Site Characterization and Monitoring Technologies
Technology Profile
◆ Field Analytical Explosives Measurements ◆

Technology Description

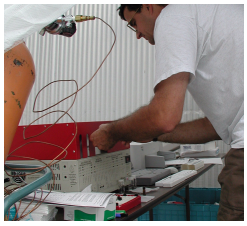
Many military facilities across the United States have been declared Superfund sites due to extensive contamination caused by the production, packing, and firing of a variety of munitions. In Eastern and Western Europe explosive contaminated sites are even more widespread. Two compounds—2 4,6-trinitrotoluene (TNT) and hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)—are the major ingredients in nearly all military munitions. While TNT and RDX are the contaminants most frequently detected in the soil and groundwater at contaminated sites, by-products and biotransformation compounds, such as 2,4-dinitrotoluene (2,4-DNT) and 4-amino-2,6-dinitrotoluene (4AmDNT), are also often present. On-site analytical methods for explosives are used to quickly characterize the extent of contamination and to reduce the number of non-detect samples sent offsite for expensive laboratory analyses. Operating principles of field-portable technologies for the measurement of explosive residues such as RDX and TNT are varied and include: gas chromatography with ion mobility spectrometer or thermoionic detection and flow-through immunoassay techniques with fluorescence detection and surface plasmon resonance. The performance factors of four technologies have been verified for detecting and quantifying explosives and their by-products in soil and/or water. Product and contact information for the participating vendors is included below.

Technology	Vendor	Contact	Address and Web Information
GC-IONSCAN™ (Gas chromatograph-ion mobility spectrometer)	**Barringer Instruments**	**Yin Sun** 908-222-9100 ysun@bii.barringer.com	30 Technology Drive Warren, NJ 07059 www.barringer.com
FAST 2000™ (Continuous-flow immunosensor)	**Research International**	**Elric Saaski** 425-486-7831 resrchintl@aol.com	18706 142nd Ave. NE Woodinville, WA 98072-8523 www.resrchintl.com
Spreeta™ Sensor (Surface plasmon resonance sensor)	**Texas Instruments**	**Jerry Elkind** 972-995-1214 elkind@ti.com	13536 N. Central Expressway Dallas, TX 75243 www.ti.com
GC-TID (Model 8610C) (Gas chromatograph-thermionic ionization detector)	**SRI Instruments**	**Hugh Goldsmith** 310-214-5092 hagoldsmith@earthlink.net	20720 Earl Street Torrance, CA 90503 www.srigc.com


GC-IONSCAN


FAST 2000


Spreeta Sensor


GC-TID

Additional verifications can be performed for interested vendors.

General Market Information

How much does it cost to purchase explosives detection technologies?

The capital costs of the equipment necessary to analyze soil or water samples for explosives vary widely and have changed since the verification tests. The reader should contact the vendor for current pricing. In general, the cost of purchasing these instruments ranges from $5,000 to $70,000.

Who would use or purchase such technologies?

Field portable analytical technologies for explosives can be used to detect, and in most cases, quantify, the presence of nitroaromatic or nitramine compounds in soil or water. Customers for these technologies include the Department of Defense (DoD), consulting engineers, and state and Federal regulatory personnel. Also, those involved in the evaluation of Brownfields may be particularly interested in these field instruments.

Verification Test Description

The verification objectives were to obtain performance information using environmental and quality control samples, to compare the field results to the conventional fixed-laboratory analyses (EPA SW-846 Method 8330), and to report on the logistical operation of the technology. Test samples included spikes, blanks, and environmental samples. For each sample, replicates of four were imbedded in the experimental design. Environmentally contaminated soil samples were collected from DoD sites in California, Louisiana, Iowa, and Tennessee and ranged in concentration from 0 to approximately 90,000 mg/kg. Explosives-contaminated water samples from Tennessee, Oregon and Louisiana with concentrations ranging from 0 to 25,000 µg/L were analyzed. The primary constituents in the samples were 2,4,6-trinitrotoluene (TNT); isomeric dinitrotoluene (DNT), including both 2,4-dinitrotoluene and 2,6-dinitrotoluene; hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX); and octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX). In all, the experimental design included 108 soil samples and 176 water samples. The verification test plan and individual technology performance reports can be found at http://www.epa.gov/etv/library.htm.

Technology Performance Factors

The results of the verification tests can be downloaded from our web site at www.epa.gov/etv. The following is a list of performance factors that are discussed in the verification reports.

- ✓ Precision
- ✓ Accuracy
- ✓ Sample Throughput
- ✓ Comparability with SW-846 Method
- ✓ Completeness
- ✓ False Positive/False Negative Results
- ✓ Cost
- ✓ Ease of use

For More Information

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