National University of Singapore

12-13\textsuperscript{th} of November 2013

Rigs to Reef Prospects in SE Asia

Issues with large jackets

Thor Sterker
Where we come from
Some 200++ man years installation experience

Removal methods:
1. Heavy Lift Vessel
2. Single Lift vessel
3. Piece small
North Sea Platform Removal
Removal methods

- Reversed installation
- Piece small
- Single lift
- Any combination of the above

- Topsides 20,000 tonnes
- Jacket 18,000 tonnes
- Water depth 144 metres
- Jacket footings - left in-situ
Platform Removal – Agenda

Scenario’s
- Leave in place
- Leaving part in situ and emplacement of top
- Reefing elsewhere

Jacket removal
- Size
- Cutting plans + Details
- Survey details
- Focus points jacket removal

Quay lay out

Questions
Size does matter
Jacket – Remove in blocks
Cutting plan

Top section

North & South section

Footing
Jacket Removal Proposal – Top section

~4075 mT
Jacket Removal Proposal – Bottom sections

\[ \sim 3400 \text{ mT} \]
Footing: pile clusters + piece small

Estimated weight 3000 mT

Pile cluster
- single piece -
  (4x)

Center section
Footing: pile clusters + piece small
Focus points: Jacket removal

More detailed engineering required for:
• Cutting methods for OD 6m legs
• Improve cutting methods for braces up to OD 1400 mm
• Lifting tools for North and South sections
• Incorporate output of ROV inspections
• Weather window / sea state required for large piece jacket removal
• Verification of structural integrity prior, during and after lift
Quay layout

30,000 m²
1. Introduction
2. Basic assumptions & starting conditions
3. Jacket toppling
4. Jacket reefing
This presentation is to explain the jacket toppling and reefing methods, including a cost estimate and a comparison to the base case jacket removal (full removal and recycling onshore)
Jacket toppling

- Toppling means to pull over the jacket and leave it on the seabottom at site
- There are various methods, but for this study we have chosen to use the HLV according the attached sketches
- The reason is that the HLV will be on site for the topside removal and has all the necessary equipment to perform the toppling method
- Alternative, like using a small crane vessel and heavy tugs may be investigated in a later stage. It is not expected that alternative methods will provide a significant cost reduction
1. HLV removes soil plugs from jacket legs and cuts the piles 3 m below sealevel
2. The HLV connects rigging and lifts and pulls over the jacket in one sequence
3. The HLV lays down the jacket onto the seabed in a controlled manner and disconnects rigging
Install rigging platform
Remove soil plug
Cut foundation piles
Connect rigging
Lift jacket and turn
Lay down jacket to seabottom
Disconnect rigging and leave jacket on seabottom

Courtesy to Svitzer Salvage for preparation of sketches
The cost estimates are based on the following durations for the HLV:

1. Mobilisation: 0 (the toppling is performed directly after the topsides removal)
2. Remove soil plug and cut piles: 2 days (for a 4 legged jacket)
3. Connect rigging and lay down jacket to seabottom: 1 day
4. Total HLV duration: 3 days

<table>
<thead>
<tr>
<th>Dayrate</th>
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<tbody>
<tr>
<td>HLV</td>
<td>$ 245,000</td>
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<tr>
<td>Cutting tool spread</td>
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<tr>
<td>ROV</td>
<td>$12,000</td>
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- Total dayrate rate: $272,000
- Total cost per jacket: $816,000 (4 legged jacket)
overall cost jacket removal
Jackets are transported to recycling yard by cargo barges

<table>
<thead>
<tr>
<th></th>
<th>no</th>
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<td>39,73</td>
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<tr>
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<tr>
<td>Process plfm 3</td>
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<tr>
<td>WHP</td>
<td>1</td>
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<tr>
<td>total</td>
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Δ pltfm 1 32.9
Δ pltfm 2 25.3
Δ pltfm 3 25.3
Δ whp 2.32

overall cost jacket toppling on site

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As an alternative, the jacket can be transported to a designated reefing site. This is allowed in countries like the USA, where specific reefing legislation exists. The jackets are transported by the HLV to the reefing site and toppled. The chosen method is similar to the toppling, only the transportation to the site has to be incorporated. 2 days for transport to the site and 2 days for returning of the HLV results in 4 additional days for the HLV @ $816,000 results in $3.2 million additional costs per jacket compared to the toppling method.
**Cost comparison with full removal**

Overall cost jacket removal
jackets to recycling yard by cargo barges

<table>
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Overall cost for transporting jacket to designated reefing site and toppling

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\(\Delta \text{pltfm } 1\) 27.7
\(\Delta \text{pltfm } 2\) 23.0
\(\Delta \text{pltfm } 3\) 23.0
\(\Delta \text{whp}\) 2.32
In 1987 an 8-pile drilling and production platform in 238’ of water was toppled in-place in SMI 146 by OXY. The savings resulted in a donation of $250,000 to the program.

<table>
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<th>ITEM</th>
<th>TRADITIONAL</th>
<th>RIGS-TO-REEFS</th>
<th>SAVINGS</th>
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<td>($30,000)</td>
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Thank you