



www.protech-enterprise.com

HCR™ - Hydrocarbon Recovery

Turning Waste into Wealth

The Cutting-edge Solution to Crude Oil Sludge
Remediation





Introducing HCR™

After more than a decade of development and testing, 2020 has seen the introduction of HCR™ (Hydrocarbon Recovery) technology to the UK, Europe and the Middle East.

HCR™ **converts** hazardous crude oil sludge into a marketable asset. The treatment process mitigates risks to both on-site personnel as well as the environment, while simultaneously **recovering otherwise-lost revenue** for owners and users of storage vessels, oil tankers and pipelines.



First formulated by our lead chemist, HCR™ technology is the result of
30 years
of experience working with waxes and polymers



The HCR™ process uses a specially formulated surfactant blend, designed for recovery of **saleable products** from crude oil sludge.

Viscous with high-cling characteristics, the HCR™ additive cleans and **coats** surfaces whilst treating **large volumes** of crude oil sludge economically. All while reducing the environmental impact.

Tailored to reduce the viscosity of petroleum sludge; HCR™ dissolves emulsion deposits by suspending and dispersing accumulated paraffin that contributes to its formation. This process allows the recovery of up to **95% of the constituent hydrocarbon components** - an outcome unmatched by any competing product on the market.

About Us



Protech is a consortium of engineers, scientists and business professionals working provide the latest and safest technology to the energy industry both in the UK and worldwide. Our research and development focus is to provide high-quality, innovative products where safety and cost are critical factors in the success of your project.



Features and Benefits

One gallon of HCR™ cleaner has been proven to treat hundreds of gallons of light or heavy sludge with zero negative downstream effects.

| HCR™ Technology | Conventional cleaning methods |
|---|---|
| Liabilities turned into assets – unwanted sludge is now a saleable crude oil product | Loss of inventory – wasted revenue with no saleable asset |
| The HCR™ Process requires minimal third-party equipment and personnel | Heavy expenditure for specialist equipment and additional manpower |
| Significant reduction in costly out-of-service time for cleaning, inspections, repairs, and maintenance | Tank out of service for extended time-period for labour-intensive manual cleaning |
| Simultaneously cleans tank, floating roof and mixer, coating surfaces to protect against water corrosion and paraffin build-up | Results of cleaning process limited by method and practicalities |
| Eliminates liabilities associated with off-site transportation and disposal of hazardous waste | Hazardous landfill waste disposal process worsens environmental impact |
| No-man entry process limits risks to on-site personnel, avoiding exposure to hazardous confined spaces | Workforce repeatedly exposed to hazards from confined spaces and toxic environments |
| Enhances crude oil storage capacity inside tanks / pipelines whilst minimizing risks of leaks and spills associated with traditional cleaning methods | Sludge occupies potential storage space in tank, resulting in lost revenue |



Applications

Storage Tanks

The HCR™ process offers a unique solution to accumulated crude sludge in oil storage tanks. The process treats the sludge deposits prior to the addition of crude oil. This means **no hazardous substances need to be extracted** after the process is complete and **no personnel need enter the tank**. The crude oil is then blended with the sludge-cleaner mixture, yielding a saleable product at the end of the treatment process.



Pipelines

The HCR™ process has been optimised for the treatment of sludge in oil pipelines. A calculated volume of HCR™ cleaner is deposited in front of a pig prior to launch. The pig administers the cleaner to sludge-affected sections, followed by incremental additions of HCR™ additive as required. The process **increases** the internal diameter of the pipe, improving flow rate while avoiding out-of-service time.

Crude Tankers

The HCR™ process is also suitable for use in crude oil tanker compartments. The process involves addition of a small quantity of the product to crude oil cargo in a shore battery, for premixing prior to loading. The HCR™-crude mixture is then homogenised with the sludge in-transit by the natural agitation of the waves. This **enables the extraction of sludge** as a saleable product upon offloading.





