

Removal and Destruction of  
Chemical Agent Identification Sets  
At Fort Benning

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## **Introduction**

Non-Stockpile Chemical Warfare Materiel (CWM) is a safety hazard that constitutes an imminent and substantial danger to the public, project personnel and the environment. CWM is suspected to remain at various sites in the United States and its territories. Presently within the United States certain types of Chemical Agent Identification Sets (CAIS) are categorized as CWM. Fort Benning, a US Army Active Installation, had a known area where CAIS were buried prior to 1945.

Fort Benning brought U. S. Army Engineering and Support Center, Huntsville onboard to plan and execute a Removal action, and provide safety oversight for the destruction operation. This paper provides a background on the planning and removal operations, the findings, and an overview of the CAIS destruction operations.

## **Background**

Fort Benning is located in western Georgia and eastern Alabama in the United States. The Main Post is approximately six miles southeast of Columbus in the southwestern corner of Georgia. Fort Benning was initially established as Camp Benning by the US War Department in September 1918, and achieved permanent status in 1922. An area within the Main Post, called Harmony Church Area served as the unit mobilization facility, constructed in the early 1940s. While reviewing a 1945 water distribution map, Ft Benning personnel noticed an area identified as the "Toxic Agents Buried" within the Harmony Church area. An environmental study was performed in the area in the late 1980s/early 1990s. During the investigation several CAIS bottles were unearthed and excavation was halted.

Fort Benning requested that U. S. Army Engineering and Support Center, Huntsville perform a geophysical investigation to determine the extent of the burial at the Harmony Church area. Using historical aerial photography, disturbed earth areas were selected for geophysical investigation. A total of six burial pits including the site where the CAIS was originally found were selected. Based on the findings from the geophysical investigation and the original findings of the environmental study, it was decided that a CWM removal action should be initiated. U.S. Army Engineering and Support Center, Huntsville awarded the removal action contract to USA Environmental, Inc (USAE).

CAIS vial and bottles were small containers of chemical warfare agent and industrial chemicals used for training military personnel in the familiarization and handling of Chemical Agents. More than 100,000 CAIS were produced for use by all branches of the military between the 1930s and the 1960s. In the late 1970s and early 1980s, a program to destroy remaining CAIS was successfully completed at Rocky Mountain Arsenal. In this operation, 21,458 CAIS were destroyed. The remaining 80,000 sets are thought to have been primarily expended through training although some were disposed of by the military. In the past, one of the standard and approved procedures for disposal was burial (U.S. Army Program Manager for Chemical Demilitarization, 1995).

CAIS were known by several names including Toxic Gas Sets, Chemical Agent Identification Training Sets, Instructional War Gas Identification Sets, Detonation War Gas Identification Sets, and Instructional Gas Identification Replacement Sets. The 17 different types of CAIS can be grouped into three varieties. One major variety of CAIS was an instructional “sniff set” that contained glass bottles filled with agent-impregnated charcoal and agent simulants. It was intended for use indoors to instruct military personnel in recognizing the odors of chemical agents. This type of set contained only small amounts of chemical agent. These sets were packed in hinged wooden boxes that resembled small foot lockers. The bottles were stored in the box in metal cans with paint-can type lids. This group included the K945, K955, and Navy X sets.



Figure 1 - CAIS “Sniff Sets”

A second major variety, which was designed for outdoor use, consisted of agent (pure or in solution) in sealed Pyrex tubes, often called vials or ampoules. The glass tubes were 1 inch in diameter and about 7 ½ inches long. The gas tubes would be detonated with a blasting cap, creating an agent cloud. Soldiers would then try to identify the agent based on its odor and other characteristics. These tubes typically contained more agent than the instructional “sniff sets” and pose a greater health hazard. Each tube was packed in a cardboard screw-cap container with the agent type indicated on the container. Twelve cardboard containers were fit into a metal can with a press-fit lid. Four cans were stored in a steel shipping container, also known as a ‘Pigs’, about 6 ½ inches in diameter and 38 inches long. The open end of the steel container was flanged and covered with a lead gasket and a metal plate secured by eight bolts torqued to specific requirements. This variety included the K951/K952 and K953/K954 sets.



