METHOD 4050

TNT EXPLOSIVES IN SOIL BY IMMUNOASSAY

1.0 SCOPE AND APPLICATION

1.1 Method 4050 is a procedure for screening soil samples to determine when trinitrotoluene (TNT, CAS No. 118-96-7) is present at concentrations above 0.5 mg/kg. Method 4050 provides an estimate for the concentration of TNT by comparison with a reference.

1.2 Using the test kit from which this method was developed, 93% of soil samples containing 0.25 ppm or less of TNT will produce a negative result, and 99+% of soil samples containing 1.0 ppm or greater of TNT will produce a positive result.

1.3 In cases where the exact concentrations of TNT are required, quantitative techniques (i.e., Method 8330) should be used.

1.4 This method is restricted to use by or under the supervision of trained analysts. Each analyst must demonstrate the ability to generate acceptable results with this method.

2.0 SUMMARY OF METHOD

2.1 Test kits are commercially available for this method. The manufacturer's directions should be followed.

2.2 In general, the method is performed using an extract of a soil sample. Samples and an enzyme-TNT conjugate reagent are added to a immobilized TNT antibody. The enzyme-TNT conjugate "competes" with TNT present in the sample for binding to the immobilized TNT antibody. The enzyme-TNT conjugate bound to the TNT antibody then catalyzes a colorless substrate to a colored product. The test is interpreted by comparing the color produced by a sample to the response produced by a reference reaction.

3.0 INTERFERENCES

Chemically similar compounds and compounds that might be expected to be found in conjunction with TNT contamination were tested to determine the concentration required to produce a positive test result. Table 1 provides the concentrations of compounds tested with the D TECH™ test kit that are required to elicit a positive response at the MDL, as well as the concentration required to yield 50% inhibition compared to the standard curve.

4.0 APPARATUS AND MATERIALS

Immunoassay test kit: D TECH™ TNT (Strategic Diagnostics Inc.), or equivalent. Each commercially available test kit will supply or specify the apparatus and materials necessary for successful completion of the test.

5.0 REAGENTS

Each commercially available test kit will supply or specify the reagents necessary for successful completion of the test.

6.0 SAMPLE COLLECTION, PRESERVATION, AND TRANSPORTATION

6.1 See the introductory material to this chapter, Organic Analytes, Sec. 4.1.

6.2 Soil samples may be contaminated, and should therefore be considered hazardous and handled accordingly.

7.0 PROCEDURE

Follow the manufacturer's instructions for the test kit being used. Those test kits used must meet or exceed the performance specifications indicated in Tables 3-6.

8.0 QUALITY CONTROL

8.1 Follow the manufacturer's instructions for the test kit being used for quality control procedures specific to the test kit used. Additionally, guidance provided in Chapter One should be followed.

8.2 Use of replicate analyses, particularly when results indicate concentrations near the action level, is recommended to refine information gathered with the kit.

8.3 Do not use test kits past their expiration date.

8.4 Do not use tubes or reagents designated for use with other test kits. Do not mix reagents from one kit lot with a different kit lot.

8.5 Use the test kits within their specified storage temperature and operating temperature limits.

8.6 Method 4050 is intended for field or laboratory use. The appropriate level of quality assurance should accompany the application of this method to document data quality.

9.0 METHOD PERFORMANCE

9.1 Table 1 provides data on the minimum concentrations of possible interferants and co-contaminants required to elicit a positive response in the test kits evaluated.

9.2 Twenty five soil samples, known to not be contaminated with TNT, were extracted and analyzed using the D TECH™ TNT kit to determine the extent of soil matrix effects on the performance of the test kit. The results are provided in Table 2, and show that false positive results are not attributable to soil components.

9.3 Thirty soil samples, known to not be contaminated with TNT, were each spiked with TNT at one-half and two times the MDL (0.25 and 1.0 ppm respectively). These samples were analyzed with the D TECH™ TNT test kit to determine the error rate of the assay. The results are presented in Table 3 .

