The Center for Health Promotion and Preventive Medicine (USACHPPM) Gas Chromatographic Procedures for Analysis of Water and Soil for Energetics and Related Compounds

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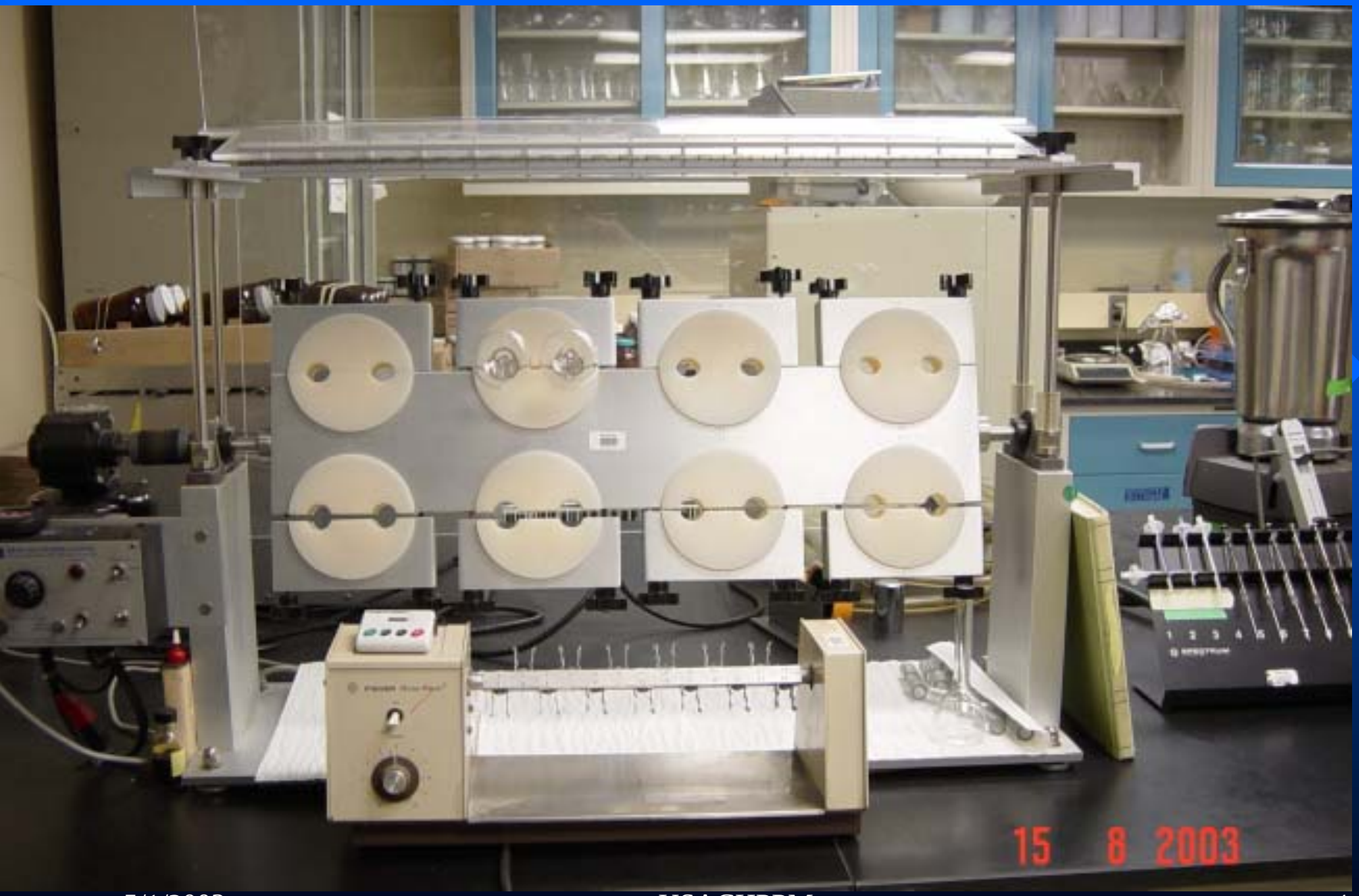
Topics of Discussion

- USACHPPM Method
- Other Methods Available for the Detection and Measurement of Explosives
- Advantages and Disadvantages of Methodologies

USACHPPM Extraction Method

- Water Extraction
  - 100 mL sample
  - 1.0 mL IAA
  - Rotate for 30 Min
- Soil Extraction
  - 2-5g sample, 20 mL H2O
  - 5.0 mL IAA
  - Shake for 3 Hr

