Technical description of the Neptune Processor along with the functional specifications, applied science and device functional applications.

Technology Overview

Mark A. Skoda
Chief Executive Officer

Introducing Neptune Processor Technology

Several promising techniques based on the use of electrochemical technology, distillation technology and membrane technology are being developed and are already entering into industrial wastewater applications. Principal among these newly developed technologies is the Neptune Processor for oily-wastewater process streams.

Standard oily-wastewater remediation relied for decades on API 650 for oily-wastewater separation (OWS) treatment using gravimetric lagoon separation, then reprocessing the recovered floatable oil portion, and using holding-pond clarification of the wastewater portion before 'land-farming' discharge, which led to substantial groundwater and air pollution.

Gravimetric treatment and application discharge had significant design shortcomings during outline process upsets, under-sizing for increased production, and uncontrolled storm runoff mixing with the wastewater. OWS certainly can't be expected to meet the more stringent requirements of modern environmental regulations or be deployed for remote sites as a package treatment plant option.

Various new configurations of separation technology have expanded oily-wastewater treatment options, including everything from hydro-cyclones to coalescing plate filters, dissolved air flotation and even the use of ultra-filtration to separate and concentrate the individual waste streams. While these methods offer good process response through a wide range of flows and can meet typical 1OOmg/1 total hydrocarbon cleanup regulations, they are incapable of meeting proposed environmental protection legislation.

Moreover, none of these filtration methods offer the capability of treating the produced wastewater for heavy metals, chemical oxygen demand, de-nitrification and phosphorus removal without more advanced treatment processes, such as chemical precipitation, air stripping, chemical oxidation, or activated carbon adsorption. Again, these advanced processes generally cannot be mobile deployed to remote sites as a package treatment plant option, and all produce a toxic concentrate or sludge, which then becomes another waste stream.

Technology based on thermal processing today has advanced well beyond the campfire. Earlier technologies for the processing of waste liquids have been distillation, reverse osmosis, micro filtration, chemical filtration and electro-coagulation etc. These processes work to varying degrees some better than others. What is today a set of difficult combinations of chemicals, minerals, bacterial, and heavy metals including organic and inorganic compounds that do not allow just a single process to purify and restore the water back to a usable commodity. Modern industry requires a modern solution. Most all membrane processors and clarifying processes have major quantities of polluted materials that are now a concentrated and a larger liability. Many processes treat the suspended solid but not the dissolved solids. Volatile organic compounds easily destroy membranes. In other words, today's effluents demand a solution that is efficient, safe, viable to actually deal with the complex problems created by industry today.

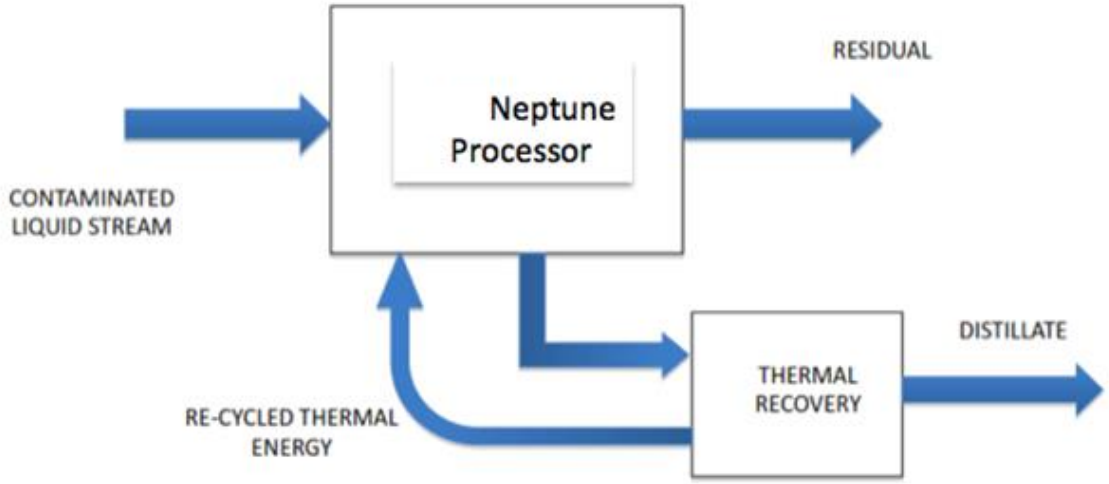
The problem requires an enhanced method of reacting the targeted condition and creating a series separation and thermal reconstructions of the targeted effluent that create a series of products from the effluents and the residual waste. This is easier said than done. The good news is we have a method that lends itself to clearly processing most industrial wastewater conditions. The Neptune Processor has stepped forward from years of trial by fire research and will set the standards for efficiency, viability in the recovery of water to a natural state. Negating the need for injection wells, storage of contaminated materials, opens the door to responsible and technically affordable solutions. This will free future generations from the burden of a damaged and polluted environment. The correction and rehabilitation of the environment can be accomplished with these new environmentally friendly processes.

