Electrical Conductivity of Biodiesel*

The conductivity of a fuel is a measure of the ability of a fuel to dissipate static electric charge. Conductivity is important because in a low conductivity fuel electrical charges can accumulate and ultimately lead to dissipation in the form of a spark. This in turn is a fire safety hazard. Low conductivity fuels have been blamed for several petroleum products terminal fires in recent years. As a consequence, minimum conductivity specifications have been established for certain petroleum product handling operations.

Unichem 7551 was the static dissipater (conductivity) additive selected for this project. This product is commonly injected into rundown streams in refineries and into products as they flow through distribution pipelines.

ASTM 2624, Standard Test Methods for Electrical Conductivity of Aviation and Distillate Fuels, was used for evaluating the conductivity of the subject blends. It is commonly used by product pipelines to monitor the products they receive from refiners and distribute to their downstream customers.

Results
Table 1 shows the results of the analyses of the base and additized blended fuels evaluated.

TABLE 1--ASTM D2624 Conductivity Test Results

Percent of Recommended Treat Rate of Unichem 7551	**% Blend of Biodiesel with #2 Fuel Oil**					
	#2 Fuel Oil	**2%**	**20%**	**40%**	**60%**	**Neat Biodiesel**
0%	102	157	201	282	303	498
50%	328	266	395	509	548	544
100%	411	312	440	579	640	646
200%	548	491	598	754	817	904

Data Analysis
In each set of blends, the additive had the desired effect on this product characteristic. The following data show that, for each set of blends having the same concentration of biodiesel, the magnitude of the change in conductivity is approximately the same. These changes in the conductivity due to the additive were:

Base petroleum diesel	446 pS/m
2% biodiesel	334 pS/m
20% biodiesel	397 pS/m
40% biodiesel	472 pS/m
60% biodiesel	514 pS/m
100% biodiesel	406 pS/m

These calculated values do not reveal a trend as the concentration of biodiesel changes.

The base petrodiesel fuel had a relatively high conductivity. ASTM 4865, Standard Guide for the Generation and Dissipation of Static Electricity in Petroleum Fuel Systems, suggests that a minimum conductivity of 50 pS/m is appropriate for non-aviation fuels. It further states that, for some fuels, conductivities are typically maintained at 150 to 250 pS/m, at point of use.

These data suggest that at a 2% blend of biodiesel in low conductivity petrodiesel would result in a conductivity above the minimum conductivity found in the ASTM guide. To confirm or refute this interpretation, low conductivity petrodiesel samples were obtained for analyses. These samples were blended with biodiesel at 2, 4 and 6 percent, to determine the effects of biodiesel when blended at low concentrations. The data follow:

Conductivities at Various
Percentages of Biodiesel (pS/m)

Product	0%	2%	4%	6%
Petrodiesel A	1	8	9	10
Petrodiesel B	2	16	29	41

The empirical data presented above refutes the hypothesis that sufficient conductivity is obtained by blending biodiesel at low levels with low conductivity diesel fuel, although the conductivity does increase.

An additional set of data with low conductivity diesel fuel was conducted over the full range of biodiesel blend percentages. It is presented below

Conductivities at Various
Percentages of Biodiesel (pS/m)

Product	0%	2%	20%	40%	60%	100%
No. 2 Fuel Oil	2	7	75	358	775	1209

Conclusions

Unichem 7551 is as effective in biodiesel as it is in petrodiesel. Biodiesel has sufficiently high conductivity that a static dissipater is typically not required. Blends of biodiesel at or above a 20% blend level would normally not require the addition of a static dissipater due to the increase in conductivity imparted by the biodiesel.

*Results Courtesy of the National Biodiesel Board. Testing conducted by Williams Pipeline.