Figure 2 – CAIS Vials or Ampoules

A third major variety of CAIS were those containing bulk mustard in small bottles or vials. These CAIS were used in decontamination training by purposely contaminating terrain or equipment with mustard, and then training the soldiers how to don the correct protective equipment and decontaminate the area or equipment. This variety included the K941 and K942 sets.



Figure 3 – CAIS Bottle

### **Preparations for Chemical Warfare Materiel Removal Action**

A CWM removal action must be performed under a Chemical Safety Submission (CSS) per Department of Defense (DoD) regulations. Both the CSS and Work Plan had to be prepared and approved prior to beginning any operations. Once approval was obtained the contractor, USAE, mobilized to the site and began setup, to include the Interim Holding Facility (IHF), a Command Post, Personnel Decontamination Station, monitoring equipment, etc., and training. Prior to beginning intrusive work a Table-Top Exercise, Huntsville Survey and Department of the Army Pre-Operational Survey (DA Pre-Op) must be conducted. The DA Pre-op is a

requirement of Army Regulation 385-61 and DA Pamphlet 385-61. The DA Pre-Op is intended to evaluate the operational readiness of the project team to conduct operations which includes operations relative to safety, environmental, quality assurance, and operational readiness. The USAESCH Military Munitions Center of Expertise has been delegated the authority by Headquarters U.S Army Corps of Engineers (USACE) to perform these DA Pre-Ops for USACE projects. Typically, the DA Pre-Op team is comprised of Huntsville personnel as the Chair person, USATCES as a voting member, 22nd Chemical Battalion [Technical Escort (TE)] as a voting member, Product Manager for Non-stockpile Chemical Materiel (PMNS) as a voting member, U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) as a voting member, Edgewood Chemical and Biological Center (ECBC), and in this case, the MACOM, Fort Benning, could elect to be a voting member as well. Since it is mandatory that the DA Pre-Op be successfully completed in order to begin work at the project site, USAESCH performs a preliminary survey, called the Huntsville Survey, to ensure that the site team has adequately prepared for the DA Pre-Op. The Table-Top Exercise is intended to ensure that adequate coordination has been done with all participating entities: Range Control, Ammunition Supply Point (ASP) personnel, Fort Benning Safety and Security Offices, TE, Medical Support, USAESCH On-Site Safety Specialist and the contractor Team Leads. The Table-Top Exercise was completed on 1 May 2006. The Huntsville Survey was completed on 2 May 2006 with a recommendation that the project proceed with the DA Pre-Op on the following day. The DA Pre-op was performed the following week with 2 Category One findings. Failures found during a DA Pre-Op can be designated as Category 1, Must be corrected prior to recommendation to start operations; Category 2, Corrective Action/Improvement plan must be accepted prior to recommendation to start operations; Category 3, Corrected and closed during pre-operational survey; or Category 4, No response required. These findings were corrected by the end of the DA Pre-op. A notice to proceed was provided the following day. Removal operations began on 8 May 2006.

### **Intrusive Operations and Findings**

Personnel were dressed in modified Level D personal protective equipment (PPE) at the beginning of excavation at each burial site. If CWM items were found or air monitoring using Miniature Chemical Agent Monitoring System (MINICAMS) detected chemical agent as the excavation proceeded, personnel would upgrade to an appropriate level of PPE in accordance with the work plan. The Depot Area Air Monitoring System (DAAMS) were used as confirmation, if the MINICAMS indicated the presence of chemical agent.

Based on the magnetic anomalies located during the Geophysical Investigation, each polygon was searched using a hand held magnetometer (Schonstedt GA-52CX) prior to performing intrusive activities. The purpose was to locate any magnetic anomalies and investigate those anomalies using hand excavation methods. This precaution was taken so that any near surface drums, 'pigs' or associated CWM metallic objects, were uncovered prior to using mechanical methods. A handheld magnetometer was used when excavating within close proximity of a magnetic anomaly in order to reduce the chance of rupturing the outer casing or damaging any buried CWM associated materials.