Rotary Agitators



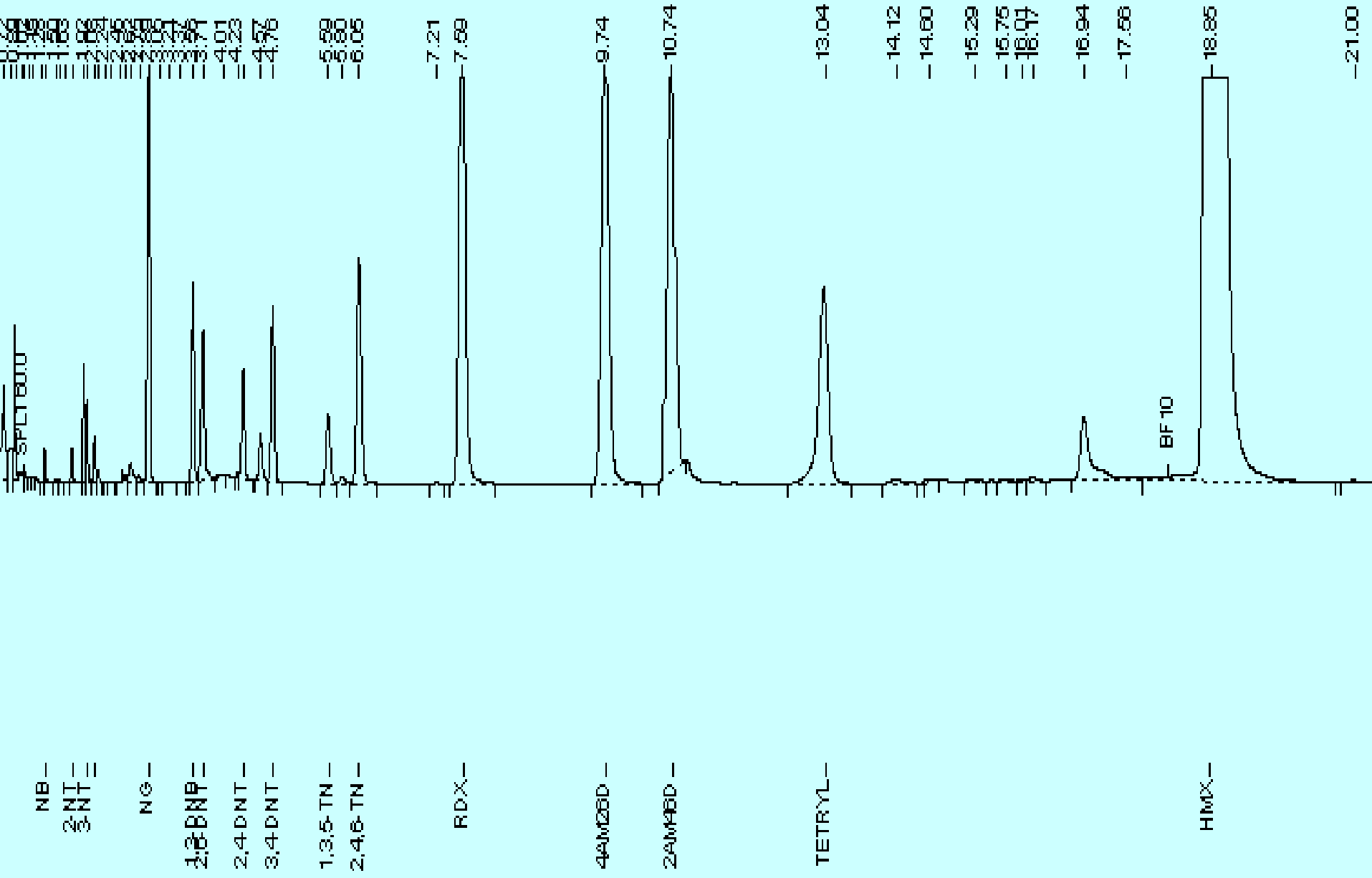
Flatbed Shaker

Method Reporting and Detection Limits

	Water - µg/L		Soil - µg/g*	
Compound	MDL	MRL	MDL	MRL
2,6-Dinitrotoluene	0.001	0.01	0.004	0.01
2,4-Dinitrotoluene	0.003	0.02	0.006	0.02
2,4,6-Trinitrotoluene	0.004	0.03	0.007	0.01
RDX	0.016	0.1	0.006	0.01
HMX	0.58	3	0.023	0.05
2-Nitrotoluene	0.016	0.09	0.006	0.02
3-Nitrotoluene	0.044	0.09	0.005	0.02
4-Nitrotoluene	0.035	0.09	0.006	0.02
Nitrobenzene	0.004	0.03	0.005	0.02
1,3-Dinitrobenzene	0.011	0.09	0.005	0.02
1,3,5-Trinitrobenzene	0.004	0.03	0.006	0.02
4-Amino-2,6-Dinitrotoluene	0.023	0.1	0.026	0.05
2-Amino-4,6-Dinitrotoluene	0.026	0.1	0.009	0.02
Tetryl	0.023	0.5	0.012	0.02
Nitroglycerin	0.015	0.09	0.025	0.05

* Soil data based on a 5.0-gram sample.

