



FINAL REPORT

**DECONTAMINATION OF EXPLOSIVES-
CONTAMINATED RANGE SCRAP USING
A TRANSPORTABLE HOT GAS
DECONTAMINATION SYSTEM**

**U.S. Army Environmental Center
U.S. Army Aberdeen Test Center
Parsons Corporation**

May 2003



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List of Acronyms

AAP	Army Ammunition Plant
ABR-9	Air Base Range 9
AD-3	Ammunition Dump 3
AEC	Army Environmental Center
AEDA	Ammunition, Explosives, and Dangerous Articles
APG	Aberdeen Proving Ground
ATC	Aberdeen Testing Center
ATIRS	Automated Test Incident Reporting System
BCS	burner control system
BRAC	Base Realignment and Closure
BRACO	BRAC Office
CAA	Clean Air Act
CCTV	closed circuit television
CEM	continuous emissions monitor
C&P	Cost and Performance
COTS	commercial off-the-shelf
CRREL	Cold Regions Research and Engineering Laboratory
CTT	Closed, Transferred, and Transferring
DoD	Department of Defense
DRMO	Defense Reutilization and Marketing Office
DSHE	Directorate of Safety, Health, and Environment
ECP	Explosives Contaminated Property
ECAM	Environmental Cost Analysis Method
ESTCP	Environmental Security Technology Certification Program
FUDS	Formerly Used Defense Sites
IDL	Instrument Detection Limit
IG	Inspector General
GC/MS	gas chromatograph/mass spectrometer
HGD	hot gas decontamination
HMX	Octahydro-1,2,5,7-tetranitro-1,3,5,7-tetrazocine
HQDA	Headquarters Department of the Army
HPLC	high performance liquid chromatography
IDL	instrument detection limit
I/O	input/output
IOC	Industrial Operations Command
IOP	Internal Operating Procedures
IPR	In-Process Reviews
JHA	Job Hazard Analysis
LCS	laboratory control sample
MDE	Maryland Department of Environment
MHE	material handling equipment
MMR	Military Munitions Rule
MPPEH	Material that Presents the Potential for Explosives Hazard

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MSDS	Material Safety Data Sheets
NAAQS	National Ambient Air Quality Standards
NEMA	National Electric Manufacturers Association
NIST	National Institute of Standards and Technology
NFPA	National Fire Protection Agency
NO _x	oxides of nitrogen
OEESCM	Operational and Environmental Executive Steering Committee
OW	operator workstation
PAHs	polycyclic aromatic hydrocarbon compounds
PETN	Pentaerythritol tetranitrate
PLC	programmable logic controller
PM _{2.5}	particulate matter with an aerodynamic diameter less than or equal to 2.5 microns
PM ₁₀	particulate matter with an aerodynamic diameter less than or equal to 10 microns
PPE	personal protective equipment
QA	quality assurance
QAPP	Quality Assurance Project Plan
R3	Resource Recovery and Recycle
RDX	Hexahydro-1,3,5-trinitro-1,3,5-triazine
REC	Record of Environmental Consideration
RPD	relative percent difference
SOP	standard operating procedure
SSHSP	Site-Specific Health and Safety Plan
SVOC	Semi-volatile organic compounds
TCLP	Toxic Characteristic Leaching Procedure
TIR	Test Incident Report
TNT	Trinitrotoluene
TSOP	Temporary Standing Operating Procedures
USAEC	U.S. Army Environmental Center
USAGAPG	U.S. Army Garrison Aberdeen Proving Ground
USEPA	U.S. Environmental Protection Agency
UXO	unexploded ordnance
VOC	volatile organic compounds
Yellow D	Ammonium Picrate

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1.0 INTRODUCTION

This report documents the results of the field demonstration of a transportable hot gas decontamination (HGD) system for decontamination of explosives-contaminated range scrap. Under management of the U.S. Army Environmental Center (USAEC), a low-cost HGD process configuration was selected by the Environmental Security Technology Certification Program (ESTCP) for full-scale demonstration of field decontamination of explosives-contaminated range residue at the U.S. Army Aberdeen Test Center (ATC), located on Aberdeen Proving Ground (APG), Maryland. In addition to funding by ESTCP, additional financing has been provided by the USAEC to perform this field demonstration. This report documents the performance of the decontamination system, provides design and operational details and performance of the materials and equipment, and provides a performance assessment of operational data, including air emissions monitoring and test coupons.

1.1 BACKGROUND

The Department of Defense (DoD) has numerous target, bombing, test, and firing ranges that have accumulated a substantial amount of high-value recyclable scrap metal in the form of ammunition, explosive, and dangerous articles (AEDA), range residue, Explosives-Contaminated Property (ECP), and Materials that Present the Potential for Explosive Hazard (MPPEH). This scrap metal includes practice bombs, expended artillery, small arms and mortar projectiles, aircraft bombs and missiles, rockets and rocket motors, hard targets, grenades, incendiary devices, experimental items, demolition devices, and other materials fired on or upon a military range (See Figure 1.1-1). These articles include various expended primers, flash tubes, stub bases, and other items and present a unique problem to generating activities. This material is collected in range sweeps and removal operations at active and inactive ranges, and unexploded ordnance (UXO) removal operations at Closed, Transferred, and Transferring (CTT) sites. Contrary to popular belief, these items often have explosives residue after detonation. Explosive incidents involving scrap metal from training and firing ranges have occurred over the years and recently have come under close scrutiny.

A safe, environmentally conscious alternative to decontaminate firing range scrap is a low-temperature thermal desorption process called the hot gas decontamination (HGD) technology developed by the U.S. Army Environmental Center (USAEC). The HGD technology uses controlled heat to volatilize and thermally decompose the explosives contamination. A low-cost HGD process configuration was demonstrated in which the scrap metal is placed in piles and covered with an insulated thermal blanket. Propane-fired portable burners inject heat at a controlled rate to meet the time and temperature criteria (up to 600°F for up to a 6-hour holding time), to reach a decontamination level which can be certified as inert. Range residue has not previously been decontaminated in this manner. Although not used on range residue, many Army facilities have flashed range scrap to make it safe for sale before the range residue problem developed. Although this method did not use propane as the heat source, the use of wood or petroleum-based fuel was used to heat-treat metal scrap.