9.4 Ten different soil types, all known to not be contaminated with TNT, were spiked with an acetone solution containing approximately 1.0 ppm TNT. This spiking solution was later quantitated by Method 8330 and found to contain 0.77 ppm TNT. The spiked soil samples were analyzed three (3) times with the D TECH™ kit to determine the extraction efficiency of the method. The data are presented in Table 4.

9.5 Table 5 presents the results of analysis of three soils spiked at approximately 1 and 3 ppm TNT. Each sample was analyzed once using Method 8330 and ten times using the D TECH™ kit.

9.6 Tables 6A and 6B present the results of two field trials. In each trial, soil samples were obtained at a West Coast site from borings, using a split spoon technique. The samples were homogenized by placing approximately six cubic inches of soil into a stainless steel vessel and mixing for five minutes with a stainless steel trowel. The soil was aliquotted into two (2) six ounce glass bottles, tested on-site using the D TECH™ method and transported to commercial laboratories (one laboratory per field trial) for analysis by Method 8330. Table 6C presents the results of a third party field trial, conducted by the California Department of Health Services.

10.0 REFERENCES

1. D TECH™ TNT Users Guide , SDI/EM Sciences 1994

2. Hutter,L., G. Teaney, and J.W.Stave, "A Novel Field Screening System for TNT Using EIA", in Field Screening Methods for Hazardous Wastes and Toxic Chemicals, Vol 1, Proceedings of the 1993 U.S. EPA/A&WMA International Symposium, p.472, 1993.

3. Teaney, G., J.Melby, L.Hutter and J.Stave, "A Novel Field Analytical Method for TNT", Proceedings of the American Association of Analytical Chemists, 1993.

4. Haas, R.J., and B.P. Simmons, "Measurement of Trinitrotoluene (TNT) and Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) in Soil by Enzyme Immunoassay and High Performance Liquid Chromatography (EPA Method 8330)", California Environmental Protection Agency, Department of Toxic Substances Control, Hazardous Materials Laboratory, March, 1995.

TABLE 1

CROSS REACTANTS
D TECH™ TNT TEST KIT

COMPOUND	MDL[a] (ppm)	IC 50[b] (ppm)	% CROSS REACTIVITY[c]
TNT (2,4,6-trinitrotoluene)	0.5	17	100
Tetryl[d]	3	48	35
1,3,5-trinitrobenzene	4	75	23
2-amino-4,6-dinitrotoluene	13	150	11
4-amino-2,6-dinitrotoluene	>500	>500	<1
2,4-dinitrotoluene	90	390	4
2,6-diaminonitrotoluene	>500	>500	<1
2-nitrophenol	>500	>500	<1
4-nitrophenol	>500	>500	<1
2,4-dinitrophenol	>500	>500	<1
RDX[d]	>500	>500	<1
HMX[d]	>500	>500	<1

The following compounds were not detected at or above 100 ppm:

Benzene	Xylenes	PCB 1254	Triazine
Ethylbenzene	Toluene	PCP	

PAHs - an equal concentration mixture of:

Acenaphthene	Acenaphthalene	Anthracene
1,2-Benzanthracene	Benzo(a)pyrene	Pyrene
Benzo(b)fluoranthene	Chrysene	Phenanthrene
Benzo(ghi)perylene	Fluoranthene	Fluorene
Benzo(k)fluoranthene	Indeno(123-cd)pyrene	Naphthalene
Dibenz(ah)anthracene		

[a] The Method Detection Limit (MDL) is defined as the lowest concentration of compound that yields a positive test result.

[b] The IC_{50} is defined as the concentration of compound required to produce a test response equivalent to 50% of the maximum response.

