Enhanced Hydrocarbon Recovery Via Proven & Safe Chemical Tank Cleaning
Vision Petroleum Malaysia (ViP) is a Chemical Technology based company offering the Oil and Gas Industry’s only engineered chemistry crude recovery solution. ViP have many years of experience servicing Malaysian based Oil Producers and are now looking to expand their services globally.

ViP’s goal is to maximise their Clients Oil production and at the same time generate additional Oil revenues where previously there was none!

Irvine Engineering Pte Ltd have joined with ViP to assist bringing their product to market, effectively using industry world wide contacts to introduce the product too.
Tank Storage and Cleaning - Main Issues

• Long term sludge in storage tanks is an accumulating problem.

• Sludge volume takes up valuable crude storage space.

• Typical conventional acid based sludge removal:
  – Health & safety risks are high for personnel and facilities (long term exposure to tanks and ignition risks).
  – Quality and amount of any recovered oil is unknown, a lost resource and revenue to producers.
  – Storage tanks out of commission, typically ~12 to 18 months.
  – Solids in sludge (sand) requires further cleaning/treatment.
  – Water from sludge requires further treatment.
  – A personnel and equipment intensive operation.
  – Is an expensive and timely operation to the producer/operator.
The Past and the Present!

Conventional Acid Tank Cleaning Operation

V6 Sludge Breaker Tank Cleaning Operation
Vision Petroleum’s Solution - Features

Formulated Site Specific V6 Sludge Breaker:

- Guaranteed safe and rapid sludge removal, typically ~4 weeks!
- The formulation itself maximises sludge breakers interaction with the sludge.
- Maintains fluidity of the sludge, creating processible crude.
- Assist with surfactant dispersion & penetration.
- Minimizes and prevents wax formation.
- No toxic byproducts, leaves wet solids for easy disposal.

V6 Sludge Breaker Properties:

- Low temperature, nano chemistry hydrocarbon recovery agent.
- Surfactant based sand control chemical.
- Low temperature, nano chemistry heavy oil viscosity modifier.
- Low dosage nano chemistry core demulsifier.
- Nano chemistry sand oil surfactant.
- Universal parafinic pour point depressant.
Laboratory Test Performance Data Summary of Results

- Rapid oil-water separation (10-20 minutes);
- Separated water has 10.6 -12.4 ppm oil content, which is within operational limit of 30 ppm (Petronas Standard);
- No re-emulsification even after re-agitation;
- Complete BS&W reduction at higher dosages (60 ppm);
- Tested for crude compatibility with no impact - density, metal content (100% organic), sulfur (ASTM D4294), mercury (UOP 398), salt content.
Laboratory Test Performance Data
Summary of Results

- Fluidized sludge by reducing viscosity (80-90%).
- No cooling impact - fluids mobile at 20°C.
- Works at ambient temperature - no heating required.
- No re-emulsification with clean crude (diluent) - 100% solubility in hydrocarbon solvent.
- Separated solids are water-wet.
- Surfaces are water-wet.
- No impact on Micro Carbon Residue Test (ASTM D4530) i.e. will not cause fouling on metal surfaces.
V6 Separation Examples

Sludge Sample

Sludge Sample with V6 Added, Displays the Separation Process, Typically under 4 minutes
V6 Separation Examples cont’d

Untreated Sludge Sample

V6 Treated Sludge Sample
V6 Separation Examples cont’d

Sludge Sample @ ambient 20°C (Untreated)  Sludge Sample @ ambient 20°C (Treated with V6)
Overall Tank Cleaning Method and Approximate Timings

**Tank Pre-survey**
Sampling for Laboratory Tests
(2 weeks)

Site Tank Verification Sampling
(1 week)

Site Team Mobilisation
(1 week)

Injection of V6 with Carrier Crude, Chemical Reaction
(1 week)

Water is Drawn Off
(1 day)

Liberated Crude Piped to Process facility
(Pumping 5 days)

Remaining Non Hazardous Solids Removed
(1 week)

Tank is Ready for Service
(complete operation start to finish ~7 weeks)

Note: Does not take into account contractual agreement time
Does not take into account personnel availability
The V6 Sludge Breaker Pre-Survey Process

1. Pre-survey Clients Crude & Sludge Samples are sent for Laboratory Analysis

2. V6 is Introduced to the Crude Site Samples, Various Testing Formulations are Prepared to Obtain the Optimum Formulation

3. Each Sample is Mixed with Actual Site Tank Crude, Simulation Exercise

4. Testing is Complete Within 4 to 7 Minutes where the Optimum Formulation is then Found
Tank Sludge Profile, Samples Taken at All Tank Sampling Points
Benefits of the V6 Sludge Breaker

• >90% crude recovery from the sludge.
• Recovered crude meets with sales crude quality turning sludge into a substantial revenue.
• Rapid cleaning schedule, typically 4 weeks (conventional acid cleaning methods can be as long as 18 months!).
• Rapid tank turnaround time.
• Typically a 5 person team with minimal equipment.
• Excellent mechanical tank cleaning process.
• Greatly improved health and safety liability as far less tank exposure to personnel.
• More environmentally friendly as remaining solids and water are treated within the process.
Tank Cleaning Experience

• Sludge Breaker was originally subjected to extended third party lab testing to ensure it’s properties met with companies high recovery standards.

