**PROJECT EXECUTION PLAN**

**INTERNAL CLEANING OF BOGT PRODUCED WATER SURGE TANK T1401**

1. **INTRODUCTION**

The produced water surge tank T1401 in BOGT has not been cleaned internally since commissioning in 2007. Water flows to the inlet of the Surge Tank (T-1401) through a 36” header (line 36-WP14006-11410) that collects water from the crude storage tank draining, the FWKO’s and the emulsion treatment system. Desand water return from sand collection tanks T1601A/B is also directed to T-1401. A flocculant is injected in the water just upstream the surge tank to aid separation of oil but no inline static mixer is provided for homogeneous mixing and as such mixing of the chemical is poor.

Debris and solids from the produced water settle at the base of the tank along with the unmixed flocculant and has built up over time. Recent operations of the produced water plant have been impaired by carryover of the debris and solids leading to fouling of CPIs and ISFs and reduced system performance as well as reduced reliability of LCVs (14LCV007/033) and pumps (P1404A/B). A by-pass line 30-WP14009-11410 is provided, which allows tank T-1401 to be shut down for maintenance. CPI trains can be directly fed through the by-pass line when required.

This project aims internally clean T1401 while operating the bypass to enable normal terminal operations to continue.

1. **MAIN PROJECT DRIVERS**

The main project drivers are as follows

* Enabler for continued compliance with statutory effluent water disposal quality requirements (BDH < 40ppm)
* Compliance with statutory 5 yearly tank cleaning frequency requirement
* Increase MTBF for P-1404 and 14LICA-007/033
* Reduce frequency of pinhole leaks in Unit 14

1. **PROJECT OBJECTIVES**

The objectives of the project are to

* Isolate and remove T1401 from service with the bypass in service
* Drain and degas T1401 in preparation for entry
* Perform internal cleaning of T1401
* De-isolate and commission T1401

1. **PROJECT SCOPE**

The project scope is limited to operation of the produced water system using the surge tank bypass line and internal cleaning of T1401.

1. **CRITICAL SUCCESS FACTORS**

Factors critical to the success of the project are

* Availability of P-1404A/B or reliable alternative
* Availability of Slurry Pumps
* Availability of personnel for task execution

1. **COST – BENEFIT ANALYSIS**

Total projects cost is the cost of procurement of disposable coveralls, plastic shovels, squeegees, spares for slurry pumps, raincoats, rain boots, sand bags, orinasal (respirator) and other miscellaneous items totaling about $15,000

The financial benefits of executing the project as outlined in this plan document include

* Financial savings of circa $180,000 compared with option of using external contractor for the tank cleaning (Reference T1201A/B cleaning cost of 2014)
* Maintenance savings of circa $150,000 by increasing MTBF of P-1404 from 2 weeks to 26 weeks ($6k for shaft repair and journal bearings replacement)

1. **RESOURCES**

Resources required to complete this project are physical and human resources as outlined below.

* 1. **Physical Resources**

The physical resources required are

|  |  |  |
| --- | --- | --- |
| **Material** | **Required** | **Available** |
| Disposable Coveralls | 100 | 10 |
| Plastic Shovels | 20 | 0 |
| Squeegees | 20 | 0 |
| Gas Testers | 10 | 10 |
| Extractor Fans | 3 | 3 |
| Air Compressor | 1 | 1 |
| Slurry Pumps (OSR) | 10 | 10 |
| Hoses | 200m | 200m |
| Raincoats | 40 | 10 |
| Rain boots | 20 | 0 |
| Sand Bags | 100 | 0 |
| Orinasal (Respirator) | 20 | 0 |
| First Aid Box | 2 | 2 |
| Fire Extinguisher 50Kg | 2 | 2 |
| Life Line | 200m | 200m |

* 1. **Human Resources**

The human resources required are

|  |  |
| --- | --- |
| Project Lead | 1 |
| AHSS | 1/Run |
| Permit Holder | 1/Run |
| Tank Cleaning Personnel (Vessel Entry) | 15 / Run |
| Pump Operator | 1 / Run |
| HSE Personnel | 1/ Run |
| Standby Man | 2/ Run |

***NB: A temporary management waiver for crude storage tank filling header BS&W will be required for the duration of the tank cleaning exercise (New target BS&W <15%)***

1. **REQUIRED PRE-WORK**

The following pre-work is required to be completed prior to project commencement

* 72hr performance test for the produced water system whilst bypassing the surge tank to demonstrate feasibility of using the produced water surge tank (T-1401) bypass line while carrying out Tank cleaning activities.
* Corrective maintenance of 14LCV-033A/E
* Corrective maintenance of P1404A/B
* Skimming of Sludge Pit E
* Calibration of 14FIC-016 and 14LT-029

1. **OPPORTUNITY MAINTENANCE**

The following maintenance activities will be carried out as opportunity maintenance during the project execution window

* Tank Internal Visual Inspection
* UT measurement of tank shell and bottom plate
* Freeing of blocked tank sampling lines (status check lines)
* Corrective maintenance of Surface Pumps at Pit E

1. **EXECUTION**

The project will involve enhanced and improved operator monitoring and intervention to ensure bypass feed below 500ppm oil content to CPI and the tank cleaning will be managed as confined space entry.

