Evaluation of the TT-FFS Product Sensitive Cable For use as a Leak Detection System for Sumps

Final Report

PREPARED FOR:

Tyco Thermal Controls

October 3, 2006

KWA

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Evaluation of the TraceTek™ TT-FFS Product Sensitive Cable For use as a Leak Detection System for Sumps

Draft Report

PREPARED FOR:

Tyco Thermal Controls
300 Constitution Dr.
Menlo Park, CA 94025
650 474-7485

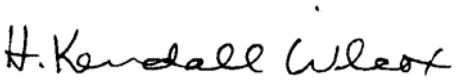
October 3, 2006

Preface

This report describes a third-party evaluation of the TraceTek TT-FFS fuel sensing system when used to detect leaks in sumps. The evaluation was conducted by Ken Wilcox Associates, Inc. at the Fuels Management Research Center in Grain Valley, Missouri.

Technical questions should be addressed to Mr. McCoy at Tyco Thermal Systems, phone 650 474-7485 or Mr. Warren at Industrial heater phone 901 382-4761.

Approved:



H. Kendall Wilcox, Ph.D.
President

October 3, 2006

A. Background

The TraceTek TT-FFS cables are designed to change electrical characteristics when exposed to hydrocarbons. These cables are extremely sensitive to the presence of hydrocarbons, either in the pure liquid state or floating on water. They have been designed to monitor for the presence of hydrocarbons in sumps.

Various regulatory agencies need independent data to assure that such systems will work as advertised. This interim report describes the testing that has been completed by KWA September of 2006. These results demonstrate that the TraceTec cable will detect product releases into sumps, whether from spills, leaks or the secondary containment of a double wall pipeline.

B. Description of the TraceTec System

The TraceTec system consists of up to 12 product sensitive cables and a monitoring console that displays the alarms and the location of any release that occurs along the length of the line. The cable is installed in slotted pipe along side or above the pipeline. These can be easily installed at a new facility as well as retroactively installed on existing systems. A site suitability study is conducted at each potential site to determine that the soil and backfill conditions will be suitable from migration of the product from a leak to the cable.

C. Description of Test Facility and Testing Procedures

Three types of tests were conducted on several liquids with different physical properties. The first test consisted of testing a thin film of liquid similar to what might be present if the product under investigation were spilled or leaked onto a flat surface. The thickness of this film was estimated to be less than one millimeter.

The second set of tests was conducted to determine if the system would alarm when a thin film of liquid was floating on a water surface. The thickness of the film was closer to a sheen rather than any measurable thickness.

The third set of tests was designed to determine if adequate cleaning methods would allow the cable to reused. The cable was immersed in the cleaning liquid and retested after drying, at least one hour.

<u>Thin Film on Solid Surface</u>

A thin film of liquid was formed on the surface of an aluminum container by adding one ml to the bottom of the aluminum test cylinder. After the fuel had spread more-or-less evenly across the bottom of the cylinder the cable was placed flat on the surface until an alarm occurred. The thickness of the product was calculated to be 0.005 inches. The crude oil did not seem to alarm at this thickness so these tests were conducted by adding 5 ml of crude oil to the cylinder bottom surface. The thickness of the crude oil was calculated to be 0.024 inches.

Thin Film Floating on Water

To conduct these tests, the cylinder will filled with water to a depth of approximately 3 inches. The sensor was then installed in the test cell approximately to a depth of half the length of the sensor. A thin film of liquid was then formed by adding one ml of product to the surface of the water for all products including crude oil.

Cleaning Procedures for Reuse of the Sensors

To clean the sensors for reuse, the cable was immersed in Naphtha for 10 minutes and then air dried overnight. The sensors were found to reset after following this process for at least 6 cleanings. The manufacturer reports that these sensors have been found to reset at least 50 times.

D. Test Results

The test results for the TT-FFS sensors are shown in Table 1 for thin layers of fuel floating on a water surface and in Table 2 for thin layers of fuel on a solid surface.

Table 1. Alarm Time for Thin Layer of Fuel Floating on Water

	Thin Layer on Water*			
Run #	**Gasoline**	**Diesel Fuel**	**Jet A**	**Crude Oil**
1	<1min	<1min	<1min	1m 3sec
2	<1min	<1min	<1min	2m 11sec
3	<1min	<1min	<1min	2m 37sec
4	<1min	<1min	<1min	2m 14sec
5	<1min	<1min	<1min	4m 11sec
6	<1min	<1min	<1min	3m 6sec

* Thickness for all products on water was 0.005 inches

Table 2. Alarm Time for Thin Layer of Fuel on Solid Surface

	Thin Layer on Solid Surface*			
Run #	**Gasoline**	**Diesel Fuel**	**Jet A**	**Crude Oil****
1	<1min	<1min	<1min	5min
2	<1min	<1min	<1min	<1min
3	<1min	<1min	<1min	15 min
4	<1min	<1min	<1min	37 min
5	<1min	<1min	<1min	3 min
6	<1min	<1min	<1min	7 min

* Thickness for all products except crude oil on solid surface was 0.005 inches

** Thickness for crude oil on a solid surface was 0.024 inches

E. Data Analysis

The data analysis was straightforward for these tests. The time to alarm for each cable and the location of the leak were recorded. Since there were no missed detections and all of the test times, the probability of detecting a leak that produces a layer of product, either on the surface of a solid or floating on the water table within less than one minute is 100% for gasoline, diesel fuel and Jet A with a confidence interval of For heavier materials such as crude oil the response times may be of the order of a few minutes.

