Procedure Number: IN-QP-012

Owner User Program - Facilities
Interval Revision Process - Sour Facilities

Contents

Revision History

Date	Revision	By	Chk	Approver
May 21, 2015	1.0	CS	CS	IS

© 2011 Canadian Natural Resources Ltd.

Scope

This process is to be applied to sour gas gathering systems or sour oil production systems where extension of inspection interval is requested by CNRL Operations, Production, or Integrity. The process is intended to be applied to production systems where the number of pressure vessels is less than 100. Suitability for the use of this process for a given facility is subject to the discretion of the Chief Inspector. Larger facilities with more complex process systems may require a detailed RBI as per the CNRL Owner User Program. Note: this process is not intended for justification of inspection intervals beyond the requirements of the AB-506 (ABSA) document.

Process

Field Summary

Facility & Field Data	
Name / LSD of Central Facility:	Mulligan Oil Battery/11-25-081-11W6
System Description: (e.g. sweet gas gathering system, oil production)	<u>Oil Battery – Sour Facility</u> (Oil Treating, Oil Tanks, Water Tanks, Sales Compression)
Types of Processes in Use (e.g. compression, dehydration, refrigeration, separation, oil treating)	1. Oil Treating 2. Compression
Typical Gas Composition CO2/H2S%:	~0.007% CO_2, 7700ppm H_2S
Typical Operating Pressures: (include wellhead shut-in pressures, facility operating pressures)	(1) Field Shut-In Pressure: 250psi max (2) Treater Pressure: ~40psi (3) Low Pressure Inlet: ~50psi (4) High Pressure Inlet: ~50psi (confirmed as correct) (5) Gas Sales Pressure: 850psi max, 600psi normal
Typical Operating Temperatures:	(1) Inlet Temperature: 10^{0}C (2) Treater: 60^{0}C (3) Sales: 20^{0}C
Typical Water Content:	169,326 PPM (Total Dissolved Solids) 7.2 PH 99969 mg/L Cl Content
Daily Production:	(1) Oil Production: 20m^3/day (2) Water Production: 10m^3/day (3) Gas Production: 40e3m3/day

Table 1 – Facility and Field Data

© 2011 Canadian Natural Resources Ltd.

Risk Assessment

Likelihood Analysis

Inspection / Field History		
Age of Facility:	Battery built in 1990 (24 years old).	
Production history / summary of significant production changes: (how long has the field been producing in its current state?)	Production History (previous peak values): (1) Oil Production: 400m³/day (2) Water Production: 120m³/day (3) Gas Production: 200e³m³/day	
Date of last vessel inspections:	2013 for all vessels	
Was corrosion found?	1. TREATER 2. 1ST STAGE SUCTION SCRUBBER 3. 1ST. STAGE SUCTION BOTTLE 4. 1ST STAGE DISCHARGE BOTTLE 5. 2ND. STAGE SUCTION SCRUBBER 6. 2ND. STAGE SUCTION BOTTLE 7. 2ND STAGE DISCHARGE BOTTLE 8. 3RD. STAGE SUCTION SCRUBBER 9. 3RD STAGE SUCTION BOTTLE 10. 3RD STAGE DISCHARGE BOTTLE 11. FUEL GAS SEPARATOR 12. GROUP SEPARATOR 13. FLARE KNOCK OUT DRUM 14. FUEL GAS SCRUBBER 15. AIR RECEIVER	1. 0.010 mm/yr 2. 0.050 mm/yr 3. 0.044 mm/yr 4. 0.061 mm/yr 5. 0.039 mm/yr 6. 0.044 mm/yr 7. 0.039 mm/yr 8. 0.050 mm/yr 9. 0.063 mm/yr 10. 0.106 mm/yr 11. 0.072 mm/yr 12. 0.006 mm/yr 13. 0.033 mm/yr 14. 0.056 mm/yr 15. 0.033 mm/yr
Were cracks found?	None detected on Firetube inspection.	
Have any vessel repairs ever been done? When?	Coating Patches completed in TAR 2013	
Summary of worst corrosion or cracking found: (describe where the most significant damage found i.e. in what vessel? What part of the process?)	1. Air Receiver (C50235) – Thickness calculations carried out UT point 315 (bottom Head) – nominal thickness is 2.5mm / min thickness is 2.3mm / T min thickness is 2.0mm.	

© 2011 Canadian Natural Resources Ltd.