Our Process

1

Pre-treatment: Profile tank to determine percentage of sludge. Perform load test to confirm proper mixer operation

2

Lower tank inventory to predetermined level, followed by introduction of HCR™ additive using pump truck

3

Activate tank mixers

4

Continue the mixing process until the HCR™ cleaner and the sludge are homogenised

5

Introduce live crude, filling tank to capacity

6

Continue the mixing process for 7-10 days to ensure the tank contents are sufficiently blended

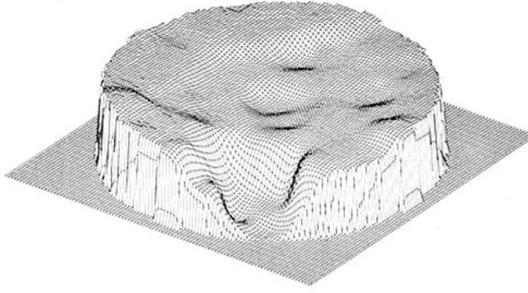
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Hydrocarbons are fully incorporated into the live crude inventory – crude oil is now ready for market

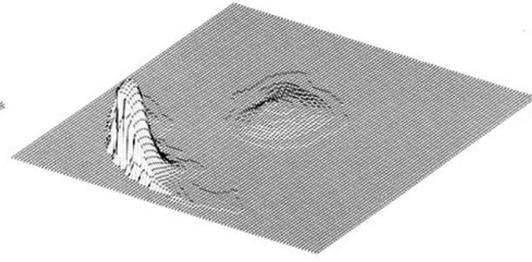


Our Results

Typical profile – A crude oil tank with significant sludge deposit:

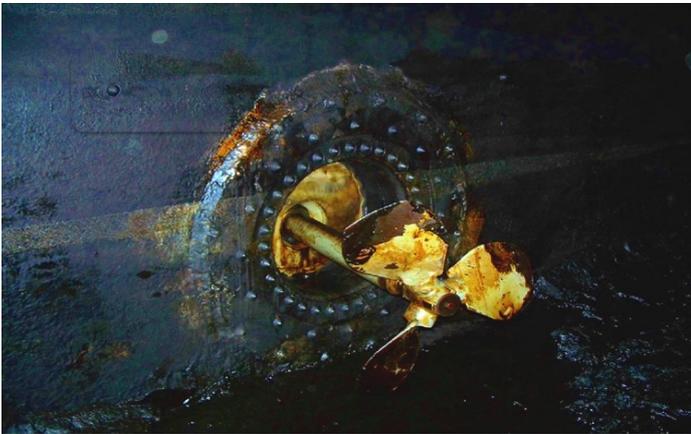


Before HCR™ treatment



After HCR™ treatment

Tank internal space, images post-treatment:



Mixer [left] and wall [right]: Walls, rivets and mixer shaft are notably clear of sludge. The HCR™ Process performs essential maintenance by removing sludge that may otherwise cause corrosion damage to internal structures.



Wider images of the tank, indicating clean walls and floating roof with minimal residual sludge apparent.



13 tonnes
of hazardous waste produced
each second across the globe



Millions of barrels
of lost crude oil recovered
thanks to HCR™



Did you know?
Our clients can fully offset all costs
with the additional revenue
we create for them



Our Clients

Available in the UK and the wider world for the first time, the HCR™ Process has seen 10 years of successful application in the United States, with clients including: Sunoco, Plains All American, Oxy, Tepco, and Shell. The product is responsible for the treatment and cleaning of hundreds of tanks, yielding millions of barrels of reclaimed product, and counting.



Oiltanking GmbH

Oiltanking has been active in crude oil storage since 1972 and is one of the largest independent operators for crude oil storage in the world. Oiltanking has operations in 23 countries with a total storage capacity of 20 million m³ in five continents.

“ *Oiltanking* was interested in trying HCR due to the fact it was advertised as a hydrocarbon-based contact agent **not requiring special equipment or man entry** to liquefy the sludge in oil storage tanks.

The tank we needed to clean was a tank we were converting from storing crude oil sludge to gasoline so we needed a product that would do a thorough job cleaning the tank of sludge. **HCR was an excellent product for this.** We also found it interesting that **HCR does not affect the specifications of the oil, nor require any additional processing of the sludge or temperature control.** Just add HCR and circulate it with the sludge.

