

Introduction

The United States' Cooperative Threat Reduction (CTR) Program was established as a result of the Nunn-Lugar Act (22 USC 68) of the early 1990s declaring that it was "in the national security interest of the United States... [to ensure] the elimination of [Soviet] chemical, biological and other weapons capabilities." The legislation was later expanded to authorize CTR efforts outside of former Soviet Union countries. Under the Defense Threat Reduction Agency (DTRA), the CTR sought to help foreign states to safeguard, dismantle, and destroy their stockpiles of weapons of mass destruction, including nuclear, biological, and chemical material. In early 2005, ECBC was called upon to provide technical expertise and analytical support to the DTRA-CTR Program in a joint effort to destroy a stockpile of CWA located approximately 13 miles east of Tirana, Albania. The stockpile had been previously declared to the OPCW in accordance with the CWC treaty. ECBC provided expertise and support to DTRA-CTR throughout all phases of the destruction effort, including site mobilization/demobilization and agent characterization, sampling, analysis, and monitoring efforts. Additionally, ECBC provided a panel of Subject Matter Experts (SMEs) who assisted in selection of the thermal treatment technology and processes by which the agent stockpile would be destroyed.

Phase I included a complete characterization of the CWA in storage, including non-intrusive inspections, determining container weights, and determining approximate liquid-to-solid ratios in containers where agent degradation had taken place. ECBC also performed intrusive sampling and analysis of chemical agent containers to determine purity, impurities, degradation products, and the quantity and type of dissolved metals. ECBC was also tasked with over-packing leaking containers to mitigate further agent degradation, environmental release, and risk to Health and Safety. **Phase II** involved providing analytical support in the form of air monitoring during all destruction activities. This included ambient air monitoring for health and safety purposes, as well

as monitoring of process effluent streams to ensure efficacy of the thermal destruction methods and engineering controls. A third party contractor was tasked with the actual agent destruction. In **Phase III**, ECBC performed monitoring and decommissioning support for the site, including demolition of the thermal treatment facility where the agent destruction operations took place. Upon completion, all remaining waste was packaged in drums, inventoried, and stored in large freight containers for disposal by the Albanian government. In late 2011, ECBC received a request for support from the U.S. Department of State (DOS), that a small stock of chemical warfare agents was discovered in the Central Laboratory of the Albanian Armed Forces (AAF). Representatives from the Albanian government worked through the U.S. Embassy in Tirana, Albania to supply an inventory of toxic chemicals to be destroyed. The inventory included a variety of chemical agent classes to include riot control, incapacitating, vomiting, choking, vesicant, and nerve agents. The chemicals, present in relatively small quantities, reportedly were used previously as analytical reference standards for training Albanian soldiers on the operation of their laboratory and portable detection equipment

Chemical Destruction Approach

Destruction conditions for each chemical agent were based on Army Hazardous Waste Delisting Procedures, ECBC Standard Operating Procedures, and/or "standard lab practices", based on expected reaction chemistry. Table 1 shows the type of neutralization agent used for each agent. The neutralization agent quantities shown were calculated based on delisting procedures or a 2x-5x stoichiometric excess.

Table 1. Neutralization Agent Selection

Agent	Neutralization Type†	Quantity
HD	Bleach	18.8 L*
L	NaOH	26.7 L*
HN3-HCl	NaOH	3.1 L**
GB	NaOH	2.9 L*
AsCl ₃	NaOH	23.4 L**
DM	Bleach	5.1 L**
BZ	Alic. NaOH	0.3 L**
CS	Alic. NaOH	0.7 L**
DP	NaOH	3.9 L**
CN	Alic. NaOH	1.2 L**
PS	Alic. NaOH	1034.5 L**

† - "NaOH" indicates 10% (w/w) NaOH solution.
 ‡ - "Alic. NaOH" indicates 10% (v/v) alcohol was added to the neutralization agent to aid in agent solubility.
 * - Values are based on Delisting or MSDS Procedures, which are in very high excess.
 ** - Values are based on Stoichiometry of destruction reactions- values represent 5x equivalents.



