### Information on Water, Corrosion and Microbial Issues with Diesel Fuel Management in Storage Tanks

#### BACKGROUND

Shell Oil Products US and Motiva Enterprises LLC ("Shell/Motiva") fuel quality technical experts have years of experience in evaluating and resolving water issues in retail diesel fuel storage tanks. Typical issues are a result of water bottoms accumulating over a period of time in the storage tank that can lead to filter plugging and equipment corrosion along with a large amount of tank bottom material, which is mostly rust and scale. In very severe cases there can be evidence of microbial induced corrosion (MIC).

Since Ultra Low Sulfur Diesel (ULSD, < 15 ppm sulfur) was introduced to retail in the US in summer and fall of 2006, the diesel fuel industry has identified an increase of water in diesel fuel storage tanks contributing to (a) an increase in the presence of microbial growth in fuel storage tanks in some cases and (b) an increase in the number of product incidents with consumers. The entire industry has noticed this increase.

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#### PROBLEM DIAGNOSIS AND SOLVING

Our experience is that the most effective action is to implement good water management procedures at retail level. If not eliminating completely, those procedures will actively manage and minimize potential impacts of water-related issues.

We have only seen a single incident where the water issue in diesel fuel was related to the terminal. In all other cases, the water (typically less than 1 inch) and tank bottoms were a result of "housekeeping" and water management methods and protocols for storage tanks at the retail location. Lower throughput tanks are generally at a heightened risk, particularly after a new load is received into the tank and the water-diesel interface is disrupted.

Water in the system typically results in consistent symptoms of filter plugging, equipment corrosion, and tank bottom material. When the dispenser filters are working properly, the water and tank bottom material should not affect customers and vehicle performance. However, the filter can only handle a certain amount of sediments and only for a certain period of time. The key indicator is slow product flow due to clogged filters. If not timely addressed, this can potentially lead to water and tank bottom materials passing into customer vehicle tanks. Recognizing the slow product flow indicator and initiating appropriate "housekeeping" steps can avoid an unfavorable consumer experience at your site.

Despite the use of automatic tank gauge systems, and periodically sticking the tank with water detecting paste, water related issues might still occur.





To further assist and eliminate the potential for water-related issues with diesel fuel at retail locations, we have developed a diesel fuel storage tank bottom sampling procedure. This procedure helps to diagnose the issue early before other symptoms are identified.

#### THREE BASIC STEPS TO MANAGE DIESEL FUEL AT RETAIL SITES

- I. Be diligent in water management; always know the true water levels in any tank. Since the detection of water levels below 1 inch is not consistently accurate with an automatic tank gauge system, weekly stick readings with water detecting paste should be utilized to verify the presence and level of water. Since incorrect tank slope may also mask the presence of water, even by sticking, know the low point of the tank and be able to stick there. Have water removed from the tank if the water level reaches 1 inch or more.
- II. Take early symptoms seriously. At the first signs of slow-flow issues, clogged filters or indications of equipment corrosion, check and if needed change the filter and take a tank bottom sample and follow the recommended diagnostic procedure to take appropriate actions.
- III. Have the tank properly cleaned if a significant amount of tank bottom or metallic material is found. The product pumped out from the tank shall not be reloaded into the tank after cleaning, since being a contaminated product. Monitor the tank closely after the tank cleaning, and track deliveries from terminal supply points. Increases in water after rain events may indicate there an issue with tank integrity or drainage on the pad.

#### Use of Biocides

If sites choose to proceed with additional treatment with biocides, this additional step can only be applied after tank cleaning is complete.

#### ASSISTANCE

If needed, we can offer further information on how to manage water. Our Passionate Experts with significant product quality and problem solving expertise are available to help.

#### How?

- I. Utilize a tank bottom sampling procedure for underground tanks (see example below).
- II. Utilize a tank bottom sampling checklist for documentation (see example below). A digital picture of your tank bottom sample will significantly help you assess the issue and get appropriate support.
- III. In the event you would like further assistance, e-mail your documentation (incl. the digital picture) to

SOPUS-PQsupport-WaterManagement@Shell.com





## Bottom Sampling Procedure For Retail Underground Storage Tanks

Owner: Product Quality Group for Shell Oil Products US and Motiva Enterprises LLC

#### OBJECTIVE

The objective is to help diagnose problems at the location, which could potentially be caused by water in the fuel / tank system. This procedure is intended for use at a station where systematic issues are seen such as chronic filer plugging, equipment corrosion or failure.

A checklist has been developed to facilitate appropriate documentation and additional support in diagnosing the problem.

The procedure is applicable for all gasoline and diesel products.

#### **BASIC STEPS**

Please use the checklist attached to the procedure to facilitate appropriate documentation.

- I. If the tank is connected to a Veeder Root or other similar tank gauging system, record the water reading.
- II. Stick the tank with water-detecting paste appropriate for the product being examined. Record the water level in the tank. If possible stick both ends of the tank, especially if there is a known slope in the tank.
- III. Using the fill tube take a sample from the bottom of the tank. A "Bacon Bomb Sampler" or a "Gammon Tank Sampling Device" can be used, or any apparatus that will get a sample from the bottom.
- IV. Put the sample in a clear and clean (water-free) glass container. Document the appearance of the sample. It is strongly recommended to take a digital picture of the sample at the appropriate time as noted in step V. Examples are attached to this procedure.
- V. Water is heavier than either gasoline or diesel. If present, a water layer will be on the bottom and a product layer on the top. It may be necessary to let the sample settle for a few minutes to see the two layers or see any solid material settle to the bottom. If rust, corrosion material or other material is seen, run a magnet across the bottom to see if the particles are magnetic.
- VI. If there are two layers, see if there is any evidence of some material at the interface of the two layers. This is called a "rag layer". If a rag layer or a multiphase layer sample is not observed, a sample should be obtained on the turbine end of the tank. This ensures that if the tank is sloped, a sample will be obtained from the low end where the water will accumulate.

A checklist that can be sent to maintenance contractors or samplers is attached. The main result of the sampling procedure will be a description and pictures of the sample.





**EXAMPLE 1:** Diesel, large water layer with corrosion products; Slight rag layer.



**EXAMPLE 2:** Diesel, small water layer, significant corrosion products. If this sample was allowed to settle, product could become clear







## **Retail UST Bottom Sampling Checklist**

Date	Time	
Sampler – Name and Company worked for		
Name		
Company		
Retail Location – Address and Site Number		
Address		
Site Number		
Contact Person		
Phone Number (Contact Person)		

#### Description of Issue/Problem that the Station is having

#### Product and Tank

Product Code

Tank Number





#### Does the tank have a Veeder Root or other automatic tank gauging system?

If yes, record the number in inches the system is showing for water	
Stick the tank with water detecting paste and record the level in inches	
Where was stick reading done? (fill tube, turbine, etc)	
If there is evidence of tank slope, stick the tank from the other end and record water level	
(IF APPLICABLE) – Specify the location of the second stick reading	
What typle of bottom sampler has been used?	
Description of how the sample smelled	

If at all possible, take a digital picture of the tank bottom sample

How many layers were seen in the tank bottom sample?





If only one (1) layer, describe it, otherwise describe the bottom layer; What color is it, is it clear or hazy, does it have sediment or material in it, is the material magnetic?

# If the sample has two (2) layers, describe the upper layer using the descriptors above

If two layers, do you see any evidence of a rag layer between the two

If yes, describe the size and appearance of the rag layer

#### Do you have any other relevant observations?





#### **Contact Shell for further help**

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