Remaining Life Calculations: (What is the worst-case remaining life calculation for the field under review?)	1. Air Receiver (C50235) – Retirement Date to "T"min is year 2022 (9 Years). This is considered a low risk/consequence piece of equipment but we will continue to monitor at next inspection interval. Corrosion rates are not a concern from the remaining UT data provided.
Date of last PSV servicing:	June 27, 2013
Summary of Pre-pop data:	See Summary of Issues spreadsheet.
PSV notes / concerns:	All pre-pop data present. No pre-pop deviations over 10%

Table 2 – Inspection / Field History

Likelihood Designation

Based on the information captured in Section 2.2.1, the likelihood of in-service damage must be designated as one of the following categories:

Likelihood Category	Description
High	repeat failures, significant corrosion, remaining life < 12 years, no PSV pre-pop data
Medium	one failure, random corrosion, remaining life 12 – 23 years, PSV pre-pop completed with minor deviations
Low	no failures, minor/no corrosion, no cracks, remaining life > 24 years, good PSV data with acceptable pre-pops

Table 3- Likelihood Designation

Field Likelihood Designation: **MED**

Consequence Analysis

Severity Data	Yes / No	Description of Worst Case [Note: refer to CNRL RBI process].
Are there any vessels where failure will result in negative impact to local residents?	No	Isolated Area
Are there any vessels with economic consequence of failure > $100K?	Yes	Treater Failure would be >$100K in production
Are there any vessels where failure will directly result in serious lost-time injury requiring medical aid?	No	Fired and Rotating Equipment on site with appropriate safe guards in place.
Are there any vessels where failure will directly result in significant off-site environmental impact?	No	All equipment and production isolated to Battery Site, and then trucked away.

Table 4 – Consequence Analysis

© 2011 Canadian Natural Resources Ltd.

Consequence Designation

Based on the information captured in Section 2.2.3, the consequence of in-service failure must be designated as one of the following categories:

Consequence Category	Description
High	Yes to 2 or more of the above
Medium	Yes to 1 of the above
Low	Yes to 0 of the above

Table 5 – Consequence Designation

Field Consequence Designation: **MEDIUM**

Risk Assessment – Sour Facilities

The field likelihood designation and consequence designation must be entered into the following risk matrix to determine an overall Small Facility RBI Risk ranking and acceptable re-inspection interval.

		LIKELIHOOD DESIGNATION		
		Low	Medium	High
CONSEQUENCE DESIGNATION	High	RISK = MED 4 Year Max Interval	RISK = HIGH 3 Year Max Interval	RISK = HIGH 3 Year Max Interval
	Medium	RISK = LOW 5 Year Interval Acceptable	RISK = MED 4 Year Max Interval	RISK = HIGH 3 Year Max Interval
	Low	RISK = LOW 5 Year Interval Acceptable	RISK = LOW 5 Year Interval Acceptable	RISK = MED 4 Year Max Interval

Table 6 – Risk Assessment

© 2011 Canadian Natural Resources Ltd.

Summary

Likelihood designation is determined to be MEDIUM. No failures, no cracks, corrosion is present but at a manageable rate with remaining life beyond 20+ years. Additionally, PSV data is recent, mostly complete and no deviations are present in said data.

Consequence of failure is determined to be a MEDIUM designation due to the economic consequences of failure in the treater package (in excess of $100,000). Engineered safety and containment measures are in place (fire eyes, LEL & H_2S detection, ESD, tank berms/containments) and the facility is situated in a remote location.

Using Table 6 – Risk Assessment the inspection interval for Mulligan Oil Battery 11-25-081-11W6 is justified at 4 years based on Canadian Natural Resources Ltd. Owner User Program.

Recommendations

- Move to extend to a 4-year inspection interval. Plan to inspect all vessels and PSVs in 2017 using VE, UT, VI and MT inspection methods where applicable.
- Post 2017 turnaround; re-evaluate the inspection interval based on the new inspection and pre-pop data to determine the appropriate inspection interval within the CNRL Owner User Program.
- Ensure any noted at-risk vessels are added to the preventative maintenance (PM) system.
- Ensure Maxitrak is updated with inspection records and the new 4 year interval.
- Request PSV Service Reports for missing data within Maxitrak, if not available have the applicable PSV's serviced.

Sign Off

Date Completed: 05/21/15

Signatures

CNRL Integrity Coordinator: ____ PESL #641

CNRL Chief Inspector: ____

CNRL Production or Maintenance Foreman: S. Pe____

CNRL Database Administrator

Intervals changed in Maxitrak____

© 2011 Canadian Natural Resources Ltd.