Soil samples were collected from the bottom of the burial pits where bottles were located and from the excavated soils. Locations of all soil samples were recorded using the Pro-XR Geographic Positioning System. Soil samples were taken for the purpose of determining if any chemical agent or agent breakdown products were present in the soils at areas were suspected CWM or associated CWM items were located. CWM associated items include vials, bottles, and 'pigs'.

All soil samples were cleared by headspace analysis for chemical agent prior to being shipped offsite for analysis. A split sample was sent to the ECBC at their off-site laboratory located in Edgewood, Maryland to be analyzed for low-level chemical warfare agent. Results of all soil samples were reported as clear of chemical agent and agent breakdown products, so there was no need for further waste characterization to be done. The soil was placed back into in the respective polygon location from which it was initially removed.

On May 15, 2006, the downrange intrusive crew discovered a single bottle marked "3 PS". PS is identified as chloropicrin and is categorized as an industrial chemical, not CWM. The type of bottle found was from an instructional "Sniff Set" (K945, K955, and Navy X sets). The bottle was located at a depth of 2 feet. Visual inspection of the bottle later revealed that the bottle did not contain a stopper or any charcoal and was full of soil. No other bottles were discovered at that location. A second check of the spoils pile was performed to ensure no secondary bottles or glassware remained. On May 17, 2006, a 'pig' was discovered at a depth of 3 feet. The TE packaging crew packaged the 'pig' in a 12-inch Multiple Round Container (MRC) and later transported it to the ASP for storage in the IHF. The following day three additional 'pigs' were discovered at a depth of 4 feet. The TE packing team packaged the three 'pigs' in three 12-inch MRCs. It was reported that all the 'pigs' had all the flange bolts in place with the exception of the last 'pig' discovered. It was reported that the third 'pig' had only three flange bolts in place. The intrusive operation was completed in on May 22, 2006. There was no release or any indication of airborne CWM or industrial chemical presence through the entire intrusive operation.



Figure 4 - Three of the Four 'Pigs' Recovered.

Due to the uncertainty of the contents, TE mobilized the 'pigs' back to the Harmony Church Chemical Agent Burial Site from the IHF for the purpose of conducting an initial assessment by using X-Ray capabilities. X-Rays of all the 'pigs' (stored in the MRC's) were taken. The X-Rays indicated that the 'pigs' contained M1 Bottles with a visible liquid line. Based on this initial assessment the determination was made that the 'pigs' are likely to contain Chemical Agent.

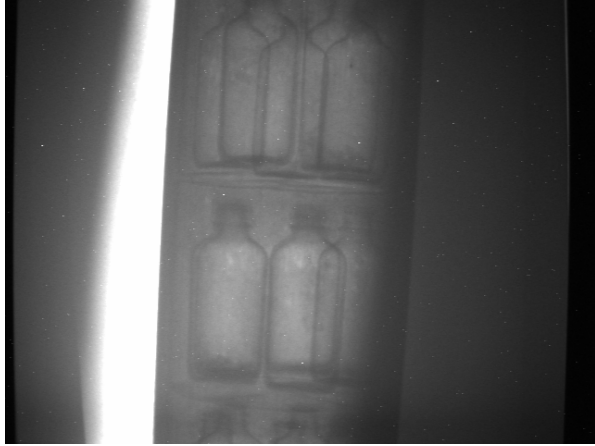


Figure 5 - X-Ray of one 'Pig' Showing Presence of Bottles Possibly Containing Chemical Agent.

### **CWM Items Located**

Over the course of the operation, a total of 133 K941 bottles were recovered from the Chemical Agent Burial Site. All bottles were marked "HS" for Mustard. Initial assessment by TE determined that 117 of the 133 bottles were compromised of unknown liquids (suspected to be clear decontaminant) but confirmed not Mustard or they contained foreign material not considered to be associated with CWM. Prior to disposal, the 117 bottles were placed in a decontamination liquid (bleach) and rinsed out by TE packaging personnel. A total of 16 bottles were assessed by TE to contain Mustard. Over the course of the excavation of the Chemical Agent Burial Site, the bottles were packaged by TE in three 7-inch Multiple Round Containers (MRC's).



