7,468**	
Total VCS Capacity (scfh)	**14,920**	**18,563**	
VCS Capacity minus PPIVF (scfh)	**4,862**	**8,503**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	4/15/2016 & 11/18/2016 & 4/26/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	4/19/2016 & 12/13/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WINTERS T5N-R65W-S3 L01**

Consent Decree Tank System Number: **2208**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.51**	**0.51**	**0.51**					
Z2	**-0.86**	**-0.86**	**-0.86**					
Z3	**0.98**	**0.98**	**0.98**					
Z	**0.62**	**0.62**	**0.62**					
Gas/Oil Ratio (scf/bbl)	**88.4**	**88.4**	**88.4**					

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**	**0.78**	**0.78**					
Valve Coefficent (gpm/psi) (C_v)	**7.20**	**7.20**	**7.20**					
Critical Pressure (psia)[b]	**526**	**526**	**526**					
Vapor Pressure (psia)[c]	**68**	**68**	**68**					
Critical pressure ratio (F_F) [d]	**0.86**	**0.86**	**0.86**					
Choked Flow?[e]	**Yes**	**Yes**	**Yes**					
Peak Flow (bopd)[f,g]	**725**	**725**	**725**					

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**64.1**	**64.1**	**64.1**					
Working Flow (Mscfd)[h,i]	**7**	**7**	**7**					

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**29**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**8,010**	**8,010**
Oil Tank Working Rate	**861**	**859**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**1,189**	**1,189**
Total	**10,060**	**10,058**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WINTERS T5N-R65W-S3 L01**

Consent Decree Tank System Number: **2208**

Audit Notes

-Note on work request in Final Packet states separators "@55 psi per Jeanne 4/28".

-In Noble walkthrough (3/11/2015 in Final Packet), separator valve size of 2".

- The work request (WINTERS T5N-R65W-S3 L01 WORK REQUEST.xlsx) indicates tank automation to limit fill level to 80%. The signed engineering evaluation (Winters T5N-R65W-S3 L01_SIGNED EVAL.pdf) indicates a 90% fill level. Audit evaluation was conducted using 90%.

- IR Videos only capture 3 of the 5 oil tanks and do not contain an angle where the viewer can focus on any potential leaking equipment per each tank (i.e. Thief Hatches, Relief Valves, etc.).

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the originalSTEM Engineering Evaluation_Winters.xlsm and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1 WINTERS T5N-R65W-S3 L01.xlsm file.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WOLFE USX T4N-R63W-S7 L01**

Consent Decree Tank System Number: **1416**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
WOLFE USX T4N-R63W-S7 L01_FINAL PACKET	pdf	7/6/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
WOLFE USX T4N-R63W-S7 L01_SIGNED EVAL	pdf	7/14/2015	Engineering Evaluation
WOLFE USX T4N-R63W-S7 L01_FINAL PACKET	pdf	7/6/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1 WOLFE USX T4N-R63W-S7 L01	xlsm	9/26/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
WOLFE USX T4N-R63W-S7 L01 WORK REQUEST	pdf	5/20/2015	Work Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
WOLFE USX T4N-R63W-S7 L01 WALKDOWN	pdf	7/6/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
WOLFE USX T4N-R63W-S7 L01 IR VERIFICATION	pdf	7/2/2015	IR Camera Verification Sheet
WOLFE USX T4N-R63W-S7 L01_0020_NORMAL	mp4	7/2/2015	IR Camera Video
WOLFE USX T4N-R63W-S7 L01_0021_DUMP	mp4	7/2/2015	IR Camera Video
WOLFE USX T4N-R63W-S7 L01_0022_POST	mp4	7/2/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
WOLFE USX T4N-R63W-S7 L01_SIGNED EVAL	pdf	7/14/2015	Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WOLFE USX T4N-R63W-S7 L01**

Consent Decree Tank System Number: **1416**

☐ Yes	☑ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**2**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**4**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**70**							
Dump Valve Size & Trim Size (in)	**2" & 1"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**TEC 4-CS (48" Tornado**			
Man. Capacity (MSCFD)	**110.4**			