[c] % Cross reactivity is determined by dividing the equivalent TNT concentration by the actual compound concentration at IC_{50}

[d] Tetryl = methyl-2,4,6-trinitrophenylnitramine
RDX = hexahydro-1,3,5-trinitro-1,3,5-triazine
HMX = octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine

TABLE 2

SOIL MATRIX EFFECTS

Soil	Soil type		D TECH™ RANGE (ppm)
133	Avonburg Fine Sine Silt	N/A	<0.5
101	Matapeake Silt Loam	DE	<0.5
100	Clay Loam	DE	<0.5
102	Sassafras Sand Loam	DE	<0.5
106	Evesboro Low Organic Sand	DE	<0.5
107	Pokomoke High OM Sand	DE	<0.5
109	Davidson Clay Loam	GA	<0.5
111	Shontic Casa Grande Sand	AZ	<0.5
112	Casa Grande Clay Loam	AZ	<0.5
113	Trix Sand Clay Loam	AZ	<0.5
114	Trix Casa Grande Clay Loam	AZ	<0.5
115	Yolo Loam	CA	<0.5
116	Capay Silt Clay	CA	<0.5
117	Sycamore Silt Loam	CA	<0.5
118	Dennis Silt Loam	KS	<0.5
119	Grundy Silt Clay Loam	KS	<0.5
120	Luray Silt Clay Loam	OH	<0.5
121	Wooster Silt Loam	OH	<0.5
122	Vienna Loam	SD	<0.5
123	Opal Clay	SD	<0.5
124	Raub Silt Loam	IN	<0.5
125	Rockfield Silt Loam	IN	<0.5
127	Cisne	IL	<0.5
128	Muscatine Loam	IL	<0.5
130	Sandy Brae	DE	<0.5

TABLE 3

FALSE NEGATIVE AND FALSE POSITIVE RATES, SOIL MATRIX[a]

Spike Concentration	False Positive Rate	False Negative Rate
0.25 ppm	7%	-
1.0 ppm	-	0%

[a] Thirty negative soils were spiked with TNT at one-half and two times the MDL (0.25 and 1.0 ppm respectively). These samples were analyzed with the D TECH™ TNT test kit to determine the error rate of the assay.

TABLE 4

DETERMINATION OF EXTRACTION EFFICIENCY FROM SOIL SAMPLES[a]

SOIL ID	MEAN TNT CONC. (ppm)	SD	%CV	%RECOVERY
101	0.54	0.04	7	70
106	0.64	0.06	9	84
108	0.87	0.18	20	113
109	0.63	0.08	13	82
110	0.88	0.15	17	115
116	1.02	0.15	17	115
117	0.82	0.15	15	132
123	0.87	0.23	26	113
126	0.95	0.26	28	123
128	0.65	0.11	16	84
SPIKING SOLUTION	0.77	N/A	N/A	100

[a] Ten different TNT negative soils were spiked with an acetone solution containing 0.77 TNT. The spiked soil samples were analyzed three times with the D TECH™ kit to determine the extraction efficiency of the method.

TABLE 5
RECOVERY OF TNT SPIKED INTO REAL SOILS

Three (3) soils were spiked at approximately 1 and 3 ppm TNT. Each sample was analyzed once by Method 8330 and ten (10) times by the D TECH™ TNT immunoassay test product.

SAMPLE ID	AMOUNT SPIKED	D TECH™ (ppm)	HPLC METHOD 8330	AGREEMENT Y, FN, FP
106-1	1.0	0.5 - 1.5	0.69	Y
		0.5 - 1.5		Y
		0.5 - 1.5		Y
		0.5 - 1.5		Y
		0.5 - 1.5		Y
		0.5 - 1.5		Y
		0.5 - 1.5		Y
		0.5 - 1.5		Y
		0.5 - 1.5		Y
		1.5 - 3.0		FP
116-1	1.0	0.5 - 1.5	0.73	Y
		0.5 - 1.5		Y
		1.5 - 3.0		FP
		0.5 - 1.5		Y
		0.5 - 1.5		
		0.5 - 1.5		Y
		0.5 - 1.5		Y
		0.5 - 1.5		Y
		0.5 - 1.5		Y
		1.5 - 3.0		FP
128-1	1.0	0.5 - 1.5	0.75	Y
		0.5 - 1.5		Y
		0.5 - 1.5		Y
		0.5 - 1.5		Y
		0.5 - 1.5		Y
		1.5 - 3.0		FP
		0.5 - 1.5		Y
		0.5 - 1.5		Y
		0.5 - 1.5		Y
		0.5 - 1.5		Y

TABLE 5 (cont.)

