**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.

<table>
<thead>
<tr>
<th>Technology</th>
<th>Vendor</th>
<th>Contact</th>
<th>Address and Web Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>GC-IONSCAN™ (Gas chromatograph-ion mobility spectrometer)</td>
<td>Barringer Instruments</td>
<td>Yin Sun 908-222-9100</td>
<td>30 Technology Drive Warren, NJ 07059 <a href="http://www.barringer.com">www.barringer.com</a></td>
</tr>
<tr>
<td>Spreeta™ Sensor (Surface plasmon resonance sensor)</td>
<td>Texas Instruments</td>
<td>Jerry Elkind 972-995-1214</td>
<td>13536 N. Central Expressway Dallas, TX 75243 <a href="http://www.ti.com">www.ti.com</a></td>
</tr>
<tr>
<td>GC-TID (Model 8610C) (Gas chromatograph-thermionic ionization detector)</td>
<td>SRI Instruments</td>
<td>Hugh Goldsmith 310-214-5092</td>
<td>20720 Earl Street Torrance, CA 90503 <a href="http://www.srigc.com">www.srigc.com</a></td>
</tr>
</tbody>
</table>

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](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](http://www.epa.gov/etv). The following is a list of performance factors that are discussed in the verification reports.

- Precision
- Accuracy
- Sample Throughput
- Completeness
- False Positive/False Negative Results
- Cost
- Ease of use

**For More Information**

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