



B86 Comparison of U.S. Environmental Protection Agency and Accelerated Solvent Extraction Explosives Contaminated Soil Sample Analysis Methods

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This presentation will discuss the comparison of the U.S. Environmental Protection Agency's sample preparation technique for soils containing explosives with that of accelerated solvent extraction. Attendees will learn of the potential for each of these methods and which is the most efficient for applications involving explosives in soil matrices.

This research will have a direct impact on the forensic community by comparing two established extraction methods and providing a basis for choosing an extraction technique for the analysis of explosives in post-blast or contaminated soil environments.

In 2001 The U.S. Army Corps of Engineers (Corps) estimated spending between \$15 billion and \$20 billion to remediate thousands of properties, located throughout the United States, formerly owned, leased, possessed, or operated by the Department of Defense (DOD) or its components.¹ These properties are known as Formerly Used Defense Sites (FUDS) and include sites used for military training and testing.

The area of the Monongahela National Forest known as the Dolly Sods Wilderness Area in eastern West Virginia is a Formerly Used Defense Site. Most of this region was acquired by the U.S. Federal Government between 1916 and 1939 and was used for military testing during World War II. From 1943 to 1944 the area was used for maneuvering exercises and artillery/mortar practice.² When the military testing concluded, the site was cleared of any ordnance before being returned to the United States Forest Service. In 1995, the Army Corps of Engineers performed site inspections and confirmed the presence of unexploded ordnance within this area.

Scenes of forensic interest, such as those found after an improvised explosive device (IED), could contain the same type of explosives, propellants, and degradation products as the FUDS areas. Therefore, the same type of analytical methods and techniques used on the abandoned military sites could be used on such crime scenes.

The current research is part of an effort to identify concentrations of exploded and unexploded ordnance, their degradation products, and related contaminants in soil matrices found in post-blast environments. Control soil samples were taken from an arboretum in Morgantown, WV and spiked with known concentrations of explosives. Soil samples recovered from old Department of Defense firing ranges within the Dolly Sods Wilderness Area were used as unknowns to further test the suitability of these extraction techniques. All samples were extracted and analyzed for explosives listed in the Environmental Protection Agency (EPA) 8330 and 8095 methods using high performance liquid chromatography (HPLC) and gas chromatography/electron capture device (GC/ECD). Among others, the explosives analyzed for were 2,4,6-Trinitrotoluene (TNT), 2-Amino-4, 6-dinitrotoluene (2-ADNT), 4-Amino-2,6-dinitrotoluene (4-ADNT), Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX), and Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX). Two extraction techniques, the EPA 8330b method and the use of an accelerated solvent extractor (ASE), were compared for sample pre-treatment to determine which was most efficient.

The samples extracted using the EPA 8330b method were allowed to air dry and then homogenized using a sieve and a mortar and pestle. Using a shaker table, 10 gram samples of the homogenized soil were then extracted in 20 mL of acetonitrile over a period of 18 hours. The ASE method had separate 10 gram samples mixed with diatomaceous earth and extracted at a temperature of 100°C, a pressure of 1500psi, over a period of 15 minutes. The ASE method required 50 mL of acetonitrile.

Explosives, Soil Analysis, Accelerated Solvent Extraction