F. Conclusions

The TraceTek product sensitive cables are very sensitive to the presence of hydrocarbons, either as a think film on a solid surface such as might be produced by a small spill or while floating on the surface of water. The response is very fast, usually less than one minute for volatile hydrocarbons and after several hours for heavier materials such as crude oil.

The cables are easily cleaned in Naphtha, which is readily available from most hardware stores. The number of times these can be reused is at least six and may be much larger, based on tests conducted by the manufacturer.

Attachment A

Results Forms for the

TraceTek TT-FFS Product Sensitive Cables

Results of U.S. EPA Alternative Evaluation

Product Sensitive Cables

This form documents the performance of the product sensitive cables described below. The evaluation was conducted by the equipment manufacturer or a consultant to the manufacturer according to the U.S. EPA's requirements for alternative protocols. The full evaluation report also includes a report describing the method, a description of the evaluation procedures, and a summary of the test data.

Tank owners using this system should keep this form on file to prove compliance with the federal regulations. Tank owners should check with state and local agencies to make sure this form satisfies their requirements.

Method Description

Name TraceTec Sump Sensor

Version number(s) TS-FFS

Vendor Tyco Thermal Controls
(Name of Manufacturer)

300 Constitution Drive
(Address)

Menlo Park	CA	94025	(650) 474-7485.
(City)	(State)	(Zip Code)	(Phone)

Evaluation Parameters

The sensors listed above were tested for their abilities to respond to liquids when the sensors are installed in underground storage tank applications. The following parameters were determined from this evaluation.

Threshold Levels – The liquid levels at which alarms are triggered.

Precision (standard deviation) - Agreement between multiple measurements of the same product level.

Detection Time - Amount of time the detector must be exposed to product before it responds.

Fall Time - Amount of time before the detector stops responding after being removed from the product.

Specificity - Types of products that the sensor will respond to

Evaluation Results

Note: If the test data can be presented in a more appropriate manner, the evaluator may select to present the information below in a data table, which can be attached to these forms.

Table 1. Results of the Evaluation for the Beaudreau Dual Float Reservoir Sensor

Table 1. Alarm Time for Thin Layer of Fuel Floating on Water

Run #	Thin Layer on Water*			
	Gasoline	Diesel Fuel	Jet A	Crude Oil
1	<1min	<1min	<1min	1m 3sec
2	<1min	<1min	<1min	2m 11sec
3	<1min	<1min	<1min	2m 37sec
4	<1min	<1min	<1min	2m 14sec
5	<1min	<1min	<1min	4m 11sec
6	<1min	<1min	<1min	3m 6sec

* Thickness for all products on water was 0.005 inches

Table 2. Alarm Time for Thin Layer of Fuel on Solid Surface

Run #	Thin Layer on Solid Surface*			
	Gasoline	Diesel Fuel	Jet A	Crude Oil**
1	<1min	<1min	<1min	5min
2	<1min	<1min	<1min	<1min
3	<1min	<1min	<1min	15 min
4	<1min	<1min	<1min	37 min
5	<1min	<1min	<1min	3 min
6	<1min	<1min	<1min	7 min

* Thickness for all products except crude oil on solid surface was 0.005 inches

** Thickness for crude oil on a solid surface was 0.024 inches

Specificity – This sensor will respond to most hydrocarbons. Testing was conducted only on UL gasoline, diesel fuel, Jet A and crude oil.

Additional Limitations or Considerations - After proper cleaning, these sensors can be used a minimum of six times and probably many more times.

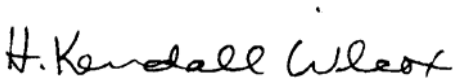
> Safety Disclaimer: This test procedure only addresses the issue of the methods ability to respond to liquids. It does not test the equipment for safety hazards

Certification of Results

I certify that the product sensitive cables were tested under conditions according to the vendor's operating instructions. I also certify that the evaluation was performed using methods described in the accompanying report.

H. Kendall Wilcox, Ph.D., President
(printed name)

Ken Wilcox Associates, Inc.
(organization performing evaluation)



(signature)

Grain Valley, MO 64029
(city, state, zip)

October 3, 2006
(date)

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(phone number)