DEWATERING OF STORAGE TANKS, AUTOMATIC DRAW WATER CONTROL, & MANUAL TANK GAUGING

INTRODUCTION

Storage tanks containing hydrocarbon feedstocks, intermediates and finished products will, over time, accumulate a water layer in the bottom of the tank (exceptions are water-soluble hydrocarbons such as alcohols and ethers). Standard industry practice is to periodically drain the water from storage tanks so that the water does not adversely impact specifications of the hydrocarbon. Water removal also reduces corrosion problems on the floor of the tank and the risk of "Boil-Overs" in case of fire.

Manual control of water draw-off can result in HC product in the discharge. The loss of this HC product means less product available for sale and increases the cost of wastewater treatment. Additionally, environmental regulation trends (e.g., USA Benzene/NESHAP and SOCMI/HON) may impose large economic penalties for designing water draw conveyance and treatment systems that allow HC product in the water draw-off discharge.

Two types of water draw-off control approaches use the AGAR ID-200 Series Interface Detector. Each water draw discharge control strategy has its own advantages and disadvantages.

The control strategies are:

- Using In-Tank Interface/Concentration Detectors
- Using Insertion Hydrocarbon/Water Monitors in the Effluent Water Draw-Off Line

AGAR applications specialists can assist in identifying the optimum strategy for controlling water discharge.

Agar ID System 1 & 2 Tank Installation

I. IN-TANK INTERFACE DETECTOR

In-Tank measurement of the hydrocarbon/water interface gives the best results for eliminating the discharge of hydrocarbons. Usually, AGAR ID-201 probes are inserted into the tank through AGAR's patented seal housing, as shown in the photo above. Special installation may require the use of the AGAR ID-202 for extended length.

The two probe system can operate under two strategies. A main control/safety strategy - **System #1** shown in Figure 1 and a high-low control strategy - **System #2** shown in Figure 2.

System #1

When the AGAR ID-201 probe detects HC free water, the water discharge valve is opened. As water is drained off the bottom of the tank, the hydrocarbon/water interface begins to drop. When the AGAR ID-201 probe detects the hydrocarbon/water interface, the signal is sent to close the discharge valve. Output options to control the valve can be 4-20 mA, relay and/or pneumatic. Local indicating lights are also available. If the hydrocarbon floats, the ID-201 will prevent it from being discharged with the waste water.

Figure 1 shows an upper probe used for control, with the lower probe used for low-level alarm and positive shutdown of the water discharge valve.

SYSTEM 1 CONTROL LOGIC			
Hi Probe	WATER	OIL	Water or Oil
Low Probe	WATER	WATER	OIL
Local Indicating Light	WATER	OIL	ALARM
Valve Position	OPEN	CLOSED	CLOSED

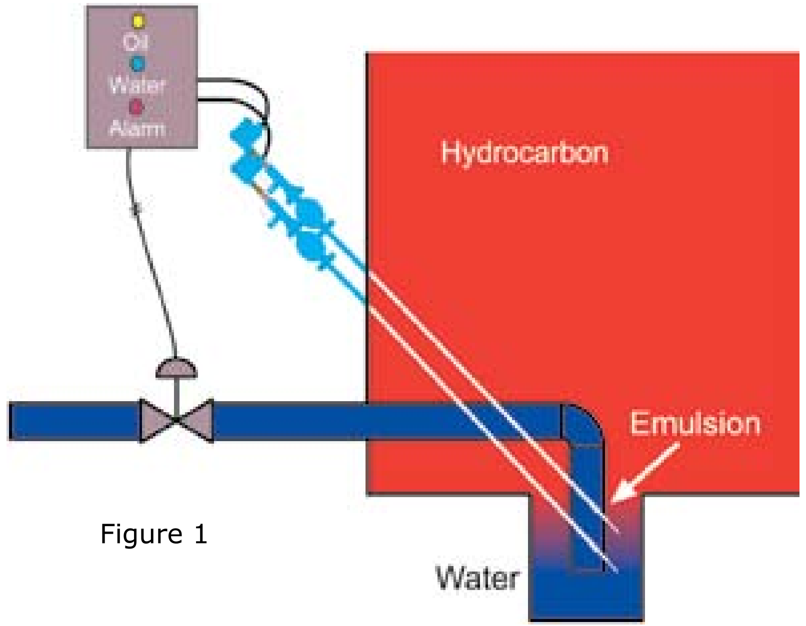

Figure 1

System #2

Figure 2 shows the high-low control logic in which the valve would close only after both probes have detected hydrocarbon. Figures 1 and 2 also show how to overcome tank bottom sludge build-up problems by placing the active part of the AGAR ID-201 probe over the sump in the bottom of the tank. It is nearly impossible for sludge to build-up and cover the probes in this configuration.