• Between 2010 and 2012 the Sludge Breaker was successfully introduced at three different tank site locations where it out performed company expectations. The three Petronas locations were at:
  – Miri, Malaysia
  – Melaka, Malaysia
  – Terengganu, Malaysia (TCOT)

• Since 2012 Sludge Breaker has undergone further refinement resulting in an improved version, V6. This version is now ready for full global market release.
1. Pre-survey: Clients' Crude & Sludge Samples are sent for Laboratory Analysis.

2. Samples are introduced to the V6 formula where a first pass analysis is made to align a correct V6 formulation.

3. A report is made to the client confirming a V6 cleaning schedule and site-specific work methodology, an eventual contractual agreement is later agreed.

4. Tank cleaning personnel are mobilised to site along with equipment and V6.

5. After tank is emptied of crude, further samples are taken from the tank sampling points to generate a full sludge tank profile and make ready fresh samples for further analysis with the V6.

6. The tank sludge profile identifies the required amount of V6 needed for the cleaning & sludge crude recovery.

7. Samples are given a final at site analysis with V6 where any V6 concentrations may be varied.

8. V6 is introduced with crude carrier to the tank via the tank's transfer pump. Water is then drawn off and production quality crude is pumped out to the site's production facility.

9. Non-hazardous clean sand solids are then removed and taken away.
Tank Solids Profiling

Objectives:

- Obtain solids heights and viscosities data throughout the tank floor level via sample holes.
- Data is used to optimise V6 formulation.
- Data is also used to obtain solids quantity for crude recovery estimation as well as residual solids and water information.
Tank Cleaning Experience Example - TCOT

Pre-survey Testing, Crude and Sludge Samples:

- **Client:** Petronas
- **Project:** PCSB-PMOT T-446
- **Country:** Malaysia
- **Application:** 1% Sludge Breaker Mixed with 10% Carrier Crude & T-446 Sludge. Stirred 30 mins then Settled 4 Hours
- **Work Scope:** Pre-survey Sample Testing to Align Sludge Breaker Formula with Sample
- **Capacity:** 1 Drum
- **Performance:** Performance
- **Date:** 20/11/2010

- Within 4 hours, crude and water separated into 2 phases (with solids dropped in the bottom);
- Crude %BS&W reduced to less than 0.2% (export quality);
- Viscosity reduced by 90% at 30°C;
- Recovered Crude does not re-emulsify and compatible with clean crude;
- Maximize crude oil recovery (>95%);
- Separated solid is water-wet, and easily flushed to clean residual oil for disposal;
- No adverse effect on produced water quality
# Tank Cleaning Experience Example - TCOT

## T422 Tank Cleaning Results at TCOT:

<table>
<thead>
<tr>
<th>Client:</th>
<th>Petronas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project:</td>
<td>PCSB-PMOT T-446</td>
</tr>
<tr>
<td>Country:</td>
<td>Malaysia</td>
</tr>
<tr>
<td>Application:</td>
<td>100 ppm, 2 cycles chemical injected into rundown (carrier) crude</td>
</tr>
<tr>
<td>Work Scope:</td>
<td>Complete Tank Cleaning Operation</td>
</tr>
<tr>
<td>Capacity:</td>
<td>Complete Storage Tank</td>
</tr>
<tr>
<td>Performance:</td>
<td>95% Crude Oil Recovery from Sludge</td>
</tr>
<tr>
<td>Date:</td>
<td>20/01/2011</td>
</tr>
</tbody>
</table>

- 100 ppm, 2 cycles chemical injected into rundown (carrier) crude.
- Reduced sludge viscosity to pumping grade (lower than 2,000 cP; untreated sludge viscosity ~ 80,000 cP).
- 2.8 meters sludge level reduced to 0.1 meter.
- Recovered crude meets export quality (%BS&W below 0.5%, TMB samples – as low as 0% emulsion; SGS data).
- Crude recovery from sludge valued at >RM 10 million (date 2011) (30,000 bbl) - “extraction cost” was substantially less.
Tidy V6 Pump / Injection Arrangement