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**4,508**	**12,751**	**183%**
Calculated Burner Capacity (scfh	**4,181**	**4,600**	
Headspace Surge Capacity (scfh)	**2,378**	**3,984**	
Total VCS Capacity (scfh)	**6,559**	**8,584**	
VCS Capacity minus PPIVF (scfh)	**2,051**	**-4,167**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	Erin Ehrmantraut/Tom Kussard
Audit Document Review Date:	3/17/2016 & 11/18/2016 & 5/1/2017
Audit Document Review Verified by:	Angela M. Oberlander & James Van Horne
Audit Document Verification Date:	3/24/2016 & 12/12/2016 & 5/25/2017

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WOLFE USX T4N-R63W-S7 L01**

Consent Decree Tank System Number: **1416**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**0.77**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**0.89**							
Gas/Oil Ratio (scf/bbl)	**112.8**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.77**							
Valve Coefficent (gpm/psi) (C_v)	**21.25**							
Critical Pressure (psia)[b]	**539**							
Vapor Pressure (psia)[c]	**83**							
Critical pressure ratio (F_F) [d]	**0.85**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**2409**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**271.7**							
Working Flow (Mscfd)[h,i]	**23**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**11**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	**Noble**
Oil Tank Flash Rate	**11,321**	**3,720**
Oil Tank Working Rate	**955**	**313**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**475**	**475**
Total	**12,751**	**4,508**

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WOLFE USX T4N-R63W-S7 L01**

Consent Decree Tank System Number: **1416**

Audit Notes

-Initial site evaluation information indicates the 270# Separator has a 1" valve (Kimray 1400) with 1/4" trim. Dump valve modifications on the Work Request stated to modify to a 1" trim. Kimray does not make a 1" valve with a 1" trim. A 1" valve with a 1/2" trim was used in the final engineering evaluation. The job sheet provided in the Final Packet indicated that the LP oil dump valve was trimmed to 1"; a 2" valve with a 1" trim was used in SLR's evaluation calculations.

-SLR used Noble's workbook to calculate headspace surge capacity with the correct valve and trim size. Noble's spreadsheet predicts a maximum pressure of 15.6 oz/in2 (less than the thief hatch set point). However the predicted capacity (8,166 scfh) is predicted to be less than the PPIVFR (12,748 scfh). SLR's calculations also predicted the system capacity is less than the PPIVFR.

"VOC Design Tank Pressure" was originally 10 oz/in^2 in the originalWOLFE USX T4N-R63W-S7 L01_SIGNED EVAL.pdf and was changed to 11 oz/in^2 in the modified STEM Engineering Evaluation_rev1 WOLFE USX T4N-R63W-S7 L01.xlsm file.

UPDATE: Noble agrees that the Engineering Evaluation was incorrect and the site did not meet the Performance Standards. A PCCM was completed on July 14, 2017. Updated Engineering Evaluation design parameters submitted with Noble's Semi-Annual Report (5th) (July 28, 2017).

UPDATE: After reviewing SLR's Draft Report, Noble contacted Tornado to confirm that its burners can handle capacities beyond the published specification or 10 oz/in2. Tornado confirmed that the published burner curve can be hydraulically extrapolated beyond 10 oz/in2. Moreover, Tornado noted the stated capacity is based on heat release (86.4 MSCFD at 2,300 BTU/scf). Noble's typical flash gas is lighter in composition (1,800 BTU/scf) such that the Tornado burner would be capable of handling up to 110.4 MSCFD at the published heat release limit. The Tornado specification sheet notes the maximum flow is dependent on heating value of the gas, consistent with Noble's conversation.

UPDATE: Noble agrees that the Engineering Evaluation was incorrect and the site did not meet the Performance Standards. A PCCM was completed on July 14, 2017. Updated Engineering Evaluation was completed and a revised COCR submitted with Noble's Semi-Annual Report (5th) (July 28, 2017).

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WOLFE USX T4N-R63W-S7 L02**

Consent Decree Tank System Number: **1500**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
WOLFE USX T4N-R63W-S7 L02_FINAL PACKET	pdf	7/20/2015	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
WOLFE USX T4N-R63W-S7 L02_SIGNED EVAL	pdf	7/20/2015	Engineering Evaluation
STEM Engineering Evaluation_WOLFE USX T4N-R63W-S7 L02	xlsm	7/17/2015	Tank VOC Analysis
STEM Engineering Evaluation_rev1_WOLFE USX T4N-R63W-S7 L02 (update)	xlsm	6/3/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description
WOLFE USX T4N-R63W-S7 L02 Work Request	pdf	6/4/2015	Work Request
Noble 3rd Party Audit Wave 12 Update Info Request_20170117	pdf	1/17/2017	Information Request Response
Attachment Q - WOLFE USX T4N-R63W-S7 L02 COMPLETED REWORK.pdf	pdf	1/17/2017	Rework Request