SYSTEM 2 CONTROL LOGIC					
ID-201 PROBES		VALVE STATUS	LIGHTS		
HIGH	LOW		OIL	WATER	ALARM
WATER	WATER	OPEN	OFF	ON	OFF
OIL	WATER	OPEN	OFF	ON	OFF
OIL	OIL	CLOSED	ON	OFF	OFF
OIL	WATER	CLOSED	ON	OFF	OFF
WATER	WATER	OPEN	OFF	ON	OFF
WATER	OIL	CLOSED	OFF	OFF	ON

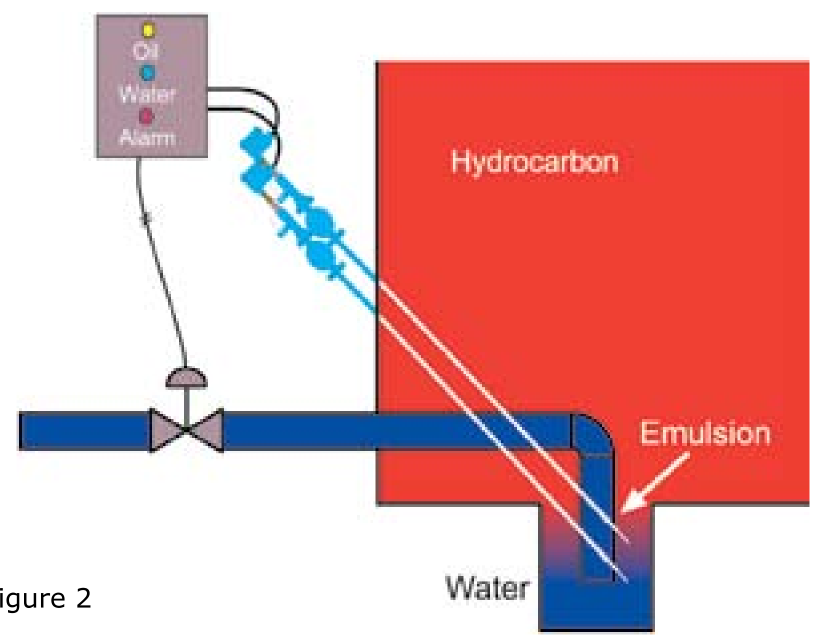

Figure 2

II. IN-LINE HYDROCARBON/WATER MONITORS

The advantage of this approach is the avoidance of tank penetration, elimination of bottom sediment build-up, and the elimination of the free water in the tank.

However, there are significant disadvantages that should be considered in design and policy decisions:

1. Some hydrocarbon must be discharged with the waste water in order for the monitor to detect it in the external pipe.
2. The drain pipe must be altered to avoid the trapping of hydrocarbons.
3. Manual initiation of water-draw cycle is required.

Figure 3 shows how the conventional Vortex Breaker bent pipe traps hydrocarbon at the end of the water draw-off cycle.