The Neptune Processor is a thermally enhanced series of stimulation, which is then processed to recover energy and enhance further processing goals increasing viability. The full gamut of enhanced separation techniques is employed while combining a resource recovery process to develop viable by-products. This style of processing is rare in our industry today. The thermal processor that can accomplish this is new; processes are designed for continuous flow. Thermal processors are not new, but the combined resource of energy recovery is, making the process one of the most economical with full cradle to grave results. The decrease in liability in the present and future is resolved by this intuitive series of processes from one machine.

Targeting Distillation Applications

Distillation has shown to be an effective process for wastewater contamination. Its shortcomings are metallic and salt plating of the heat exchangers and inability to produce a complete product of a full reduction of waste stream. The Neptune Processor can be used upstream of standard filtration units to pre-oxidize and pre-sterilize raw water, removing BOD, COD, dissolved metals and biological contaminants. Pre-treated water can be subjected to the Neptune Processor bypassing sand filtration,

ultra-filtration, GAC and CDI/ RO, as required for raw water conditioning. The system meets all necessary potable water standards.



The Neptune Processor has been successfully tested for breakdown of complex and biologically active large organic molecules such as pesticides, herbicides, dyes and endocrine disrupters (ED's). Neptune Processor treatment end-product produces small-chain, generally biologically-inert, compounds necessary to meet wastewater discharge standards. The Neptune Processor has resolved the issues of the final 20% of the hydrocarbons, salt, oil combination that no other equipment is viable in these areas.

How It Works

Oily-wastewater is composed of suspended oily lipid droplets in water, interspersed with solid particles and with dissolved compounds, each having different molecular weights, chemistries and electrical charges. These electrical charges can be measured as the 'zeta potential' and tend to keep oily lipid droplets, solid particles and dissolved compounds from interacting chemically. Electrical charges tend to form a semi-stable emulsion (similar to milk), which is difficult to separate. However, under suitable conditions of a controlled and carefully applied DC voltage and current, several unique electro-chemical effects result:

1. Coalescing Super Coagulation – The Neptune Processor neutralizes the charges surrounding the lipid droplets, allowing them to quickly coalesce and 'super-coagulate' out of an emulsion. This applies to both heavy and aromatic- hydrocarbons, with specific results in coalescing and super-coagulating dependent on molecular compound weights and their concentration within the fluid stream.
2. Chemical Oxidation- The Neptune Processor creates free hydroxyl (OH-) radicals in solution which rapidly and aggressively combine with oily lipids, particulates, and dissolved compounds, depending on their individual chemistries.
3. In particular, the Neptune Processor has the potential to breakdown complex organic molecules, including high molecular weight compounds that may be resistant to other forms of treatment,

(such as pesticides, herbicides, dyes and wet-process chemicals).

4. Neptune Processor works on many dissolved metals by forming stable metallic oxides which rapidly precipitate from solution as particles which allows a high level of removal and directly reduces chemical oxygen demand in some wastewater cases.
5. Biological Inactivation- The processor frees hydroxyl (OH-) radicals rapidly and aggressively combine with and destroy bacteria, viruses, cysts, macrophages and other biological contaminants, similar in effect to using ozone, but at a level of magnitude better. Depending on water chemistry and its contact time, inactivation is achievable. This biological inactivation potential is being used by the US military as a pre-treatment with reverse-osmosis (RO) to prevent biological-warfare on potable water supplies.
6. The Neptune Processor has achieved nearly unobtainable wastewater treatment efficiencies through distillation and thermal dissociation. Prior to this innovation, distillation and thermal dissociation processes were cost prohibitive. A major technology breakthrough resulted in this newfound efficiency. To evaluate the applicability of the Neptune Processor to particular wastewater process streams thorough and detailed water chemistry should be conducted along with a volume sampling for bench testing to confirm theoretical prediction of treatment efficiency.