RECOVERY OF TNT SPIKED INTO REAL SOILS

SAMPLE ID	AMOUNT SPIKED	D TECH™ (ppm)	HPLC METHOD 8330	AGREEMENT[a] Y, FN, FP
106-3	3.0	1.5 - 3.0	1.53	Y
		1.5 - 3.0		Y
		1.5 - 3.0		Y
		0.5 - 1.5		Y
		1.5 - 3.0		Y
		1.5 - 3.0		Y
		1.5 - 3.0		Y
		1.5 - 3.0		Y
		1.5 - 3.0		Y
		0.5 - 1.5		Y
116-3	3.0	1.5 - 3.0	2.12	Y
		1.5 - 3.0		Y
		1.5 - 3.0		Y
		1.5 - 3.0		Y
		1.5 - 3.0		Y
		1.5 - 3.0		Y
		1.5 - 3.0		Y
		1.5 - 3.0		Y
		0.5 - 1.5		N
		1.5 - 3.0		Y
128-3	3.0	0.5 - 1.5	2.07	FN
		1.5 - 3.0		Y
		1.5 - 3.0		Y
		1.5 - 3.0		Y
		1.5 - 3.0		Y
		1.5 - 3.0		Y
		1.5 - 3.0		Y
		1.5 - 3.0		Y
		1.5 - 3.0		Y
		1.5 - 3.0		Y

TABLE 6A

COMPARISON OF D TECH™ SOIL RESULTS WITH METHOD 8330

SAMPLE ID	D TECH™ RANGE (ppm)	METHOD 8330 TNT (ppm)	AGREEMENT[a] Y, FN, FP
61-1	< 0.2	< 0.09	Y
61-10	< 0.2	< 0.09	Y
61-11	< 0.2	< 0.09	Y
61-12	< 0.2	< 0.09	Y
61-13	< 0.2	< 0.09	Y
61-14	< 0.2	< 0.09	Y
61-15	< 0.2	< 0.09	Y
61-16	< 0.2	< 0.09	Y
61-17	< 0.2	< 0.09	Y
61-18	< 0.2	< 0.09	Y
61-19	< 0.2	< 0.09	Y
61-2	> 1.5	> 3.0	Y
61-20	< 0.2	< 0.09	Y
61-21	0.5-1.0	2.44	FN
61-22	< 0.2	< 0.09	Y
61-23	< 0.2	< 0.09	Y
61-24	1.0-1.5	1.4	Y
61-25	< 0.2	< 0.09	Y
61-26	< 0.2	< 0.09	Y
61-27	0.2-0.5	0.27	Y
61-28	< 0.2	< 0.09	Y
61-29	< 0.2	< 0.09	Y
61-3	1.0-1.5	1.3	Y
61-30	< 0.2	< 0.09	Y
61-4	> 1.5	1.1	FP
61-5	0.5 - 1.0	1.0	Y
61-6	> 1.5	> 3.0	Y
61-7	< 0.2	< 0.09	Y
61-8	0.5-1.0	1.0	Y
61-9	0.2-0.5	0.56	Y
TET-1	0.5-1.0	< 0.09	FP
TET-2	< 0.2	< 0.09	Y

TABLE 6A (cont.)

SAMPLE ID	D TECH™ RANGE (ppm)	METHOD 8330 TNT (ppm)	AGREEMENT[a] Y, FN, FP
TET-3	< 0.2	< 0.09	Y
TL-1	0.2-0.5	0.99	FN
TL-2	> 1.5	1.2	FP
TL-3	> 1.5	> 3.0	Y
TL-4	0.2-0.5	0.66	FN
TL-5	> 1.5	> 3.0	Y
TL-6	0.2-0.5	0.66	FN
TL-7	0.2-0.5	0.71	FN
TL-8	0.5-1.0	1.46	FN
TL-9	0.2-0.5	0.92	FN