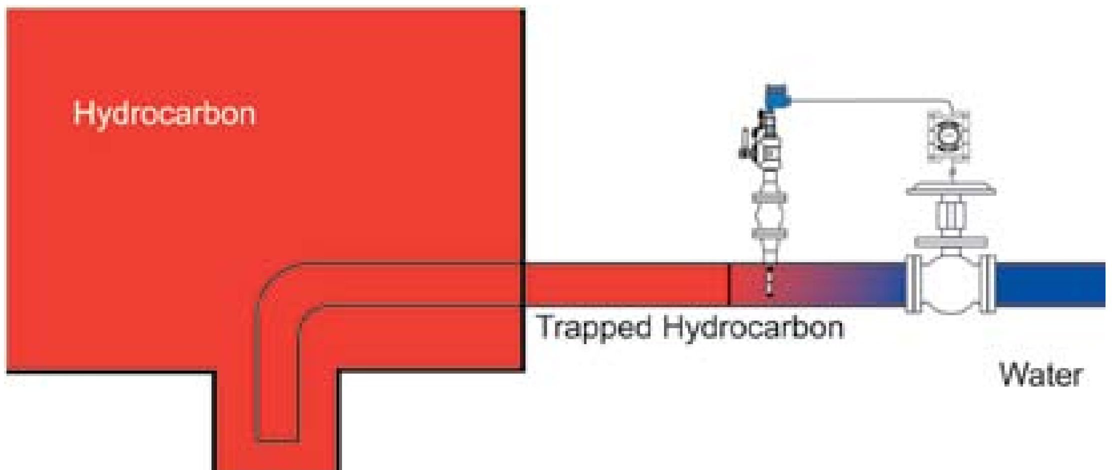

Figure 3

Assume a case where the hydrocarbon and the water have completely "phase separated" to form a clear-cut interface inside the tank. Because hydrocarbon is still present from previous water-draw, the water draw cycle will have to be initiated manually. Water will have to displace the HC before the probe can be activated. Once this has occurred, water will continue to drain until the oil/water monitor again detects hydrocarbons. At this point, the oil/water monitor will send a control signal that is used to close the water draw-off valve. However, due to the bent pipe design, this hydrocarbon is again trapped in the draw-off line. As water gradually builds up in the tank, the hydrocarbon trapped in the line acts as a seal (being lighter than water). To re-activate the dump valve for a new water-draw cycle, the oil/water monitor signal must be overridden to flush the hydrocarbon out of the line before water is again detected. Some HC is discharged to the waste water treatment system during every dump cycle.

There is no assurance there will be sufficient water in the tank to flush all hydrocarbon out of the water draw-off line. Thus, the pipe must be designed in such a way as to eliminate the trapping of hydrocarbon. A small upward inclination is desirable, with a vortex breaker at the intake. The latter avoids vortexing and the suction of hydrocarbon with water when the dump valve is fully open. Figure 4 shows hydrocarbon being discharged with the water because of the vortex action.

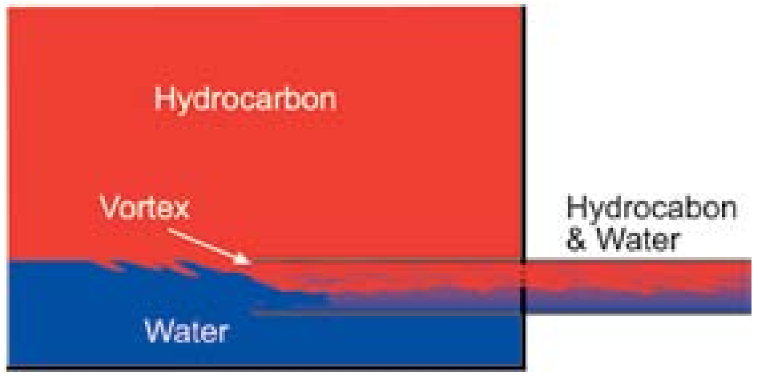

Figure 4

Figure 5 shows the correct installation with a slotted discharge pipe. Note, the cross-section of the slot must be at least ten times larger than the cross-section of the pipe. Similarly, the pipe can be perforated with many holes, whose total cross-section area exceeds the pipe's area by a factor of ten.

If the hydrocarbon is highly viscous, special care must be taken to compensate for hydrocarbon fouling that will stick to pipe walls and the AGAR oil/water monitor. The amount of hydrocarbons discharged will depend on the oil's viscosity and the flushing action of the effluent water. Calibration adjustments to the oil/water monitor will negate the effects of fouling.

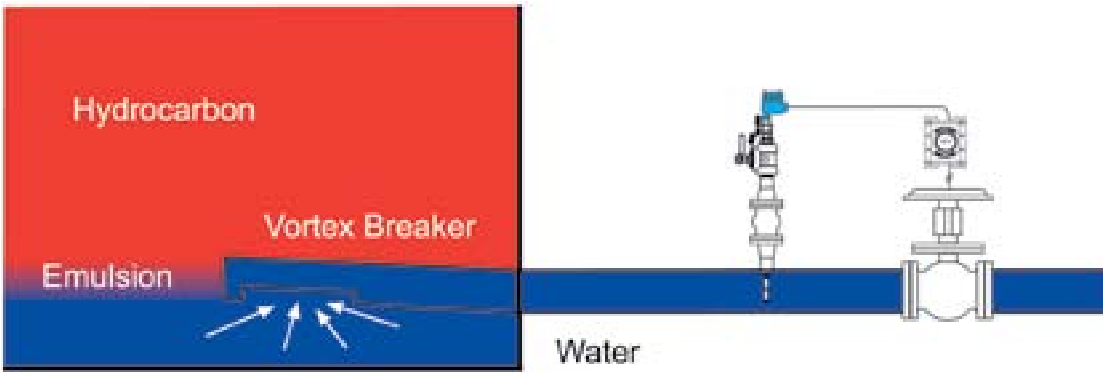

Figure 5

NOTE: Also available in a 2-wire, 24VDC loop-powered system

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