



Total Environmental Solutions

TES TECHNOLOGIES & SERVICE OFFERINGS

<https://www.tes-applications.com/>

November 2019

Who We Are



Total Environmental Solutions (TES) has a **highly experienced team** with international oil and gas and water treatment technical and operational expertise.

TES provides environmental solutions for South America through the clean-up, recovery and sale of waste oil; and the cost-effective treatment of contaminated water and solids through the application of proven industry-leading technology currently in operation from the US and elsewhere internationally; we are not experimental.

TES is currently installing a plant on the Colombian Caribbean coast in Barranquilla capable of initially processing up to 2000 barrels per day of oil emulsions and recovering oil to sales specifications of 0.5% BS&W.

The plant will:

- Comply with all environmental and operational regulations
- Provide API upgrading capability through application advanced blending technology
- TES in discussions to establish a second emulsion processing operation in Central Colombia

TES Management Team



- **Jim Bradley, CEO:** A petroleum engineer with over 40 years of international technical, operational, commercial and senior executive experience with BP, ARCO, Petro-Canada. A British citizen, who has lived and worked in challenging environments such as the North Sea, Middle East, North and West Africa and Russia throughout his career. In 2010 he co-founded White Rose Energy Ventures, an oil company focussed on deep water exploration in Africa and raised over \$400m of funding from US private equity houses Riverstone and First Reserve.
- **Brian Smith, General Manager:** Geological Engineer registered as a P.Eng. with APEGA (Alberta, Canada) and COPNIA (Colombia) and a member of the PMI, has over 30 years of oil & gas operations, management, and executive experience. He is a Canadian citizen who is resident in Colombia and actively consulting within the oil industry, with his previous positions being Project Director (consultant) for Amerisur Resources, Vice President of Operations for Petrodorado Energy Ltd. (Colombia), and Production Manager (Colombia and Peru) for Petrominerales Colombia Ltd. Mr. Smith commenced his career in field operations with Schlumberger Ltd, with technical, managerial and project management postings in Canada, the USA, Venezuela and Saudi Arabia.
- **Clark Hicks, Technical Director:** USA citizen and General Contractor having 25 years' experience with an emphasis in management and operations with companies specializing in remediation and treatment of hazardous or polluted waste. Including domestic and industrial waste streams, oil field produced water, frac water, tank bottoms, spills, fluid separation, desalination and water treatment. Designed, built and operated installations in Washington, Montana, North Dakota, Belize, The Bahamas and the U.A.E.
- **Maarten Bruggink, CFO:** A qualified accountant and experienced financial executive with broad international experience in business management, corporate restructuring and financing. Maarten has invested in a portfolio of companies active in the oil, gas and renewable energy sector.
- **Paul Richards, Chairman :** A qualified Solicitor he spent 8 years in private practice specialising in corporate, commercial and insolvency law. He transferred to Investment Banking working for Hoare Govett, Collins Stewart and Fairfax IS. He has worked in the City for over 25 years and has a very wide range of experience of working with public and private companies across many sectors.

TES Key Service Offerings



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Waste Oil Recovery

The incoming material from lagoons, tank bottoms or drill rigs will consist of a slurry of crude oil, tight emulsions, water, solids, asphaltenes, bitumens and polymers. TES technology separates the slurry into crude oil, water and solids. TES is developing a process unit to enable treatment of these materials at the oil company locations so payment to collection companies would no longer be required.

Key equipment components (Fixed or Mobile): Oil Water Separation, Proprietary Emulsion Breakers and Polymers (USA), Heat, Residence time, Centrifuges.



Water Treatment

Produced water from the oil field operations or Waste Water (grey & black water) is treated to the contract specifications. The treated effluent can be disposed of downhole (produced water) or surface discharged (produced or waste water).

TES can meet or exceed any effluent quality specification as required by the client or by environmental legislation.

Strategic equipment suppliers are located international, mainly in the USA, providing the latest, proven and field-applied technologies.