Y = Yes, FN = False Negative, FP = False Positive

TABLE 6B

COMPARISON OF D TECH™ SOIL RESULTS WITH METHOD 8330

Sample Number	D TECH™ Range (ppm)	8330 TNT (ppm)	8330 TNB (ppm)	TNT Equivalent (ppm)	AGREEMENT Y, FN, FP
1	> 1.5	5.75	< 1.0	5.75-6.0	Y
2	> 1.5	3.32	< 1.0	3.32-3.57	Y
3	> 1.5	166	< 1.0	166	Y
4	> 1.5	2500	18.50	2504	Y
5	> 1.5	2.72	< 1.0	2.72-2.97	Y
6	> 1.5	<2.0	7.02	1.76-3.76	Y
7	> 1.5	<2.0	5.12	1.28-3.28	Y
8	> 1.5	140	12.2	143	Y
9	> 1.5	230	20.2	235	Y
10	> 1.5	1100	16.9	1104	Y
11	> 1.5	23.5	11.5	26.0	Y
12	0.5 - 1.0	<2.0	2.95	0.74-2.74	Y
13	0.5 - 1.0	<2.0	1.30	0.33-2.33	Y
14	0.5 - 1.0	<2.0	1.89	0.47-2.47	Y
15	> 1.5	<2.0	3.94	0.99-2.99	Y
16	0.5 - 1.0	<2.0	4.54	1.14-3.14	FN
17	> 1.5	<2.0	4.57	1.14-3.14	Y
18	> 1.5	<2.0	10.5	2.63-4.63	Y
19	> 1.5	3.23	24.3	9.3	Y
20	> 1.5	<2.0	81	20.3	Y
21	> 1.5	<2.0	1.61	0.40-2.40	Y
22	> 1.5	4.75	2.60	5.40	Y
23	> 1.5	<2.0	2.97	0.74-2.74	Y
24	> 1.5	<2.0	6.29	1.57-3.57	Y
25	> 1.5	<2.0	< 1.0	<2.25	Y
26	> 1.5	3.64	5.05	4.90	Y
27	> 1.5	<2.0	6.62	1.66-3.66	Y
28	> 1.5	<2.0	1.94	0.49-2.49	Y
29	> 1.5	<2.0	8.53	2.13-4.13	Y
30	> 1.5	<2.0	6.77	1.69-3.69	Y
31	> 1.5	<2.0	6.75	1.69-3.69	Y
32	> 1.5	<2.0	17.6	4.40-6.41	Y

TABLE 6B (cont.)

Sample Number	D TECH™ Range (ppm)	8330 TNT (ppm)	8330 TNB (ppm)	TNT Equivalent (ppm)	AGREEMENT Y, FN, FP
33	> 1.5	6.39	39.2	16.2	Y
34	> 1.5	4.20	1.39	4.55	Y
35	> 1.5	5.14	< 1.0	5.14-5.39	Y
36	> 1.5	<2.0	2.68	0.67-2.67	Y
37	> 1.5	<2.0	7.65	1.91-3.91	Y
38	> 1.5	<2.0	27.70	6.9-8.9	Y
39	> 1.5	<2.0	9.01	2.25-4.25	Y
40	> 1.5	<2.0	30.90	7.7-9.7	Y
41	> 1.5	<2.0	35.70	8.9-10.9	Y
42	> 1.5	820	5.69	821	Y
43	> 1.5	1200	24.0	1206	Y
44	> 1.5	27.6	11.9	31	Y
45	> 1.5	7.43	9.01	9.70	Y
46	> 1.5	4.98	9.46	7.40	Y
47	> 1.5	3.32	10.4	5.90	Y
48	> 1.5	3.42	16.5	7.60	Y
49	> 1.5	4.32	28.2	11.4	Y
50	> 1.5	7.57	44.8	18.8	Y
50	> 1.5	5.12	81.2	25.4	Y
51	> 1.5	<2.0	1.64	0.41-2.41	Y
52	0.5 - 1.0	<2.0	2.27	0.57-2.57	Y
53	> 1.5	33.5	23.4	39.4	Y
54	> 1.5	2.19	8.43	4.30	Y
55	> 1.5	7.00	11.0	9.75	Y
56	> 1.5	2.84	4.69	4.01	Y
57	> 1.5	<2.0	5.67	1.42-3.42	Y
58	> 1.5	2.23	12.8	5.43	Y
59	> 1.5	5.38	31.4	13.23	Y
60	> 1.5	2.60	13.0	5.85	Y
61	> 1.5	4.43	31.1	12.2	Y
62	> 1.5	4.79	25.9	11.3	Y
63	> 1.5	2.29	18.2	6.8	Y
64	1.0 - 1.5	8.84	148	45.8	FN
65	> 1.5	9.01	< 1.0	9.01	Y
66	> 1.5	29.00	6.02	30.50	Y

TABLE 6B (cont.)