Figure 6 -"HS" M1 Toxic Gas Set Bottles Recovered.

### **CAIS Destruction Operations**

Following the CAIS removal action, PMNS was notified that the removal operations were complete and a request was made for them to perform the destruction of items found. The



decision was made to use the Single CAIS Access and Neutralization System (SCANS). The SCANS was designed as a total containment system for accessing and treating the contents of CAIS vials and bottles. The PMNS was responsible for the SCANS operations and coordinated directly with the TE, Fort Benning and USAESCH. Prior to initiating the destruction operations a destruction Plan had to be prepared, then reviewed and approved by USATCES and DDESB with the concurrence of the respective PMNSCM and Fort Benning offices, and the Department of Health and Human Services.

The Destruction Operations took place at the Fort Benning Ammunition Supply Point where the IHF was initially located during the removal action. Fort Benning provided firefighting support for the SCANS operation. PMNS provided the funding and programmatic execution of the operation and maintained the overall operational control of the SCANS for the disposal of the recovered CAIS. PMNS provided the SCANS units and coordinated with the Department of Health and Human Services and other regulatory agencies. TE performed site setup and teardown and operated the SCANS for the PMNS. The 20th Support Command performed all monitoring during the SCANS operations. The U.S. Army Engineering and Support Center, Huntsville, provided onsite safety at the request of Fort Benning, provided for hazardous and toxic waste disposal not specific to SCANS, and contracted medical and security support for the site.

Prior to destruction of the CAIS, the contents of the recovered 'pigs' needed to be assessed. An environmental enclosure (EE) would be used during the assessment. The EE had a carbon filter air filtration system to maintain a negative pressure to provide environmental control. Once approval of the Destruction Plan was received preparations for the SCANS operations began at Fort Benning. After site set up, including assembling and smoke testing the EE, a DA Pre-Op was performed. By the conclusion of the DA Pre-Op, all category 1 findings were corrected and approval was received for SCANS operations to begin.

On 9 November 2006 following the safety briefing, destruct operations began. In the first two days of the operation all 4 'pigs' were opened. Sixty-seven bottles were removed, only 22 contained agent. This brought the total number of CAIS bottle to be destroyed to 38. Destruction of the CAIS began on 11 November and was completed on 16 November.

### **Single CAIS Access and Neutralization System**

The U.S. Army Non-Stockpile Chemical Materiel Project (NSCMP) developed the Single CAIS Access and Neutralization System (SCANS), a hand-held, chemical treatment container used to access and treat Chemical Agent Identification Set (CAIS) items containing mustard (H) or lewisite (L).



Figure 7 - Single CAIS Assess and Neutralization System

The Army has planned for continued recovery of CAIS items due to ongoing remediation and construction activities at Active Installations, Base Realignment and Closure Sites and Formerly Used Defense Sites. NSCMP developed the Rapid Response System, a transportable treatment system, to dispose of large quantities of CAIS. Since the quantity of CAIS found at Fort Benning did not warrant the use of the RRS the SCANS was deployed. The volume of the SCANS container is approximately 1 gallon.

### SCANS Process

#### Step One

To begin treatment, a SCANS operator places a single CAIS item (glass ampoule, vial or bottle) inside the container adjacent to a 4-liter (approximately 1 gallon) glass jar containing neutralization chemicals [1,3-dichloro-5,5-dimethylhydantoin (DCDMH) and a co-solvent (chloroform)], which operators premix on site.





## Step Two

Operators seal the SCANS by securing the access lid.



## Step Three

The operator hits the breaker bar with a hammer, shattering both jars and mixing the agent and neutralant in the sealed container. The neutralization reaction and associated products remain completely contained within the SCANS.



## Step Four

Finally, operators overpack the SCANS with absorbent into a larger container meeting U.S. Department of Transportation requirements. Operators then label the overpacked SCANS and ship it to a permitted facility for final treatment and disposal.