Soil and Solids Remediation

Waste solids are bioremediated to a point that the treated material is no longer a hazardous waste. The treated, inert material may be land applied or disposed of at normal landfill rates.



Heavy Crude Oil Tanker Truck Offloading

Extra heavy crude oil can be difficult to offload from tanker trucks; especially if they do not have heated containers. TES' proprietary process, using an **exothermic organic heating additive + catalysts** can greatly assist with this process at a fraction of the time, thus increasing offloading efficiency and improved economics.

Our Waste Oil Recovery Process

TES offers a customised service for each specific treatment and project:

- ✓ **Laboratory testing** to determine the optimum treatment and process design for each waste fluid.
- ✓ **Best-In-Class equipment & chemical providers that internationally available** and selected based upon specific requirements for each project.
- ✓ **Only proven technologies** that are operationally tested are used.
- ✓ **Process optimised** during operations with TES experts to advise & adjust on site to ensure that the oil recovered from the emulsions will meet clients contractual sales specification .
- ✓ **Continuous improvement** during ongoing operations.

TES provides all of the personnel, the engineering, the project management, the maintenance and pays for all capital and operating costs. It charges a service fee on each barrel of emulsion treated.

Recent Tests on 'Very Tight' Rubiales Emulsions

Before: Very tight emulsion with 28% 13 API Oil + 72% BS&W.



After: Clear separation of the 3 phases with oil on top with <1% water per Karl Fischer testing (rag layer interface at its bottom), water in the middle (with suspended heavier hydrocarbons), solids settled on bottom.

Process optimization will reduce BS&W further



Waste Oil Recovery Current Global Operations



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Current Regions where Crude Recovery Companies are using proven, high technologies + stringent processes + proprietary chemistries that TES would bring to our operations