We found HCR did a great job liquefying the sludge converting our sludge to saleable crude oil. I have not seen a product to liquefy crude oil sludge that is **this simple to use and this effective.**

”



Converting waste
can cost more than disposal,
but not with HCR™



Our mission
Protect the environment and
our client's interests
simultaneously



“Crude oil tank bottom sludge has become a *critical problem* in most oil refineries.”
-Mansure et al, Journal of Advanced Chemical Engineering, 2015



Our Clients

Centurion Pipeline L.P.

Centurion Pipeline L.P. is a common carrier pipeline operator with approximately 2,900 miles of pipelines extending from southeast New Mexico across the Permian Basin of west Texas to Cushing, Oklahoma. The system has a throughput capacity of approximately 720,000 barrels per day.



The tank was initially pumped down and landed on low legs. The 30"by 60" roof man-way removed to conduct a visual inspection. Upon removal of the roof man-way there was five to six thousand barrels of non-pumpable BS&W in the tank. Prior experience with this type of BS&W and the cost associated with removing the material and cost of disposal we decided to try to treat the material. **The five thousand barrels of material are now merchantable crude** that can be pumped into our system.

HCR™ treatment delivered the following results:

- Recovered 5000 bbls crude versus disposing
- Reduced manpower 50%
- Reduced disposal 99%
- Reduced safety risk
- Reduced environmental risk
- Generated revenue from recovered crude
- Cleaned tank extremely well, reduced post clean up 75%
- Reduced cost of clean out 75%



Shell Oil Company Barge

HCR™ is also optimised for use in crude oil tankers, having seen successful deployment aboard a Shell oil company barge, granting the recovery of over 3000 bbls of saleable product. Premixed in a shore battery, a small quantity of HCR™ can be added to a crude oil payload prior to shipping. In-transit, the natural agitation provided by ocean waves mixes the payload while the HCR™ works to remove sludge, incorporating the constituent hydrocarbons into the payload. The process greatly reduces diminished capacity within vessel compartments, allowing the offloading of sludge as a saleable product. As a result, demurrage charges and refinery fees for processing sludge from compartments are also reduced.