Sample Number	D TECH™ Range (ppm)	8330 TNT (ppm)	8330 TNB (ppm)	TNT Equivalent (ppm)	AGREEMENT Y, FN, FP
67	> 1.5	<2.0	1.30	0.33-2.33	Y
78	> 1.5	<2.0	7.50	1.88-3.88	Y
69	> 1.5	<2.0	4.70	1.18-3.18	Y
70	> 1.5	2.49	30.0	9.99	Y
71	> 1.5	<2.0	29.1	7.28-9.28	Y
72	> 1.5	<2.0	8.86	2.22-4.22	Y
73	> 1.5	<2.0	30.7	7.68-9.68	Y
74	> 1.5	<2.0	38.1	9.59-11.6	Y
75	> 1.5	3.98	183	49.7	Y
76	> 1.5	5.67	122	36.2	Y
77	> 1.5	7.05	< 1.0	7.05-7.3	Y
78	> 1.5	8.04	< 1.0	8.04-8.29	Y
79	> 1.5	1000	7.49	1001	Y
80	0.5 - 1.0	2.12	2.99	2.87	FN
81	0.5 - 1.0	8.83	5.56	10.20	FN
82	1.0 - 1.5	3.64	3.20	4.44	FN
83	> 1.5	3.22	10.6	5.87	Y
84	> 1.5	<2.0	18.3	4.58-6.58	Y
85	> 1.5	<2.0	17.4	4.43-6.43	Y
86	> 1.5	<2.0	20.4	5.10-7.10	Y
87	> 1.5	<2.0	117	29.2-31.2	Y
88	1.0 - 1.5	<2.0	1.96	0.49-2.49	Y
89	> 1.5	351	5.77	352	Y
90	> 1.5	116	39.2	126	Y
91	> 1.5	4.29	3.92	5.27	Y
92	> 1.5	<2.0	11.6	2.9-4.9	Y
93	> 1.5	2.34	9.26	4.66	Y
94	> 1.5	<2.0	48.7	12.2-14.2	Y
95	0.5 - 1.0	<2.0	5.05	1.26-3.26	FN
95	> 1.5	<2.0	12.6	3.15-5.15	Y
96	> 1.5	<2.0	10.7	2.68-4.68	Y
97	> 1.5	<2.0	11.1	2.78-4.78	Y
98	> 1.5	<2.0	3.74	0.94-2.94	Y
99	< 0.2	<2.0	1.88	0.47-2.47	FN
100	> 1.5	4.24	< 1.0	4.24-4.49	Y

TABLE 6B (cont.)