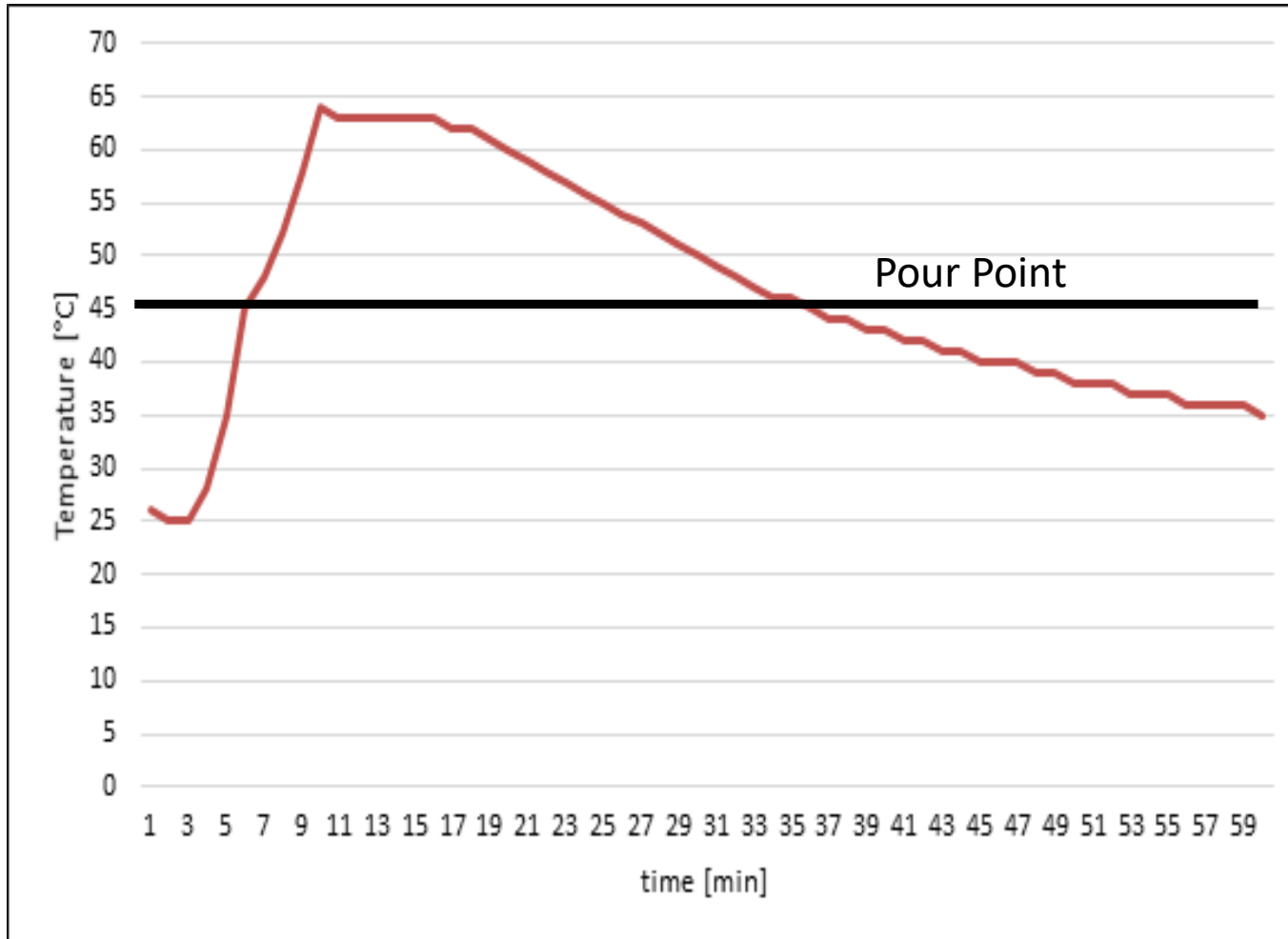


TES Technology Application: Crude Oil Heating (Exothermic Additive)

- Heavy oils require mechanical heat, naphtha or condensate to reduce viscosity to their pour points to enable them to be offloaded from a crude oil tanker truck.
 - High cost
 - Lengthy process
- TES' organic exothermic heating additive can be effective in replacing the above methods.
- Field trial + lab testing demonstrations made in Colombia for a major oil pipeline transportation company.
 - Thermal additives reduced heavy oil tanker offloading times from 4 hours to 30 minutes, so increasing station throughput
 - **No changes made to the oil's physical or chemical characteristics**



TES Technology Application: Crude Oil Heating (Exothermic Additive)



Crude oil heating profile (exothermic organic additive)

The importance of this assessment is in determining how much heat must be applied to raise the temperature of the 15° API oil above its 'pour point' to enable fast offloading.

Conclusion: It takes less than 7 minutes for this specific oil to heat to the oil desired temperature and it will stay above the pour point for 30 minutes in a laboratory environment.

TES experience shows that in the real-world environment these lab results should be multiplied by a 4 for the heating process and a factor of 5 for the cooling process considering the laws of thermodynamics and the thermal convection currents will be created during the heating process.

The ratio of cooling down depends also depends on the Ambient temperature, Container it is in, Exposure to moving air, Viscosity curve.

We can thus conclude that each truck should have around 30 minutes to heat up sufficiently and the oil would remain at a temperature for more than 2 hours based on the viscosity curve vs. heating profile.

Conclusions

- **TES services are customised** to each clients needs and follow a methodical & orderly implementation process.
 - Lab testing, Customised equipment & process design, Best-In-Class service providers in the US & Colombia, Continuous improvement during operations
- **TES operates on a service basis** and provides and pays for all of the required equipment, additives and service personnel, **and all ongoing operational & maintenance support.**
 - The client risk is minimised by paying a volume based treatment fee to TES.
- **TES can provide key service offerings with its fixed or mobile units** that offer substantial benefits to the client, such as:
 - Waste Oil Recovery from emulsions on-site removing need to ship to third party facilities
 - Produced Water & Waste Water (grey & black) Treatment to client specifications, including desalination, using proven & globally-mobilised technologies & processes from the US
 - Soils & Solids Remediation as required using proven technologies & methods
 - Heavy Crude Oil Tanker Truck Offloading, assisted by TES' organic exothermic heat additive