Mardi-Gras Pipeline

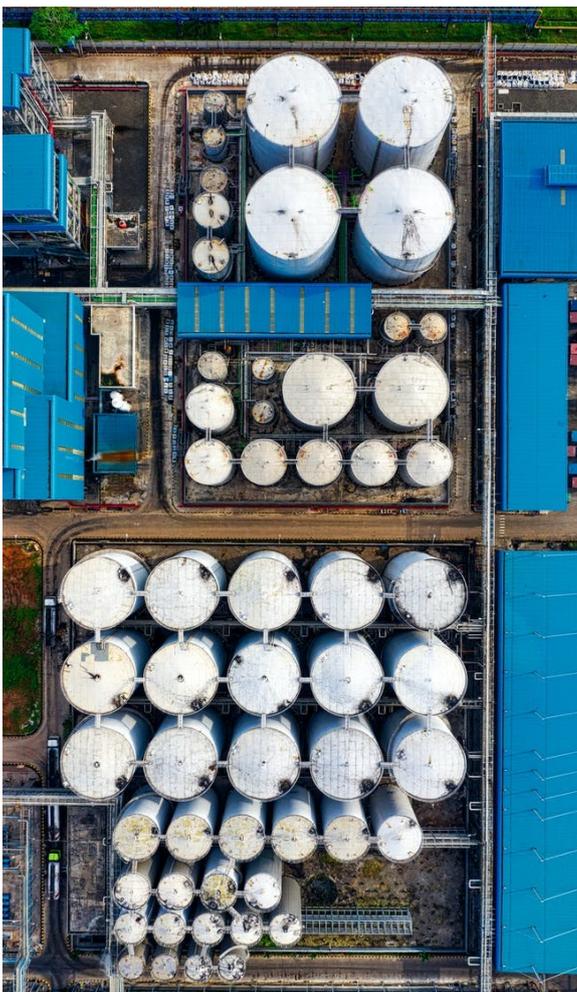
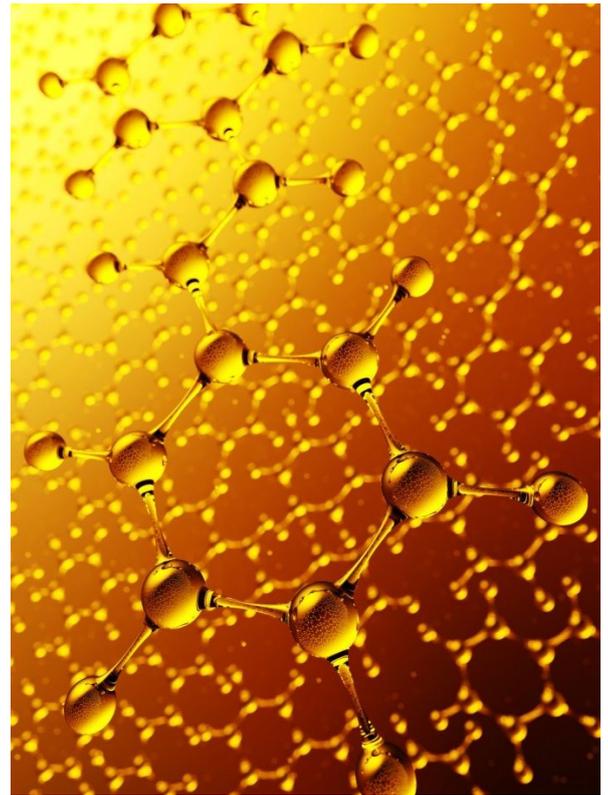
HCR™ has also seen successful application to sludge deposits in oil pipelines, including BP's Mardi-Gras pipeline, located in the Gulf of Mexico. Addition of a precalculated volume of the treatment in front of a pig prior to launch removes sludge accumulations in the line; increasing the working diameter, reducing pressure, and improving flow rate. Incremental additions of the treatment can be applied as required, to restore complete functionality to blocked or obstructed lines. Proactive treatment keeps pipelines clean while reducing corrosion from moisture and paraffin build-up along the bottom of the line.



Additional Information

How does HCR™ work?

HCR™ works by restoring fluid characteristics to high-viscosity crude sludge, separating the contents into three phases: the constituent crude oil, clean water and inorganic solids—such as sand and grit. The HCR™ additive does this by replacing the lost *volatile fraction* in the crude with a carbon molecule that behaves like a volatile ring-chain hydrocarbon, referred to as an *aromatic*. The volatile aromatic hydrocarbons are so-called because they have a tendency to easily evaporate into the atmosphere at relatively low temperatures.



These aromatic hydrocarbons are important because they prevent the crude's larger, straight-chain hydrocarbons from interacting with one other and forming Van der Waal bonds. These bonds lead to the larger molecules 'clumping' together, ultimately leading to an increase in viscosity and the formation of waxes and asphaltenes— or sludge.