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
WOLFE USX T4N-R63W-S7 L02 WALKDOWN	pdf	7/20/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
WOLFE USX T4N-R63W-S7 L02 IR VERIFICATION	pdf	7/14/2015	IR Camera Verification Sheet
WOLFE USX T4N-R63W-S7 L02_0065_NORMAL	mp4	7/14/2015	IR Camera Video
WOLFE USX T4N-R63W-S7 L02_0066_DUMP	mp4	7/14/2015	IR Camera Video
WOLFE USX T4N-R63W-S7 L02_0067_POST	mp4	7/14/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
WOLFE USX T4N-R63W-S7 L02_SIGNED EVAL	pdf	7/20/2015	Engineering Evaluation

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WOLFE USX T4N-R63W-S7 L02**

Consent Decree Tank System Number: **1500**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☑ Yes	☐ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**2**
Oil Tank Capacity:	**300**
# of Water Tanks:	**0**
Water Tank Capacity:	**0**
VOC Line Size:	**4**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**220**							
Dump Valve Size & Trim Size (in)	**1" & 1/4"**							

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)								
Dump Valve Size & Trim Size (in)								

VRT Installed? ☐ Yes ☑ No

VRT Shut in Pressure (psig)

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**COMM 200 48"**	**COMM 200 48"**		
Man. Capacity (MSCFD)	**157**	**157**		

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**10,570**	**10,571**	**0%**
Calculated Burner Capacity (scfh)	**9,077**	**13,083**	
Headspace Surge Capacity (scfh)	**7,133**	**7,133**	
Total VCS Capacity (scfh)	**16,210**	**20,216**	
VCS Capacity minus PPIVF (scfh)	**5,640**	**9,646**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☐ Yes	☑ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	E. Ehrmantraut/Tom Kussard
Audit Document Review Date:	4/15/2016 & 11/18/2016 &2/2/2017 & 4/16/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	4/19/2016 & 12/12/2016

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WOLFE USX T4N-R63W-S7 L02**

Consent Decree Tank System Number: **1500**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	**1.93**							
Z2	**-0.86**							
Z3	**0.98**							
Z	**2.04**							
Gas/Oil Ratio (scf/bbl)	**485.6**							

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	**0.78**							
Valve Coefficent (gpm/psi) (C_v)	**2.17**							
Critical Pressure (psia)[b]	**673**							
Vapor Pressure (psia)[c]	**233**							
Critical pressure ratio (F_F) [d]	**0.80**							
Choked Flow?[e]	**Yes**							
Peak Flow (bopd)[f,g]	**489**							

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	**237.6**							
Working Flow (Mscfd)[h,i]	**5**							

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)								
Valve Coefficent (gpm/psi) (C_v)								
Critical Pressure (psia)[j]								
Vapor Pressure (psia)[k]								
Critical pressure ratio (F_F)[d]								
Choked Flow?[e]								
Peak Flow (bwpd)[f,g]								

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)								
Working Flow (Mscfd)[l]								

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	**300**	**0**
scfh vapor/tank[i]	**238**	**0**
Mscfd	**11**	**0**

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	**9,901**	**9,901**
Oil Tank Working Rate	**194**	**193**
Water Tank Flash Rate	**0**	**0**
Water Tank Working Rate	**0**	**0**
Tank Breathing Rate	**475**	**475**
Total	**10,571**	**10,569**

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WOLFE USX T4N-R63W-S7 L02**

Consent Decree Tank System Number: **1500**

Audit Notes

"Max Operating Pressure" was originally 270 psi in the original STEM Engineering Evaluation_WOLFE USX T4N-R63W-S7 L02.xlsm and was changed to 220 psi in the modified STEM Engineering Evaluation_rev1_WOLFE USX T4N-R63W-S7 L02 (update).xlsm file. Noble confirmed the pressure to be 220psi.