Produced Oily Wastewater Treatment (Especially in Refinery)

The Neptune Processor has been successfully tested for breakdown of oil field produced water which further relates to oily barge ballast water, drill fluids, gas and oil pipeline entrained water and refinery process water. Treatment end products are coalesce-able and biologically inactive with oils and greases super-coagulated. Neptune Processor pre-treated wastewater is subjected to hydro-cyclone vortex, skimming and biological oxidation as required for the conditioning necessary to meet wastewater discharge standards.

Neptune Processor units are designed as portable, container modules with a minimal footprint to ease integration into existing plant layouts and are easily field deployable for batch or flow through site cleanup.

Neptune Processor Computer Control

Fully automated Neptune Processor treatment units are equipped with programmable logic control (PLC) systems which monitor, adjust, and verify the level of wastewater conversion to harmless by-products. Remote operation and adjustment monitoring is based on arriving influent and exiting effluent.

Before and after parameters are monitored and allow for adjustments in pH, turbidity, hydrocarbon and salinity in outgoing effluents. Further monitored is the filter media and the CDI module when reverse flushing are required.

NEPTUNE PROCESSOR OPERATING PARAMETERS

Wastewater Pre-Testing

Prior to wastewater treatment a series of lab tests are conducted to determine the type or extent of contaminants contained within the influent water. Analytical testing includes heavy metals, chemicals, sulfides and biological. Upon contamination establishment, the Neptune Processor system is then adjusted to specific target, goals or standards set for the application.

Harris Thermal	Project: **Frac Water**	
615 S Springbrook Rd	Project Number: 1	**Reported:**
Newberg, OR 97312	Project Manager: AC Fuchs	10/24/11 15:02

ANALYTICAL SAMPLE RESULTS

Hydrocarbon Identification (HCID) Screen by NWTPH

Analyte	Result	MDL	Reporting Limit	Units	Dilution	Date Analyzed	Method	Notes
#10 Frac-Before (A11J281-01)			**Matrix: Water**		**Batch: 1110449**			**EST**
Gasoline Range Organics	**7790**	---	4.65	mg/L	20	10/22/11 21:41	NWTPH-HCID	
Diesel Range Organics	**3560**	---	11.6	"	"	"	"	F-06
Oil Range Organics	**41.3**	---	11.6	"	"	"	"	F-08
Surrogate: o-Terphenyl (Surr)			*Recovery: 71 %*	*Limits: 50-150 %*	"	"	"	*S-05*
#10 Frac-After (A11J281-02RE1)			**Matrix: Water**		**Batch: 1110449**			**EST**
Gasoline Range Organics	**0.707**	---	0.143	mg/L	1	10/24/11 11:44	NWTPH-HCID	
Diesel Range Organics	**0.374**	---	0.357	"	"	"	"	F-06
Oil Range Organics	ND	---	0.357	"	"	"	"	
Surrogate: o-Terphenyl (Surr)			*Recovery: 92 %*	*Limits: 50-150 %*	"	"	"	

In heavy contamination applications, the Neptune Processor may require operation in loop mode, (batch) to achieve selective standards. In some applications, certain components of the Neptune Processor may not be utilized such as its filters or desalination module for increased TDS, TSS I TIC, TOC, VOC reductions.

Neptune Processor Maintenance

The Neptune processor is a platform based modular system. Modules are easily replaced in the field, or a complete unit can be changed in minutes minimizing down time or customer well site problems.

Neptune Processor is economical to operate with the FES bench system, (used to conduct testing) has shown to be effective all types of wastewater presented the use of filter media is generally unnecessary

to meet most standards, but if necessary can be used to polish to meet nearly any criteria.

Neptune Processor media filters provide flexibility in targeting certain types of contaminants, (metals, organic and non-organic substances). Media housings are designed to except particular known media's having specific and high adsorption abilities and where a series of different media can be used in combination for selective contaminants targeting.

Neptune Processor media housings provide a reverse flushing process once contaminant saturation has been reached. Upon the reverse flushing process, contaminants are directed for collection to containment chambers where once dewatered can be shipped as solids, (not liquid) for disposal or where a fractionation process can be applied to separate out potential products of value.

Economic Viability

The opportunity is to be a part of the most revolutionary piece of water technology in the last 50 years. Our technology will not only treat frack water which is the number one problem we are facing in the oil and gas business today, but it will treat a more serious problem also which is production water. Frac water is a onetime treatment and you follow the trend from site to site and well to well.

