A general overview of Decommissioning activities in the Gulf of Mexico (GOM)

Most frequent issues regarding vessel operations that occur during preparation, removal & disposal stages of projects

Types of vessels and required capabilities and technologies that are required for various types of Decommissioning operations

Insight into decommissioning of offshore installations from technological and economical perspective

What decommissioning methods Tetra Technologies prefers and why

Lessons Learned from the most recent projects
Decommissioning usually consists of Well Plug & Abandonment, Pipeline Abandonment / Removal, and Structure Removal.

The GOM Decommissioning Market is the largest in the world.

Recent estimates over the last 5 years put the recent GOM market at $1.5 to $2 billion spent a year. On Average that is more than 200 structures and 1,200 wells per year.

There are roughly 2,600 (1,194 producing) platforms and 9,900 wellbores in water less than 400 feet deep.

In deeper water, there are approximately 114 structures and 1,000 wells.
TETRA Offshore Services utilizes several types of Heavy Lift assets to remove Structures:

- **Shallow Water – Sheer Leg or Jackup Vessels**
- **Shelf Locations – Heavy Lift Anchored Barges**
- **Deep Water – DP Heavy Lift Assets**
**TETRA Hedron**

- Dimensions: 400’ x 120’ x 32’
- Crane capacity: 1,763 S. Tons
- Mooring: (10) anchors with (10) single drum 286,601-pound winches
- Auxiliary crane: Manitowoc 14000 (143-ft. boom)
- Quarters: 300-person capacity
- Registry: Republic of Vanuatu
- Class: ABS

**TETRA Arapaho**

- Dimensions: 350’ x 100’ x 25’
- Crane capacity: 800 S. Tons
- Mooring: (8) anchors with (4) double drum 300,000-pound winches
- Auxiliary crane: Manitowoc 3900W (120-ft. boom)
- Quarters: 100-person capacity
- Registry: U.S.A.
- Outfitted with 450’ SAT System
Platform Abandonment

Restoring the Environment One Field at a Time.
Various assets can be used for Pipeline Abandonment depending on the size / length of the Pipeline, and the local conditions.

Usual Types of Abandonments:
• Riser to Riser
• Riser to Sub-Sea Tie-In (SSTI)
• Subsea Well to Riser / SSTI

Typical Work Scope (*SS Well to Riser*)
- Attached to Wellhead and flush to platform
- Processed fluids at platform
- Cut, plug, and Bury Flowline at Well
- Cut, cover, and bury Wellhead Control Umbilicals
- Transit to Platform to Cut, plug, and bury Flowline and Umbilicals
Rigless Well Plug & Abandonment

- **Platform Based**
- **Lift Boat Based**
- **Subsea P&A**
- **DSV/Utility Boat Based**
TETRA Specializes in a **Riserless** P&A Spread

- **Personnel (24 Hour):**
  - 2 – P&A Supervisor
  - 2 – Pump Operators
  - 4 – Riggers
  - 1 – E-line/Slickline Operator (as needed)

- **Equipment:**
  - 1 – 10k PSI Triplex pump w/ 4 Halliburton valves
  - 1 – Double Drum E/L & .092 S/L unit
  - 1 – E-line tool box
  - 1 – lubricator system with BOP’s (10k)
  - 1 – 60 bbl tank w/ gas buster & choke
  - 1 – 500ft of hose
  - 1 – Pin chart recorder
  - 1 – Hose basket with suction, discharge & hydraulic hoses
  - 1 – Manual hydraulic pump for opening SCSSV
  - 1 – P&A tool box
  - 1 – 50 bbl Cylindrical cement blender
  - 1 – Gas detector and Norm meter
Rigless Well Plug & Abandonment – Platform Based
Rigless Well Plug & Abandonment – Liftboat Supported
Pipeline Abandonment and Subsea P&A Support

- DSV Spread (48 berths)
  - 4 Point Dive Support Vessel
  - 6 Man, 1000’ Saturation system
  - 2 Integrated Jet Pumps
  - 20 Ton Crane
  - Fugro OARS Positioning system
Well Plug & Abandonment – Working from a DSV
Subsea Well P&A from Dive Support Vessel
Special Projects
Most Frequent Issues / Preferred Vessel Types

- POB Limitations
- Crane Limitations
  - Heave Compensation Preferred
  - Two Cranes for Specialized Work
- Deckspace
- Weather Sensitivity
- Moon Pool(s)
- ROV Complexity / Downtime
- Light Well Intervention Package
  - Self Supporting Riser
  - Heave compensated Tower
The Shallow Water GOM market has been steady over the last few years but the market is being slowly impacted by low oil prices; Operators are only abandoning the absolute minimum.