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WOLFPACK_LONEWOLF B02 ECONODE T5N-R64W-S2 L01**

Consent Decree Tank System Number: **2061**

Tank Systems Engineering Design Standard Documents Reviewed

Vapor Control System Engineering Design Pre-Evaluation Documents

File Name	File Ext.	File Date	Document Description
WOLFPACK LONEWOLF B02 ECONODE T5N-R64W-S2 L01_FINAL PACKET	pdf	No Date	Field Data Sheets

Vapor Control System Engineering Evaluation Documents:

File Name	File Ext.	File Date	Document Description
WOLFPACK LONEWOLF B02 ECONODE T5N-R64W-S2 L01_SIGNED EVAL	pdf	5/26/2015	Signed Engineering Design Evaluation
STEM Engineering Evaluation_Wolfpack, Lonewolf Econode	xlsm	4/15/2015	Tank VOC Analysis
STEM Eng Eval_rev1_WOLFPACK LONEWOLF T5N-R64W-S2 L01	xlsm	11/21/2016	Revised Tank VOC Analysis

Execution of Modification Documents:

File Name	File Ext.	File Date	Document Description

Facility Walk Down Documents:

File Name	File Ext.	File Date	Document Description
WOLFPACK_LONEWOLF B02 ECONODE T5N-R64W-S2 L01 WALKDOWN	pdf	4/23/2015	Walkdown Checklist

Vapor Control System Verification Documents:

File Name	File Ext.	File Date	Document Description
WOLFPACK_LONEWOLF B02 ECONODE T5N-R64W-S2 L01 IR VERIFICATION	pdf	5/11/2015	IR Camera Verification Sheet
WOLFPACK_LONEWOLF B02 ECONODE T5N-R64W-S2 L01_2350_normal	mp4	5/11/2015	IR Camera Video
WOLFPACK_LONEWOLF B02 ECONODE T5N-R64W-S2 L01_2351_dump	mp4	5/11/2015	IR Camera Video
WOLFPACK_LONEWOLF B02 ECONODE T5N-R64W-S2 L01_2352_post	mp4	5/11/2015	IR Camera Video

Facility Engineering Sign-Off Documents:

File Name	File Ext.	File Date	Document Description
WOLFPACK LONEWOLF B02 ECONODE T5N-R64W-S2 L01_SIGNED EVAL	pdf	5/26/2015	Signed Engineering Evaluation

SLR

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WOLFPACK_LONEWOLF B02 ECONODE T5N-R64W-S2 L01**

Consent Decree Tank System Number: **2061**

☑ Yes	☐ No	Site Equipment/Emission Source Inventory Consistent Throughout Documentation?
☐ Yes	☑ No	VCS Engineering Evaluation includes applicable emissions sources?

VCS Engineering Evaluation verified inputs:

# of Oil Tanks:	**12**
Oil Tank Capacity (bbl):	**535**
# of Water Tanks:	**6**
Water Tank Capacity (bbl):	**535**
VOC Line Size (in):	**4**
# VOC Lines to KO:	**1**
# VOC Lines to Burner:	**1**

Oil	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**

Water	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Max Operating Pressure (psig)	**400**	**400**	**400**	**400**	**400**	**400**	**400**	**400**
Dump Valve Size & Trim Size (in)	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**	**2" & 1"**

VRT Installed? ☑ Yes ☐ No

VRT Shut in Pressure (psig): 12

	Unit 1	Unit 2	Unit 3	Unit 4
Tank Burner/ECD Model	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**	**LEED 48" Gen 1 #7**
Man. Capacity (MSCFD)	**140**	**140**	**140**	**140**

	Noble	**SLR**	**Percent Difference**
Calculated PPIVF (scfh)	**114,843**	**118,716**	**3%**
Calculated Burner Capacity (scfh	**10,750**	**23,333**	
Headspace Surge Capacity (scfh)	**228,512**	**228,512**	
Total VCS Capacity (scfh)	**239,262**	**251,845**	
VCS Capacity minus PPIVF (scfh)	**124,419**	**133,130**	

☑ Yes	☐ No	Based on the Tank System Document Review, the Modeling Guidance has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Engineering Design Standard has been correctly applied.
☑ Yes	☐ No	Based on the Tank System Document Review, the Vapor Control System is adequately designed and sized to handle the Potential Peak Instantaneous Vapor Flow Rate (PPIVF).
☑ Yes	☐ No	This Tank System is selected for IR Camera Inspection.