Typical set up for destruction of chemical agent.

Abstract

Members of the Chemical Biological Applications and Risk Reduction (CBARR) deployed to Tirana, Albania to assist the Albanian military with the destruction of a small stock of chemical warfare agent (CWA). The stock included samples of nerve agent Sarin (GB); vesicant agents sulfur mustard, nitrogen mustard, and lewisite (HD, HN-3, L); incapacitating agent BZ; choking agents diphosgene and chloropicrin (DP, PS); vomiting agent adamsite (DM); and riot control agents chloracetophenone and chlorobenzylidenemalononitrile (CN, CS). All agents were destroyed by treatment with appropriate chemical neutralization agents such as bleach or aqueous/alcoholic sodium hydroxide. Agent destruction was confirmed by analysis using field deployed Gas Chromatography/Mass Spectrometer (GC/MS) systems. All destruction operations were performed in a technically sound, safe, and environmentally responsible manner, following ECBC Operating Procedures. Destruction statements and supporting analytical data were provided to the Albanian government as evidence of the successful destruction of the chemical agents. The agent destruction operation was reported to the Organization for Prohibition of Chemical Weapons (OPCW) in accordance with the Chemical Weapons Convention (CWC), of which the United States and Albania are member states.

Chemical Analysis Approach

ECBC deployed two GC/MS systems and all of the laboratory supplies and chemicals required for performing sampling, extraction, derivatization, and analysis of each chemical agent. After each chemical agent was treated with the appropriate neutralization agent, samples were taken for extraction and analysis. The destruction goal for this project was <0.1% (>99.9% destruction). All samples were analyzed using an Agilent (Santa Clara, CA) 6890 gas chromatograph with an Agilent 5975 mass selective detector (MSD) mass spectrometer system. The gas chromatograph (GC) was equipped with a 30 m x 0.25 mm, 1 μm film thickness (Agilent DB-1701) silicone-coated fused-silica capillary column. All analysis was performed in accordance with EML IOP-MT-73



Eight bottles of sulfur mustard were destroyed on July 17, 2012.

Six bottles, 1 flask and 3 ampoules of Lewisite were destroyed between July 21-23, 2012.

Six bottles of solid HN3-hydrochloride were destroyed on July 19-20, 2012.

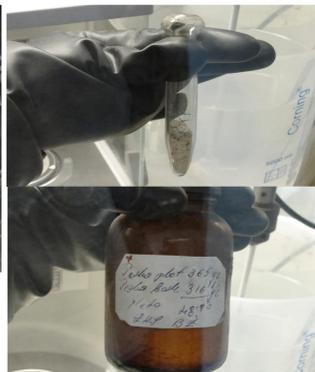


Eight bottles of solid Adamsite were destroyed on July 21, 2012.

Sixteen vials, 4 flasks and 4 small bottles of Sarin were destroyed on July 18-19, 2012.



Two flasks, 6 bottles, and 100 one mL vials of Diphosgene were destroyed on July 18-19, 2012.



One bottle and two test tubes of solid BZ were destroyed on July 18-19, 2012.



Seven bottles of solid CN and 6 bottles of solid CS were destroyed between July 18-22, 2012.



Six bottles, 1 gal jug, and 103 25-mL vials containing Chloropicrin were destroyed between July 20-26, 2012.

Chromatograms of CWA Destruction Batches



Waste Generation and Final Disposition

ECBC was tasked with destruction of all chemical agent material present in the Albanian Central Laboratory. It was the host nation's responsibility to coordinate disposal of any waste generated as a result of the destruction process. Efforts were taken to make sure that all waste was accurately characterized and safely packaged for storage at the laboratory until the Albanian government could coordinate waste disposal in accordance with their environmental regulations.