- V6 Transportation Tanks
- V6 Injection Point to Tank Inlet Piping
- Main Injection Pump together with Back-up Pump
Solids Sampling Pole

Sampling Pole Taking Sludge Samples, these will be used for Further Analysis and Data for Tank Solids Profiling

Sampling Pole Displaying Sample Shelves for Taking Samples of Solids at Different Heights
Petronas Verification Exercise

Petronas Clients Witnessing V6 Separation Ability at Site

Left Barrel, non Treated Sludge, Right Barrel V6 Treated Sludge

Sludge Stuck to Sampling Pole

No Sludge on Sampling Pole
Waste Water Draw Off and Sampling

Drain disposal quality!
Remaining Solids

Remaining Non Hazardous Solids with over 90% Crude Removal
## V6 Comparison with Other Methods

<table>
<thead>
<tr>
<th>Description</th>
<th>V6</th>
<th>Other Chemical</th>
<th>Manual Tank Cleaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dosage</td>
<td>&lt;30 deg C</td>
<td>&gt;40 deg C</td>
<td></td>
</tr>
<tr>
<td>Type</td>
<td>100 to 200 ppm</td>
<td>5,000 to above 10,000 ppm</td>
<td></td>
</tr>
<tr>
<td>HSE</td>
<td>Minimum exposure due to no-man entry requirement (online cleaning)</td>
<td>High Exposure due to manual removal of sludge for heating purposes before chemical treatment</td>
<td>High exposure due to longer man entry into tank</td>
</tr>
<tr>
<td>Duration Of Treatment</td>
<td>80% reduction in cleaning time, hence reducing tank downtime, subsequently improving availability for plant or terminal utilization (note: for maintenance batching application, downtime is almost zero)</td>
<td>Tank Isolation is required: long cleaning time with manual removal, sludge heating with boiler units and decanters required</td>
<td>Longer cleaning time required</td>
</tr>
<tr>
<td>Cost of Desludging Treatment</td>
<td>Lower direct cost due to low dosage required for chemical treatment (almost 10-20% of Acid Sludgebreaker dosage)</td>
<td>Tank Isolation is required: long cleaning time with manual removal; sludge heating with boiler units and decanters required</td>
<td>Longer cleaning time required</td>
</tr>
<tr>
<td>Heat</td>
<td>Not required</td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td>Oil Quality</td>
<td>Meet Sales quality</td>
<td>Unknown crude quality</td>
<td></td>
</tr>
</tbody>
</table>
Preventative Maintenance

• After initial V6 tank cleaning a tank preventative maintenance (PM) cleaning program can be scheduled.
• Tank PM either quarterly or half-yearly, chemical batching depending on sludge input to tanks.
• Site truck deployment with V6 supplies simple testing facility to support chemical batching.
• Tank V6 batching method for PM supports site deployment with zero chemical handling at site.
Local Content Option

• Easy site deployment of V6 allows for fast-track training of local support personnel (preferable) - minimal mechanical operations required.

• Local personnel trained and managed by Vision Petroleum in all operational aspects including health and safety.

• Site-specific standard testing procedure allows thorough testing instructions and training for local personnel.
Health and Safety

• V6 requires no heating, no boilers or fuel at site.
• V6 requires minimal equipment at site.
• Small, typically 5 person team.
• V6 is non-flammable.
• V6 has no acid content.
• No personnel tank entry required at any part of the cleaning process.
HSE - Industrial Hygiene

- Discharged water quality - pH is neutral, no further neutralisation treatment required.
- Low dosage with V6 reduced any V6 carryover into the discharged water.
- Low dosage with V6 also reduces chemical handling by personnel - supplied in tote tanks, i.e. zero handling at site.
- Low chemical volume reduced risk of chemical spill (compared to acid sludge breaker).
The Environment

• V6 is an environmentally friendly chemical, 100% organic.
• V6 is injected with carrier crude, 100% soluble, no contact with the environment and easily recovered from the crude at the crude processing stage.
• V6 has no impact on any metal content including nickel, vanadium, ferum and sodium due to it’s 100% organic makeup.
• V6 has no impact on sulphur, mercury or salt content.
V6 Summary

- V6 is a novel engineered safe to use chemical solution.
- Rapid, typically 4 week tank cleaning turnaround.
- Generates a substantial revenue from recovered crude.
- Safe and minimal site disturbance at tank location.
- Leaves minimal non hazardous inert solids.
- No further remediation of solids required.
- Leaves drain disposal quality water (pH neutral).
- No toxic emissions or byproducts.
- Can create local employment.

Proven at Petronas Tank Facilities, V6 will Deliver the Same for You!
Enhanced Hydrocarbon Recovery Via Proven & Safe Chemical Tank Cleaning

Thank You
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