These processes are invaluable in ground water restoration and remediation. Wherever past endeavors created unwanted conditions, these can be restored using this equipment. Safe and economical processing of ground water and soil contaminants are easily processed for recovery. Safe and economical return of industrial wastewater to drinking water standards can be achieved. The environmental health of our resources can be economically and safely maintained.

- Neptune has developed the technology and has exclusive rights to the technology which allows this water to be treated in an environmentally friendly manner at profitable return.
- Neptune has located some of the most profitable areas of the United States to participate in and to put our equipment to work and to showcase our technology.
- Differences in frac water and production water: Frac water is fresh water that is used to frac the well in which chemicals are injected into the water and pushed down hole at high pressure. Water returns to the surface during oil production.
- Water that has returned needs to be treated and then disposed of by injecting into an injection well or recycled by processing.

Local counties and municipalities are now charging the oil companies for the water, as each frac takes millions of gallons of water per day. The municipal facilities are easily overwhelmed, and the problem of supply becomes a major issue. Recycling water and restoring the water are beneficial to all. Drilling wastes and emulsions are easily processed with this efficient and beneficial technology.

Initial costs for the Neptune Processor deployment will be lower than fixed treatment plants. Modules can be made available for emergency deployment within 24 hours to anywhere on the globe and set up to treat water or wastewater within a matter of hours, making the processor ideal for oil spills and other emergency applications. Operations as well as electrical costs are substantially lower as the units require minimal mechanical pumping and limited operating personnel in attendance when in automated mode.

Neptune Processor Energy Consumption and Consumables

The Neptune Processor's power consumption is some of the lowest in the environmental business today. The per barrel price is slightly higher than reverse osmosis or EC. This is where the Neptune Processor steps out from the competition. The processor provides a pathway for recovery and development of material generally considered waste. The last 20% in these processes are always the hardest, and this is where the processor shines thru.

BTU 1 POUND WATER RAISED 1 DEGREE

- Just a form of energy measurement.
- Used to convey energy requirements cost and to standardize the industry.

- One gallon of water equals 8.34 pounds.
- Water to steam requires sensible and latent heat to achieve liquid to vapor.
- Sensible heat is energy necessary to raise liquid water from current temperature to 212 degrees.
- Latent heat is the energy necessary to turn a liquid to a vapor at 212 degrees.
- Example 1 pound 60-degree liquid water to vapor requires.
  - 152 degrees to raise 1 pound water to 212 degrees liquid.
    - 152 BTUs sensible heat
  - 970 bus to turn 1 pound water to vapor.
    - 970 BTUs Latent heat of vaporization
- Total 1 pound water to steam 1122 BTUs.
- To distill 1 gallon water 8.34 pounds requires 9358 BTUs.

- Natural gas 1000 BTUs per cubic foot $3.00 per 1000 cubic feet or 1,000,000 BTUs , = 0.000003
- Cost per gallon without recovery process equals 0.000003 × 9358 BTUs = 0.028074 per gallon / per barrel cost $ 1.18 without
- Energy recovery processes.
- This reflects a 100 % thermal transfer which this technology employs.

ENERGY RECOVERY PROCESSES

- The processes involved can return significant volumes of energy to the process. Convective heat accounts for approximately 40% of the energy processed through the burner.
  - This energy can be recovered by Sensible and Latent heat
- 1 gallon water to steam 9358 BTUs ×40% = 3743 BTUs recoverable
- 9358 BTUs per gallon -3743 recoverable BTUs equals 5615 BTUs.
- 5615 BTUs @ 0.0168 per gallon or 0.70 per barrel.

