Oil & Gas UK Category 1 Well

- All annuli & casing isolated
- No intervention required

Source: Oil & Gas UK, Guidelines for the suspension and abandonment of wells, Issue 4, July 2012
Oil & Gas UK Category 2.1 Well

- Oil & Gas UK Guidelines require a Minimum of 100 ft. of Cement
- Category 2.1 – The well has one annulus uncemented

Source: Oil & Gas UK, Guidelines for the suspension and abandonment of wells, Issue 4, July 2012
Oil & Gas UK Guidelines require a Minimum of 100 ft. of Cement

Category 2.2 – The well has two annuli uncemented

20” Shoe

Squeeze Possible

13 3/8” Shoe

Squeeze Possible

9 5/8” Shoe

Squeeze Possible

Source: Oil & Gas UK, Guidelines for the suspension and abandonment of wells, Issue 4, July 2012
Wellhead Abandonment Straddle Packer (WASP)

- Uses inflatable elements to cover a range of casing sizes and weights
- Accommodates two sets of perforating guns to selectively perforate and cement two casing annuli
- Incorporates failsafe valves for emergency shut-in
- Project Managed team to plan and execute campaign
- Quick operation and provides financial benefits to alternative methods. (single trip)
WASP – Run in Hole

**Category 2.2 Example**

- Drift and Scraper run performed before WASP deployment

- Run Tubing Conveyed Perforating (TCP) Guns and hang off in moonpool.

- Connect Guns to WASP

- RIH to land-off in the wellhead.
WASP – Inflate & Test Packers

- Inflate Upper and Lower Packer.
- Pressure test
WASP – Perforate A - Annulus

- Perforate through casing into ‘A’ Annulus.
WASP – Flush & Cement A-Annulus

- Circulate well fluids to surface.
- Spot Cement into ‘A’ Annulus and hold.
- Wait on Cement (WOC)
  - *Cement hold time will be determined by Baker Hughes onshore Sample Test.*
- Pressure test
WASP – Perforate B-Annulus

- Perforate through cement and casing into ‘B’ Annulus.
WASP – Establish Circulation, Drop Guns

- Circulate well fluids to surface.
- Hydraulically Disconnect Lower Guns
WASP – Cement B-Annulus

- Displace a balanced cement plug across the ‘B’ annulus and main bore
WASP – Deflate Elements

- Wait on cement (WOC)
- Pressure test
- Deflates Packers
- Pull Out of Hole (POOH) with WASP
Benefits of WASP over Conventional Methods

- Conforms to UK Oil & Gas Guidelines for the Abandonment of Wells
- Vessel Workscope allows quick mobilisation and set-up at wellsite
- Vessels Use Dynamic positioning to stay on location
- Lower cost alternative to Rig hire
- No Diver Intervention Required
- Small Equipment footprint in comparison to rig based alternative
- Project Managed Collaborative team
Vessel Requirements

- Dynamic Positioning Capability (>DP2)
- Moonpool for WASP and Severing Equipment deployment
- Crane with Capacity of 100Te is preferable
- Adequate Deck Space
- Storage Capacity for OBM
- Accommodation for WASP and Severance Crew (WASP Team, 9 Minimum for 24 hour Ops)
- ROV capability (Work Class, Minimum x 1)
## Suspended Well Abandonment Timeframe

### Basic 2.1 Job Timeline (1 well)

<table>
<thead>
<tr>
<th>Phase</th>
<th>Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onshore Quayside Prep</td>
<td>2</td>
</tr>
<tr>
<td>Transit</td>
<td>1</td>
</tr>
<tr>
<td>WASP - 2.1</td>
<td>2</td>
</tr>
<tr>
<td>Abrasive Severance</td>
<td>1</td>
</tr>
<tr>
<td>Transit *</td>
<td>1</td>
</tr>
<tr>
<td>Demob</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>7</strong></td>
</tr>
</tbody>
</table>

### Basic 2.2 Job Timeline (1 well)

<table>
<thead>
<tr>
<th>Phase</th>
<th>Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onshore Quayside Prep</td>
<td>2</td>
</tr>
<tr>
<td>Transit</td>
<td>1</td>
</tr>
<tr>
<td>WASP - 2.2</td>
<td>3</td>
</tr>
<tr>
<td>Abrasive Severance</td>
<td>1</td>
</tr>
<tr>
<td>Transit *</td>
<td>1</td>
</tr>
<tr>
<td>Demob</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>9</strong></td>
</tr>
</tbody>
</table>

### Additional 2.1 well (After *)

<table>
<thead>
<tr>
<th>Phase</th>
<th>Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>WASP - 2.1</td>
<td>2</td>
</tr>
<tr>
<td>Abrasive Severance</td>
<td>1</td>
</tr>
<tr>
<td>Transit</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4</strong></td>
</tr>
</tbody>
</table>

### Additional 2.2 well (After *)

<table>
<thead>
<tr>
<th>Phase</th>
<th>Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>WASP - 2.2</td>
<td>3</td>
</tr>
<tr>
<td>Abrasive Severance</td>
<td>1</td>
</tr>
<tr>
<td>Transit</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>5</strong></td>
</tr>
</tbody>
</table>
Batch and Multi-Well

How do we tackle Suspended Wells more efficiently?

**Example 2015** – Two North Sea Customers required for the final Phase 3 Abandonment of wells (WASP and Severance of 5 Wells)

- **Customer A** : 4 Wells
  - 1 x Cat 2.1
  - 3 x Cat 2.2

- **Customer B** – 1 Well
  - 1 x Cat 2.1

Same Vessel, Same Contractors **BUT** Separate Contracts
Future – Where Next

- Collaboration between Operators – Inventive Commercial Models
- Remove Unnecessary Mob/Demob costs
- Gain Efficiencies through planned sharing of Workscopes
- Resource Sharing between Contractors
- Industry push for tackling multi-well, multi-operator campaigns
- Batch work so that rig only completes the plugging of the reservoir. Vessel for Final plug and Wellhead Removal.
Riserless Subsea Well Abandonment Methodology

www.bakerhughes.com/wellabandonment