Audit Document Review Performed by:	E. Ehrmantraut/Tom Kussard
Audit Document Review Date:	7/6/2016 & 12/2/2016 & 5/2/2017
Audit Document Review Verified by:	Angela M. Oberlander
Audit Document Verification Date:	8/26/2016 & 12/14/2016

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WOLFPACK_LONEWOLF B02 ECONODE T5N-R64W-S2 L01**

Consent Decree Tank System Number: **2061**

Valko-McCain[a]	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Z1	-1.02	-1.02	-1.02	-1.02	-1.02	-1.02	-1.02	-1.02
Z2	-0.86	-0.86	-0.86	-0.86	-0.86	-0.86	-0.86	-0.86
Z3	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Z	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90	-0.90
Gas/Oil Ratio (scf/bbl)	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9

Peak Oil Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77
Valve Coefficent (gpm/psi) (C_v)	21.25	21.25	21.25	21.25	21.25	21.25	21.25	21.25
Critical Pressure (psia)[b]	833	833	833	833	833	833	833	833
Vapor Pressure (psia)[c]	407	407	407	407	407	407	407	407
Critical pressure ratio (F_F) [d]	0.76	0.76	0.76	0.76	0.76	0.76	0.76	0.76
Choked Flow?[e]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Peak Flow (bopd)[f,g]	6905	6905	6905	6905	6905	6905	6905	6905

Oil Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	158.2	158.2	158.2	158.2	158.2	158.2	158.2	158.2
Working Flow (Mscfd)[h,i]	66	66	66	66	66	66	66	66

Peak Water Flow	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Valve Press Recovery Factor (C_f)	0.77	0.77	0.77	0.77	0.77	0.77	0.77	0.77
Valve Coefficent (gpm/psi) (C_v)	21.25	21.25	21.25	21.25	21.25	21.25	21.25	21.25
Critical Pressure (psia)[j]	3200	3200	3200	3200	3200	3200	3200	3200
Vapor Pressure (psia)[k]	1	1	1	1	1	1	1	1
Critical pressure ratio (F_F)[d]	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Choked Flow?[e]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Peak Flow (bwpd)[f,g]	11381	11381	11381	11381	11381	11381	11381	11381

Water Tank Flow Rates	Vessel 1	Vessel 2	Vessel 3	Vessel 4	Vessel 5	Vessel 6	Vessel 7	Vessel 8
Flash Flow (Mscfd)	46	46	46	46	46	46	46	46
Working Flow (Mscfd)[l]	64	64	64	64	64	64	64	64

Breathing Rates[m]	Oil Tanks	Water Tanks
scfh air/tank	535	535
scfh vapor/tank[i]	424	424
Mscfd	122	61

Flow Rate Summary	Flow Rate (scfh)	
	SLR	Noble
Oil Tank Flash Rate	52,718	52,718
Oil Tank Working Rate	21,890	21,835
Water Tank Flash Rate	15,175	15,175
Water Tank Working Rate	21,301	21,300
Tank Breathing Rate	7,632	3,816
Total	118,716	114,844

Engineering Evaluation Verification Audit

Consent Decree (90-5-2-1-10811) - 1:15-cv-00841 RBJ

LOD ID: **WOLFPACK_LONEWOLF B02 ECONODE T5N-R64W-S2 L01**

Consent Decree Tank System Number: **2061**

Audit Notes

-Noble did not include breathing losses from non-producing tank bank. SLR included breathing losses from all tanks in its calculations. Configuration has two banks - each with 6 oil tanks and 3 water tanks.

IR Camera videos do not clearly show all tanks.

Facility emissions are greater than 50 tpy VOC, and as such an IR Camera Inspection is required.

"VOC Design Tank Pressure" was originally 11 oz/in^2 in the original STEM Engineering Evaluation_Wolfpack, Lonewolf Econode.xlsm and was changed to 12 oz/in^2 in the modified STEM Eng Eval_rev1_WOLFPACK LONEWOLF T5N-R64W-S2 L01.xlsm file.

UPDATE: Noble acknowledged that breathing losses were not incorporated for the non-producing, storage-only bank. However, Noble also chose not to incorporate the headspace surge capacity associated with those tanks. Noble asserts that modeling the single bank generates a more conservative analysis to ensure design adequacy during all operating modes. Noble acknowledges that the Modeling Guideline did not provide details for incorporation of the headspace surge capacity. Noble updated its Modeling Guideline with these details and submitted with Noble's Semi-Annual Report (6th) on January 29, 2018. SLR acknowledged that the error did not impact adequate design and agrees that omitting headspace surge capacity adds conservativism in the Engineering Design Analyses.