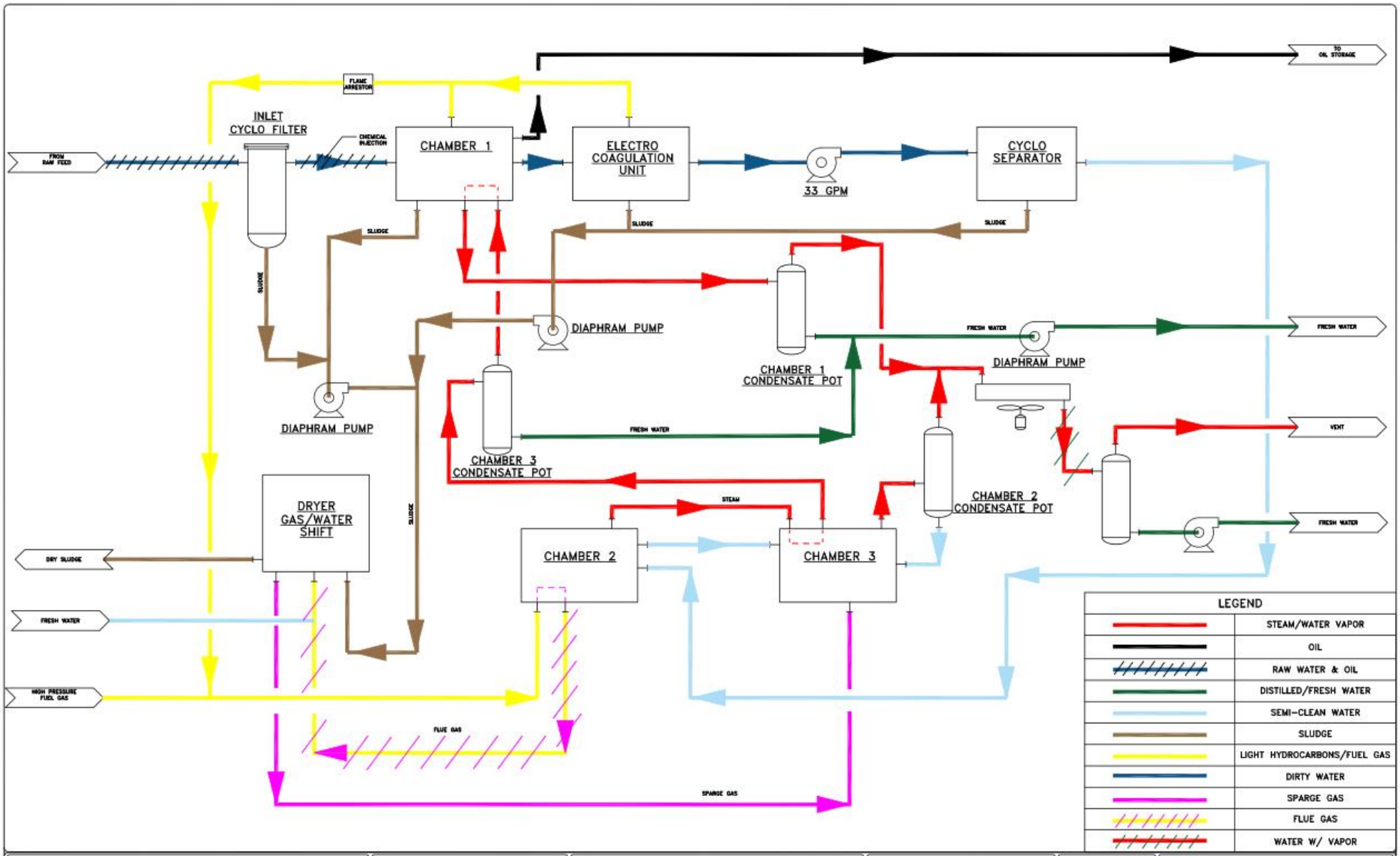
Generally, the last 20% of this process is normally not included in the cost per barrel to the customer. These extra charges dramatically alter the financial landscape for the customer. The reduced waste volume from the processor easily offsets any additional cost to the customer with little or no front-end pretreatment and reduced volume of waste makes the processor easily the most cost-effective treatment for this waste.

For further information or to schedule a meeting contact:

Mark A. Skoda

mark@neptunewrs.com

Cell: 901.277.4968


TO OIL STORAGE
FLAME ARRESTOR
INLET CYCLO FILTER
CHEMICAL INJECTION
FROM RAW FEED
CHAMBER 1
ELECTRO COAGULATION UNIT
33 GPM
CYCLO SEPARATOR
SLUDGE
DIAPHRAM PUMP
CHAMBER 1 CONDENSATE POT
FRESH WATER
DIAPHRAM PUMP
DIAPHRAM PUMP
CHAMBER 3 CONDENSATE POT
VENT
DRYER GAS/WATER SHIFT
CHAMBER 2 CONDENSATE POT
STEAM
CHAMBER 2
CHAMBER 3
DRY SLUDGE
FRESH WATER
HIGH PRESSURE FUEL GAS
FLUE GAS
SPARGE GAS
LEGEND
STEAM/WATER VAPOR
OIL
RAW WATER & OIL
DISTILLED/FRESH WATER
SEMI-CLEAN WATER
SLUDGE
LIGHT HYDROCARBONS/FUEL GAS
DIRTY WATER
SPARGE GAS
FLUE GAS
WATER W/ VAPOR