Preserving Natural Resources in a Changing World™

TALEM, Inc.

Environmental Chemistry & Compliance Specialists™

Abilene ● Fort Worth ● San Angelo

December 3, 2013

C.S.S. Technology, Inc.
P.O. Box 1618
Granbury, Texas 76048

Attn: Mr. Steve Merritt

Re: Roadbond EN1 Testing

Gentlemen:

Enclosed are the results of analytical tests performed on raw drill cuttings and on drill cuttings mixed with soil treated with Roadbond EN1 that C.S.S. Technology, Inc. submitted to TALEM, Inc. on October 16, 2013. As requested, TALEM, Inc. performed testing on a 20% mixture and a 40% mixture of cuttings to soil. The purpose of the testing was to determine if the elevated levels heavy metals would be bound by the soil mixture thereby preventing leaching of the metals into groundwater. A secondary purpose of the testing was to determine if there were elevated levels of volatile and semi-volatile organic compounds in the petroleum-based drilling fluids, and to what degree they remained after the mixing process was completed.

The results of the testing showed that the heavy metals were effectively bound by the soil treated with the Roadbond EN1 as seen in the attached table titled, “Table 1 – Total and TCLP Metals”. It is noteworthy based on mathematical calculations that the soil contained more of each heavy metal than did the raw drill cuttings and, therefore, contributed more heavy metals to both the 20% and 40% mixtures. Nevertheless the analytical data clearly show that Roadbond EN1 successfully prevented the metals from leaching, regardless of their source.

The analysis of the raw drill cuttings showed significant amounts of constituents of gasoline (BTEX) as well as total petroleum hydrocarbons and are seen in the attached table, “Table 2 – VOC and TPH Concentrations“. These results indicate that the organics are either bound by the mixture or lost by evaporation. The precise process was not evident due to the limited scope of this study.

TALEM, Inc. appreciates the opportunity to provide these analytical services, and if you have questions or need additional information please call us at 817-335-1186.

Respectfully,

J. R. “Tag” Coolidge
Sr. Vice President

Table 1 -- Total and TCLP Metals
In a
40% Drill Cuttings to 60% Soil Mixture

	Total Metals mg/KG	TCLP Metals mg/L	
Antimony	2.7	<0.0044	96.7
Arsenic	4.9	<0.006	97.6
Barium	2600	0.36	99.7
Beryllium*	<2.2	0.0003	99.7
Cadmium*	0.04	0.0017	15.0
Chromium	23	0.2	82.6
Copper	220	0.009	99.9
Lead	4.8	<0.0068	97.2
Manganese	870	0.38	99.1
Mercury*	0.017	<0.0053	NA
Nickel	18	0.017	98.1
Selenium*	<0.35	<0.0085	51.4
Silver*	0.26	<0.0017	86.9
Zinc	38	<0.0068	99.6

Note 1: The per cent retained on the soil was determined after the total was adjusted for the TCLP dilution

Note 2: NA or * means that the total concentration of the metal was so low that the calculation was skewed

Table 2 -- VOC and TPH Concentrations
in
Raw Cuttings and 40 % Soil Mixture

	Raw Cuttings Total mg/Kg	40% Mixture Total mg/Kg	40% Mixture TCLP mg/L
Benzene	5.9	<0.23	<0.00036
Ethyl benzene	16000	<0.29	<0.00029
Toluene	1400	<0.40	<0.0006
Xylenes	49000	<0.26	<0.001
TPH C6-C12	19000	1900	-
TPH C12-C28	74000	20000	-
TPH C28-C35	970	250	-
TPH Total	94000	22000	-