The GOM Deep Water Market has been poised to go into Deeper water for at least 8 years but the market is still stagnant.

Rigless Well Abandonments are limited by design issues with Horizontal Trees which to date have required a significant pulling force to unseat the Crown Plug; this leaves the market to Drill Rigs and Intervention Spreads.
Horizontal Tree – Include a crown plug for sealing the production bore with plugs that are run into tubing hangers and installed inside the tree.

- Horizontal Trees have become increasingly popular due to:
  - Lower cost
  - Increased functionality vs. Vertical Trees
  - Flexibility of using larger bore completion

- Often encounter problems with “stuck” crown plugs which can require excessive pulling forces. These forces are often greater than pulling capacity of a WL or CT unit and often beyond the wire / tubing strength itself.
Preferred Methods - Phased Execution Approach

- Phase 1 - Project Kick Off, Planning & Site Survey
- Phase 2 - Well Plug & Abandonment
- Phase 3 - Pipeline Abandonment
- Phase 4 - Platform / Facility Removal
- Phase 5 - Debris Removal & Final Site Acceptance
- Phase 6 - Project Closeout
Structures (Partially Downed in Hurricane Ike)
  • Water Depth: 430 and 463 FSW
  • Bottom Composition: Stiff clay
  • Piles: 6 and 4
  • Two Platforms, broken over at 200’ and 240’

Wells (13 and 10)
  • Several wells were leaking gas at high pressure, requiring a new approach to injecting various types of Kill Weight Fluid
**Execution**
1. Installed wire rope reinforcement and stays on unsound parts of the Jacket for diver safety
2. Conducted Make Safe with large Shears and Grapple to gain access well bay at both locations
3. Hot Tapped and conducted diagnostics on all wells, Injected Kill Weight Fluid
4. All but three wells at EI-397 Abandoned via Rigless P&A
5. The three abnormal wells (junk / sand in hole) were abandoned utilizing a specially designed Coiled Tubing and Riser Spread based from a TETRA DSV with Heave Compensated Crane
6. Flushed and abandoned 7 Pipelines and 5 Umbilicals
7. Rigged both upper Deck and Jacket sections and installed remote Diamond Wire Saws
8. for VB10K lift
9. Cut and pulled all conductors 15’ BML
10. Cut Piles at EI-397 and rigged Jacket for VB10K lift
Over the last four years TETRA Integrated Solutions Group has been addressing a growing percentage of wells requiring specific attention due to the presence of slow but consistent accumulation of gas both inside the production casing and the outer annuli. When the gas pressure is relieved and the wellhead removed it has been noted that the gas is streaming, often slowly but consistently, through small fissures in the annular cement.
Sample Rigless P&A Program

Step 1

- Flush Trees and Jumper
- Check Pressures
- Mob P&A Vessel to Site
- Inspect Subsea Equipment
- Lock Open SSCV

Step 2

- Pull Jumper and Retrieve to Surface
- Disconnect EFL and HFL
Sample Rigless P&A Program

Step 3

- Pull Tree Debris Cap
- Rig up Surface P&A Hoses

Step 4

- Kill well and Establish Injection Rates
- Pull Internal Tree Cap
Step 5

- Rig up Subsea Lubricator System (SLS)
- Rig up P&A Hoses
- Pull Tubing Hanger Plug

Step 6

- P&A Well while ROV manipulates valves
Sample Rigless P&A Program

Step 7

• Recover P&A system & SLS to surface
• ROV to unlock Tree from wellhead

Step 8

• Recover Tree to surface
• Recover wellhead
Wireline Wellbore Tractors

- Runs off from Eline power
- Can pull or push specialty tools such as milling bits
TETRA Patented Wireline Crown Plug Pulling Tool

- Various designs allow for the unit to be launched stand-alone or as part of a lubricator system
- Radially static land-able jacking sub with separate jacking string which can be connected to a crown plug in a Horizontal Tree
- Once the exterior cap has been removed and the lubricator has been securely mounted to the wellhead the jacking sub connects via landing shoulder to the crown plug and then hydraulic pressure is applied to the Jacking sub which raises the jacking string and releasing the crown plug. The tool can then be recovered as an assembly.
Technologies of Interest – Crown Plug Pulling

- Install Subsea Lubricator / Jacking Frame
- SLS / Jacking Frame
- Crown Plug
Technologies of Interest – Crown Plug Pulling

Install Jacking sub into SLS / Frame

Jacking Sub

Crown Plug
Engage Jacking system through these ports

Recover Jacking sub into SLS / Frame
Technologies of Interest – Crown Plug Pulling

1. Locked on Crown Plug
2. Engage and Pull Plug
3. Pressure
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