Chromatogram



EPA Method 8330/8095

- Liquid Chromatography (8330)
  - Water
  - Soil
- Gas Chromatography (8095)
  - Water
  - Soil

Method Reporting and Detection Limits EPA 8330

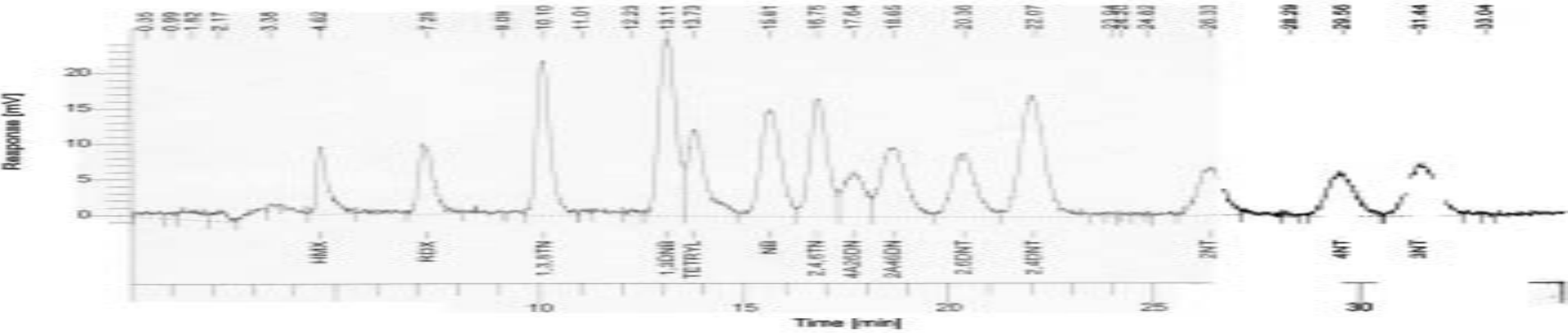
Compound	MDL (Soil - µg/g*)	MRL (Soil - µg/g*)
2,6-Dinitrotoluene	0.1	0.25
2,4-Dinitrotoluene	0.1	0.25
2,4,6-Trinitrotoluene	0.1	0.25
RDX	0.4	1
HMX	0.5	2.2
2-Nitrotoluene	0.1	0.25
3-Nitrotoluene	0.1	0.25
4-Nitrotoluene	0.1	0.25
Nitrobenzene	0.1	0.25
1,3-Dinitrobenzene	0.1	0.25
1,3,5-Trinitrobenzene	0.1	0.25
4-Amino-2,6-Dinitrotoluene	0.1	0.25
2-Amino-4,6-Dinitrotoluene	0.1	0.25
Tetryl	0.1	0.65
Nitroglycerin	–	–

- Soil data based on a 2.0-gram sample.

Chromatogram

Software Version	: 6.2.0.0.0:B27	Date	: 8/7/02 2:30:10 PM
Sample Name	: 2 ppm 8330	Data Acquisition Time	: 8/7/02 1:43:44 PM
Instrument Name	: MAXIMUS	Channel	: A
Rack/Vial	: 1/1	Operator	: bishoprw
Sample Amount	: 1.000000	Dilution Factor	: 1.000000
Cycle	: 1		

Result File :
Sequence File : \\g6099\MUSCP\RWBISHOP\LCdata\best.seq



Explosives in Soil

Peak #	Time [min]	Area [µV·s]	Height [µV]	Component Name	ug/mL
6	4.616	189155.14	9665.50	HMX	1.3714
7	7.249	252717.86	8582.68	RDX	1.3512
9	10.100	518041.28	20458.30	1,3,5TNB	1.3012
12	13.110	720240.15	24550.58	1,3DNB	1.1504
13	13.731	386876.86	12044.66	Tetryl	1.5899
14	15.609	517497.29	15153.44	NB	1.3858
15	16.752	498602.27	16407.29	2,4,6TNT	1.1949
16	17.638	223607.36	6374.85	4A26DNT	0.7961
17	18.646	416149.34	9743.19	2A46DNT	0.9707
18	20.361	356410.76	8970.48	2,6DNT	1.2504
19	22.070	711026.71	16356.39	2,4DNT	1.2514
23	26.330	296136.40	6690.56	2NT	1.0972
25	29.556	291132.90	5875.41	4NT	1.2360
26	31.435	370058.88	7140.17	3NT	1.2566
		5747653.20	168013.49		

Analyst:_____ Date:_____ PE Spheri-5 RP-18 22cm x 4.6mm i.d. 5 micron

Advantages

- USACHPPM Method
  - Simple, reproducible
  - Mini-Extraction
  - High sample throughput
  - Low detection limits
  - Applicable to deployment samples

Disadvantages

- Purity of isoamyl acetate
- Emulsions

USACHPPM Method

- Additional Applications
  - Vegetation Samples
  - Blood
  - Destruction of Munitions (PMACWA)
  - Range Residue
  - Air Sampling
- Future Applications
  - Biological tissue