OTC-24783-MS
Deepwater Subsea Waterjet Impact on HSE

Chukar Waterjet, Inc.
DEEPWATER SUBSEA WATERJET

Impact on HSE
DEEPWATER SUBSEA WATERJET
Increasing Water Depths (3,000 msw+)

Conventional Methods

Deepwater Subsea Waterjet

Photo: Offshore Technical Solutions, LLC
<table>
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<tr>
<th>Surface-based Waterjet</th>
<th>Mechanical and Thermal</th>
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</thead>
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<tr>
<td>UHP</td>
<td>Fire and explosion</td>
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<tr>
<td>Depth</td>
<td>Entrapment</td>
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<td>Entanglement</td>
<td>Excavation</td>
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<tr>
<td>Deck spread</td>
<td>Ancillary damage</td>
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<td>Response</td>
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## COMPARISON OF CUTTING PROCESSES

<table>
<thead>
<tr>
<th></th>
<th>WATERJET</th>
<th>THERMAL</th>
<th>MECHANICAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>HAZ</td>
<td>No</td>
<td>Yes</td>
<td>Minimal</td>
</tr>
<tr>
<td>Cutting Force</td>
<td>Small</td>
<td>Small</td>
<td>Large</td>
</tr>
<tr>
<td>Tool</td>
<td>Non-rigid</td>
<td>Non-rigid</td>
<td>Rigid</td>
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<tr>
<td>Start</td>
<td>Interior</td>
<td>Interior</td>
<td>Exterior</td>
</tr>
<tr>
<td>Spark</td>
<td>Closed</td>
<td>Energetic</td>
<td>Energetic</td>
</tr>
<tr>
<td>Fixturing</td>
<td>Minimal</td>
<td>Minimal</td>
<td>Complex</td>
</tr>
</tbody>
</table>
MECHANICAL AND THERMAL TECHNIQUES
Health, Safety, Environment

- Fire
- Explosion
- Entrapment

- Excavation
- Ancillary damage

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OTC-24783-MS • Deepwater Subsea Waterjet Impact on HSE
SURFACE-BASED WATERJET
Health, Safety, Environment

- Ultra-high pressure (UHP)
- Depth
- Entanglement

- Deck spread
- Response

Photo: Offshore Technical Solutions, LLC – Houma, LA USA
DEEPWATER SUBSEA WATERJET
Health & Safety Solutions

- Ultra-high pressure (UHP)
- Water depth
- Hoses
- Deck space

- Remote UHP
- Deepwater
- Single umbilical
- Clean footprint

Photo: Offshore Technical Solutions, LLC – Houma, LA
DEEPWATER SUBSEA WATERJET
Health & Safety Solutions

- Ultra-high pressure (UHP)
- Water depth
- Hoses
- Deck space

- Remote UHP
- Deepwater
- Single umbilical
- Clean footprint

Photo: Offshore Technical Solutions, LLC – Houma, LA
DEEPWATER SUBSEA WATERJET
Opportunities

- Response
- Diver/asset
- Dual-use
APPLICATION SCENARIOS

- Scenario: Explosion and intense fire claim lives and burn platform. Subsea wellhead and risers damaged.

- Response:
  - Deploy hard tools (saw, wire, shear) to prepare wellhead for capping. Operations damage the wellhead and cap cannot be properly attached.
  - Oil flows for 87 days, 4.9 million bbl
  - Cleanup cost 40 billion USD +

Macondo 2010
Without Deepwater Subsea Waterjet
APPLICATION SCENARIOS

- Scenario: Explosion and intense fire claim lives and burn platform. Subsea wellhead and risers damaged.
- Response:
  - Deploy subsea waterjet to cut wellhead in preparation for capping. Cap is attached.
  - Oil flows for 48 days, 2.7 million barrels. Cleanup cost 22 billion USD+
  - 2.2 million less bbl oil to the environment
  - Cleanup cost 22 billion USD

Macondo 2010 Projection with Deepwater Subsea Waterjet
APPLICATION SCENARIOS

- Scenario: Fire-damaged platform leans dangerously. Oil is leaking from damaged production tree.
- Response:
  - Work-generated spark causes fire to break out and delay further operations.
  - Oil and gas flows from partially closed valves.
  - Approximately 13,000 bbl of oil into the environment.
  - Cleanup approximately $55K USD

KAB-101 2007
Without Deepwater Subsea Waterjet
APPLICATION SCENARIOS

- Scenario: Fire-damaged platform leans dangerously. Oil is leaking from damaged production tree.
- Response:
  - Subsea waterjet system is used to safely cut in gaseous atmosphere.
  - Personnel work safely and without delay to repair valves and close off the wellhead.
  - Oil into the environment reduced by approximately 5,850 bbl.
  - Cleanup approximately $28K USD

KAB-101 2007 Projection with Deepwater Subsea Waterjet
APPLICATION SCENARIOS
Emergency Response with Subsea Waterjet
APPLICATION SCENARIOS
Possible Users
Acknowledgements / Thank You / Questions

Thank you!