Sample Number	D TECH™ Range (ppm)	8330 TNT (ppm)	8330 TNB (ppm)	TNT Equivalent (ppm)	AGREEMENT Y, FN, FP
101	> 1.5	<2.0	1.10	0.28-2.28	Y
102	0.5 - 1.0	<2.0	1.28	0.32-2.32	Y
103	1.0 - 1.5	<2.0	2.70	0.68-2.68	Y
104	> 1.5	<2.0	10.5	2.63-4.63	Y
105	> 1.5	<2.0	14.1	3.53-5.53	Y
106	> 1.5	<2.0	18.4	4.6-6.6	Y
107	0.5 - 1.0	<2.0	6.35	1.59-3.59	FN
108	1.0 - 1.5	<2.0	6.66	1.67-3.67	FN
109	0.5 - 1.0	<2.0	21.8	5.45-7.45	FN
110	0.5 - 1.0	<2.0	5.29	1.32-3.32	FN
111	0.5 - 1.0	<2.0	4.49	1.12-3.12	FN
112	1.0 - 1.5	<2.0	16.3	4.08-6.08	FN
113	> 1.5	<2.0	28.7	7.18-9.18	Y
114	> 1.5	<2.0	17.7	4.43-6.43	Y
115	> 1.5	<2.0	24.1	6.03-8.03	Y
116	0.2 - 0.5	6.35	< 1.0	6.35-6.6	FN
117	0.5 - 1.0	<2.0	2.40	0.60-2.6	Y
118	0.2 - 0.5	<2.0	4.70	1.18-3.18	FN
119	0.5 - 1.0	<2.0	11.6	2.9-4.9	FN
120	> 1.5	<2.0	56.9	14.2-16.2	Y
121	> 1.5	<2.0	45.6	11.4-13.4	Y
122	> 1.5	<2.0	67.7	16.9-18.9	Y
123	0.2 - 0.5	<2.0	2.78	0.7-2.7	FN
124	< 0.2	<2.0	1.61	0.4-2.4	FN
125	< 0.2	<2.0	4.07	1.02-3.02	FN
126	0.2 - 0.5	<2.0	3.12	0.78-2.78	FN
127 through 279	< 0.2	<2.0	<1.0	<2.25	Y
280 through 365	0.2 - 0.5	<2.0	< 1.0	<2.25	Y
366 through 381	0.5 - 1.0	<2.0	< 1.0	<2.25	Y

TABLE 6B (cont.)

Sample Number	D TECH™ Range (ppm)	8330 TNT (ppm)	8330 TNB (ppm)	TNT Equivalent (ppm)	AGREEMENT Y, FN, FP
382 through 391	1.0 - 1.5	<2.0	< 1.0	<2.25	Y
392 through 399	> 1.5	<2.0	< 1.0	<2.25	Y

Y = Yes, FN = False Negative, FP = False Positive

TABLE 6C

COMPARISON OF D TECH™ SOIL RESULTS WITH METHOD 8330
Third Party Field Trial

Sample	Dilution Factor	D TECH™ Results	8330 TNT Results	8330 TNT+TNB Results	AGREEMENT Y, FN, FP
1	1	<0.5	<0.15	<0.25	Y
2	1	<0.5	<0.15	<0.25	Y
3	1	<0.5	<0.15	<0.25	Y
4	1	0.5-1.5	<0.15	<0.25	FP
5	1	<0.5	<0.15	<0.25	Y
6	1	0.5-1.5	<0.15	<0.25	FP
7	1	<0.5	<0.15	<0.25	Y
8	1	<0.5	<0.15	<0.25	Y
9	1	<0.5	<0.15	<0.25	Y
10	1	<0.5	<0.15	<0.25	Y
11	1	<0.5	<0.15	<0.25	Y
12	1	<0.5	<0.15	<0.25	Y
13	1	<0.5	<0.15	<0.25	Y
14	1	<0.5	<0.15	<0.25	Y
15	1	<0.5	<0.15	<0.25	Y
16	1	0.5-1.5	<0.15	<0.25	FP
17	1	<0.5	<0.15	<0.25	Y
18	1	<0.5	<0.15	<0.25	Y
19	1	0.5-1.5	<0.15	<0.25	FP
20	1	<0.5	<0.15	<0.25	Y
21	1	<0.5	<0.15	<0.25	Y
22	1	<0.5	<0.15	<0.25	Y
23	1	<0.5	<0.15	<0.25	Y
24	1	0.5-1.5	<0.15	<0.25	FP

TABLE 6C (cont.)