* 1. **Management of Produced Water during Bypass Flow**

FWKO status will be monitored by Unit 11 operators using the sample check valves while ensuring that the sample check valves at 650mm and 800mm for all running trains always has clean free water. Operators will ensure that the emulsion pump P1106 for each running train is lined up and in operation at all times during the project. Sample check valves at 1250mm will be maintained at BS&W < 15% by varying opening of 11LCV-004 while ensuring 650/800mm always has clean water.

Controlled draining of crude storage tanks by tank-farm drainers will be achieved by keeping the respective tank water drain valve opening below 20% at all times. Water draining will be suspended when the 2nd sample check valve from tank bottom shows light emulsion while the lowest valve has clean water. Draining will then be switched to the tank emulsion drain header.

Controlled draining of emulsion tanks T1201A/B by Unit 12 operators will be achieved similarly to crude storage tank draining. Water draining will be done at a controlled rate by throttling the outlet of the water pumps P1201A/B/S while monitoring the quality of the water pump outlet quality for clean water. Water draining from the emulsion tanks will be suspended when valve at 1450mm shows light emulsion while the lowest valve shows clean water.

Desand water from T1601A/B will remain in the sand tanks for the duration of the project. Number of running produced water treatment trains will be selected by the CRO to match estimated combined water flow from all active sources and CPI feed rate continually optimized while never exceeding 2,200bbls/hr. Flushing of CPIs and ISF will be done as required based on effluent quality performance.

Flocculant injection will be reduced from 6ppm to 3ppm for the duration of the project to prevent fouling CPIs with excess chemical where residence time is too short for effectiveness.

These measures will ensure water with oil content < 500ppm is sent to the CPIs from all sources at all times and effluent water quality remains below 20ppm. A function test will be completed for 72 hours to demonstrate feasibility of surge tank bypass operations while highlighting optimization opportunities before the tank is taken out of service.

* 1. **Internal Cleaning of T1401**

T1401 internal cleaning will be managed with hot work PtW (extractor fans and diesel driven air compressor). The tank inlet will be isolated using the 30" isolation valve and 14SDV-011. Skimming of oil via Pit E Surface pumps will continue until all oil is removed from the surge tank. The tank blanket gas supply will then be isolated and tank roof vent opened. The tank will be further filled using fire water to 8.9m via the 6" water drain line to reduce the quantity of gas within the tank.

Draining of water will be done to Pit E via 6" drain hoses from the tank drain line while skimming of Pit E is done simultaneously using surface pump. Upon completion of tank draining, two 24" manholes will be opened and extractor fans installed to commence degassing. The extractor fans will be powered by air compressor located outside the tank bundwall area and near T1601.

When gas tests indicate hydrocarbon gas levels are tolerable (<10% LFL) the clean out door will be opened to continue degassing and in preparation for vessel entry.

Table 1 HSSE CF SPECIFICATIONS FOR CONFINED SPACE ENTRY

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Without** [Respiratory Protection](javascript:void(0))Respiratory Protection | **With** [Respiratory Protection](javascript:void(0))Respiratory Protection | **Inert** [**Entry**](javascript:void(0))**Entry** |
| Oxygen % | 20 to max. 21.5 | >16 to max. 21.5 | <4 |
| Toxics | < ½ OEL | < IDLH | Not applicable |
| Flammables % of LFL | Not detectable (<1) | <10  For hot work - not detectable | <10 |

Upon achieving <1% LFL, vessel entry will commence under authorized confined space entry certificate with orinasal respirator (breathing apparatus is not required under these conditions) and all other necessary control measures in place. Three teams of 5 cleaning personnel (FLM and OSR) will take turns entering the tank with shovels and squeegees for 10 minute maximum durations to push sludge towards the clean out door while sludge pumps (OSR) are used to pump to Pit E. Two standby men will maintain radio communication and visual contact with the 5 personnel within the tank at all times during tank entry.

When the sludge has been completely removed, flushing with firewater will commence while pumping to Pit E from the clean out door and skimming of Pit E via surface pump is ongoing. This will continue until the tank is clean.

* 1. **Waste Management**

Waste generated during this project will include tank bottom sludge, oily waste rags and absorbent and used disposable coveralls. All tank bottom sludge will be pumped to Sludge Pit E to awaiting treatment at the TDU plant. Oily waste rags and absorbents as well as used disposable coveralls will be disposed of in the appropriately labelled waste bins.

1. **COMMISSIONING AND START-UP**

Upon completion of T1401 internal cleaning and inspection, a Statement of Fitness will be prepared and signed off by the Asset Manager. The tank will then be de-isolated and returned to service.