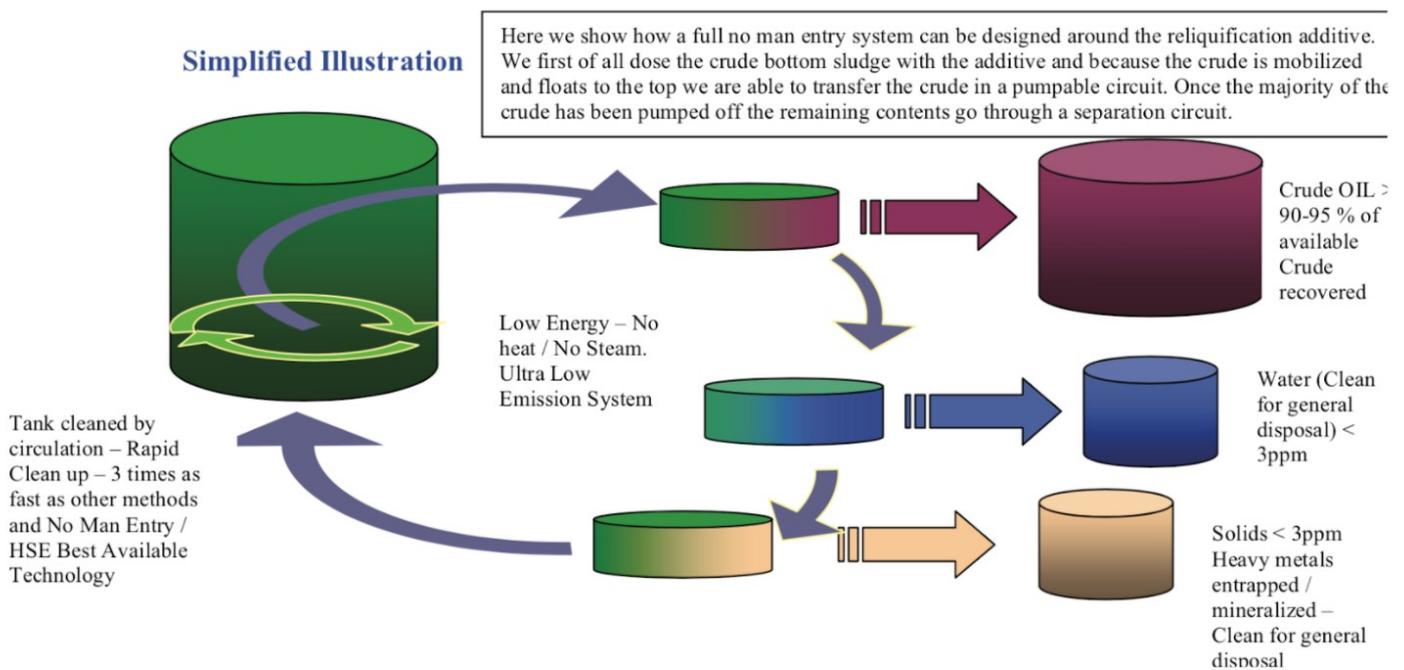
Unlike the aromatic hydrocarbons, the HCR™ additive is not itself volatile. It has a flash point of 97°C, meaning it remains in the crude without evaporating, preventing the formation of the long-chain hydrocarbon 'clumps' that lead to sludge deposits. In short; HCR™ mimics the behaviour of the lost aromatic components of the crude, but without evaporating at normal atmospheric temperatures.



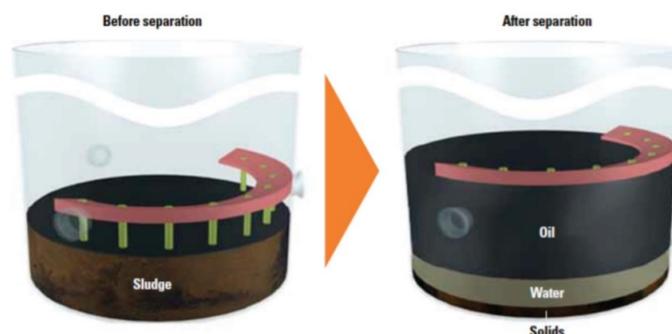
Additional Information

How do the phases separate?

As discussed, the active ingredient in the HCR™ additive is a small carbon molecule, designed to occupy the gaps or spaces in the crude or sludge left by the lost volatile hydrocarbons. As the carbon molecules fill these gaps the Van der Waal Bonds are reduced and the individual hydrocarbons are freed from the solid structures. With water-in-oil emulsions, the main stabilizer of the emulsion is the asphaltene solid. The HCR™ additive breaks the asphaltene and so breaks the emulsion – this forms a water-oil interface and achieves phase separation.



The solids trapped in the highly viscous conditions drop out of the crude and the emulsion as the solids are broken down by the HCR™ additive. All of this can be done in-situ; in the storage tank using crude oil resuspension systems for mixing. This no man-entry methodology using HCR™ additive will separate the three phases and allow the crude oil to be pumped out of the tank downstream as export grade crude oil, leaving behind clean water and solids that can be easily remediated. No pits are needed because the tank is only emptied once the sludge has been treated.