Sample	Dilution Factor	D TECH™ Results	8330 TNT Results	8330 TNT+TNB Results	AGREEMENT Y, FN, FP
25	1	<0.5	<0.15	<0.25	Y
26	1	<0.5	<0.15	<0.25	Y
27	1	<0.5	<0.15	<0.25	Y
28	1	0.5-1.5	<0.15	<0.25	FP
29	1	<0.5	<0.15	<0.25	Y
30	1	0.5-1.5	0.15-0.99	0.15-0.99	Y
31	1	<0.5	<0.15	<0.25	Y
32	1	0.5-1.5	<0.15	<0.25	FP
33	1	0.5-1.5	<0.15	<0.25	FP
34	1	0.5-1.5	0.15-0.99	0.15-0.99	Y
35	1	<0.5	<0.15	<0.25	Y
36	1	<0.5	<0.15	<0.25	Y
37	1	3.0-4.0	0.15-0.99	0.25-2.0	FP
38	1	<0.5	<0.15	<0.25	Y
39	1	<0.5	<0.15	<0.25	Y
40	1	<0.5	<0.15	<0.25	Y
41	1	0.5-1.5	<0.15	<0.25	FP
42	1	1.5-3.0	0.15-0.99	0.15-0.99	FP
43	1	<0.5	<0.15	<0.25	Y
44	1	0.5-1.5	<0.15	0.15-0.99	Y
45	1	0.5-1.5	<0.15	<0.25	FP
46	1	0.5-1.5	<0.15	<0.25	FP
47	1	0.5-1.5	<0.15	1.3	Y
48	1	<0.5	<0.15	<0.25	Y
49	1	0.5-1.5	<0.15	<0.25	FP
50	1	<0.5	<0.15	<0.25	Y
51	1	0.5-1.5	<0.15	<0.25	FP
52	10	5-15	1.4	3.2	Y

TABLE 6C (cont.)

Sample	Dilution Factor	D TECH™ Results	8330 TNT Results	8330 TNT+TNB Results	AGREEMENT Y, FN, FP
53	10	40-50	35	41.67	Y
54	1	0.5-1.5	<0.15	<0.15	FP
55	1	0.5-1.5	0.15-0.99	0.15-0.99	Y
56	1	1.5	0.15-0.99	0.15-0.99	Y
57	1	0.5-1.5	<0.15	<0.15	FP
58	1	3.0-4.0	0.15-0.99	0.15-0.99	FP
59	1	0.5-1.5	<0.15	<0.15	FP
60	10	15-30	22	22.48	Y
61	1	0.5-1.5	-	<0.15	FP
62	10	4-40	2.1	32	Y
63	10	5-15	2	3.1	Y
64	100	400-500	360	364	Y
65	1000	4000-5000	6300	6327	Y
66	10000	15000	4000	4027	FP
67	1000	15000	530	547	FP
68	10	5-15	2.8	3.375	Y
69	100	400-500	460	477	Y
70	10	15-30	4.2	6.73	FP
71	10	5-15	1.0	1.57	FP
72	10	40	5.1	34.5	Y
73	10	5-15	1.9	4	Y
74	10	5	1.6	2.7	Y
75	10	4-30	2.2	4.3	Y
76	10	5-15	1.7	2	FP
77	10	5-15	2.2	3.95	Y
78	100	300-400	180	192.19	Y
79	10	5-15	3.1	4.61	Y
80	10	5-15	2.8	5.26	Y

TABLE 6C (cont.)

Sample	Dilution Factor	D TECH™ Results	8330 TNT Results	8330 TNT+TNB Results	AGREEMENT Y, FN, FP
81	10	5-15	2.5	5.26	Y
82	10	15-30	3.2	4.5	FP
83	10	40-50	1	23	Y
84	10	15-30	3.8	18.5	Y
85	10	15-30	36	52.5	FN
86	10	15-30	3.6	8.66	Y
87	10	5-15	2.6	19.16	Y
88	10	5-15	3.2	3.84	Y
89	100	150-300	78	82	Y
90	1	4-5	18000	18050	FN
91	10000	15000	11000	11052.9	Y
92	10	40-50	36	42.4	Y
93	10000	15000-30000	11000	11052.9	Y
94	1000	500-1500	88	107	FP
95	1	3.0	9.6	10.17	FN
96	10000	40000-50000	15000	15050	FP
97	10000	4000-5000	2200	2220	Y
98	10	15-30	3.6	3.9	FP
99	10	15-30	6.4	6.7	FP
100	100	50-150	26	28.76	Y

Y = Yes, FN = False Negative, FP = False Positive