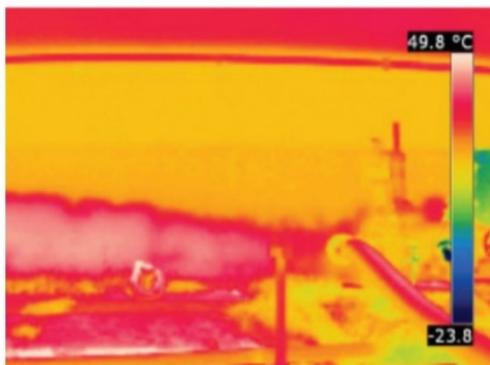




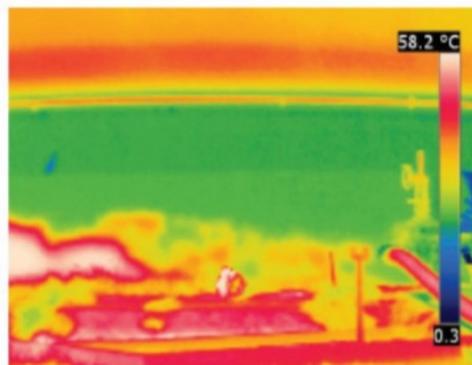
Additional Information

Inside the Tank

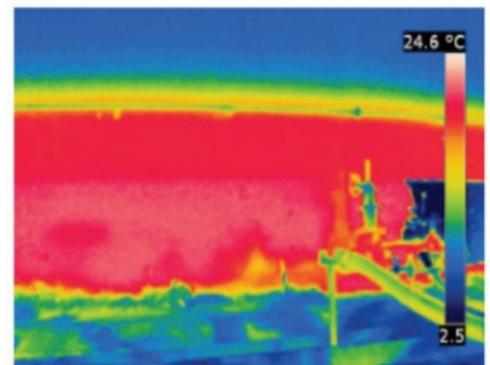
- The additive mixes with the sludge and pursues the gaps left by the lost volatiles between straight-chain hydrocarbons that exist in the agglomerated structures, reducing the Van der Waal forces and breaking up the paraffin waxes and asphaltene deposits.
- As the hydrocarbon solids liquefy, the water in oil emulsions destabilize and the emulsion becomes less viscous. Eventually, the water and oil phases separate. As this happens, the tank effectively becomes a gravity separator; inorganic solids form a third separated phase as they fall to the bottom of the tank. The separated phases can be individually drawn from the tank into storage.
- By breaking up the paraffin waxes and asphaltenes and re-liquifying approximately 95% of the hydrocarbon content, we also remediate the bulk of the inorganic solids. This in turn leaves fewer aggregated concentrations of hydrocarbon solids.
- This system reduces the time taken to clear a crude storage tank of sludge. If the tank is opened and inspected efficiently the entire job can be done in less than 30 days including degassing.



After 3 hours



After 30 hours



After 48 hours

Thermal imaging is easily conducted using handheld cameras operated outside the tank from ground level. These units report data back to software which generated 3D models of the sludge map in the tank. The software distinguishes the thermal profile of water, oil and inorganic solids. This technology allows us to monitor the progress of a desludging operation



HCR™ - Hydrocarbon Recovery

Turning Waste into Wealth

- Organic
- Carbon Based
- No Chemical Reaction
- Replaces lost volatiles permanently
- Mitigates London Dispersion Forces, preventing C20+ aggregation
- Re-liquifies paraffin waxes and asphaltenes on contact
- Doesn't evaporate (Flash point of 97°C)
- Supplied in easy-to-handle liquid
- Separates hydrocarbon content from emulsions in "slop"
- Approximately 95% of crude oil recovered
- Frees silts and ash from recovered crude, improving quality of recovered crude
- Prevents corrosion
- Compatible with all flow line types
- Reduced environmental impact / carbon footprint
- Time saved
- HSE risks mitigated
- Bottom line increased, treatment costs offset

Get in touch

Contact us today and arrange a free 20 minute consultation:

 www.protech-enterprise.com

 info@protech-enterprise.com