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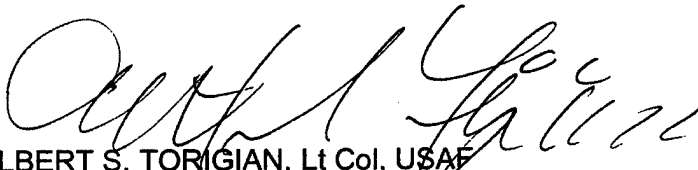
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FOR THE DIRECTOR



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The AFMC Restoration Office requested that AFRL/HEST conduct an archival search, review, and analysis of existing records for the 1948 through 1970 time frame to determine the potential for the residual presence of CW and BW agents, munitions, and training devices at AFMC bases and related sites. Archival records and unit histories of the installations were reviewed at the organizational historian's offices. Environmental reclamation officers and individuals at the Treaty Offices at each base were contacted for information they may have on previous reclamations and studies. The Defense Technical Information Center's on-line technical reports data base was searched. Links to the Army Chemical Corps CW/BW program were identified and investigated. If necessary, the Edgewood Arsenal and Fort Detrick historians were contacted. Transfer of CW/BW materiel by the Army Technical Escort Unit was tracked as records permit. An assessment was made for the discovery potential of CW/BW materiel on each base as a result of the CW/BW program. The conclusions were: 1. the BW/CW program's research and development work was conducted primarily from Wright-Patterson, Hill, Kirtland, Eglin, and Edwards Air Force Bases and dealt with the development of the munition and how it functioned with the weapon system; and 2. considerable CW/BW training occurred at most air bases during the 1940's and early 1950's.

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PREFACE

The Air Force Materiel Command Environmental Office requested that AFRL/HEST review the archived records for each of the current Air Force Materiel Command bases and determine the possibility of the presence of residual biological warfare/chemical warfare (BW/CW) agents, munitions, and training devices on the bases. Thirteen Air Force Materiel Command (AFMC) bases were identified for review. The United States Air Force (USAF) BW/CW program activities of interest occurred during the time frame of 1948 through 1970. AFRL/HEST tasked Simulation Technologies, Inc. (STI) through an existing contract (Delivery Order 0006 under contract F41624-97-D-6002) to execute the effort.

Mrs. Karen Unfried, Research Analyst, STI, and Mr. Tom Collins, Consultant, STI, conducted the investigations and analyses for this project. Ms. Joyce Jackson of STI did the editing, word processing, and assembly of the final reports.

LIST OF ACRONYMS

AAF	Army Air Forces
ABG	Air Base Group
ABM	Aberdeen Bombing Mission
ACC	Army Chemical Center
ADTC	Armament Development and Test Center
AEDC	Arnold Engineering Development Center
AEDC	Air Engineering Development Center
AFAC	Air Force Armament Center
AFATL	Air Force Armament Laboratory
AFBMD	AF Ballistic Missile Division
AFCRC	AF Cambridge Research Center
AFCRL	Air Force Cambridge Research Laboratories
AFLC	Air Force Logistics Command
AFMC	Air Force Materiel Command
AFMC/HO	Office of History, Air Force Materiel Command
AFSC	Air Force Systems Command
AFSWC	Air Force Special Weapons Center
AFWL	Air Force Weapons Laboratory
AMA	Air Materiel Areas
AMA's	Air materiel areas
AMC	Air Materiel Command
AMC	Air Mobility Command
AMC/MCMA	Armament Office
AMC/MCMK	Chemical Office
AMC's	Air Materiel Command's
AOC	Area of concern
APG	Aberdeen Proving Ground
APG	Air Corps Proving Ground
APGC	Air Proving Ground Center
APGC	Air Proving Ground Command
ARDC	Air Research and Development Command
ASC	Air Service Command
ASD	Aeronautical Systems Division
ASD/ASJ	Office of Limited Warfare
ASD/ASJB	Munitions Division
ASD/ASR	Limited War Office
ASR	Deputy Commander for Technology
AT&SF RR	Atcheson Topeka and Santa Fe Railroad
AWAC	Airborne Warning and Control
BAIT	Bacterial automated identification technique
BG	19 th Bombardment Group
BG	<i>B. globigii</i> . a biological simulant
BRAC	Defense Base Closure and Realignment Commission
BSD	Ballistic Systems Division

LIST OF ACRONYMS *(continued)*

BTF	Ballistic Test Facility
BW/CW	Biological warfare and chemical warfare
CAIS	Chemical Agent Identification Sets
CB	Chemical/biological
CBDCOM	Chemical-Biological Defense Command
CBR	Chemical, Biological, and Radiological
CmIC	Army Chemical Corps
CO	Carbon monoxide
CONUS	Continental United States
CW	Chemical warfare
CWM	Chemical Warfare Materials
CWB	Chemical Warfare Board
CWS	Chemical Warfare Service
DITA	Direct Injection Toxic Ammunition
DPG	Dugway Proving Ground
DPO	Disaster Preparedness Office
DTC	Deseret Test Center
E77	Anti-Crop Balloon Bomb
EOD	Explosive Ordnance Disposal
FSC	Federal Supply Classes
GB	Sarin
H	Mustard
HARM	Hazardous assessment rating methodology
HE	High explosive
HQ	Headquarters
IRP	Installation Restoration Program
ISA	Interservice Support Agreement
L	Lewisite
LAAFB	Los Angeles Air Force Base
LAAFS	Los Angeles Air Force Station

LIST OF ACRONYMS *(continued)*

MAC	Military Airlift Command
MIT	Massachusetts Institute of Technology
MOS	Military Occupational Specialty
MTS	Military Training Section
NAAP	Newport Army Ammunition Plant
NCOIC	Noncommissioned Officer in Charge
NCOs	Noncommissioned Officers
OC-ALC	Oklahoma City Air Logistics Center
OCAMA	Oklahoma City Air Materiel Area
OCA ^{SC}	Oklahoma City Air Service Command
OCATSC	Oklahoma City Air Technical Service Command
OCONUS	Outside Continental United States
OD	Ordinance Department
OEW	Ordinance and Explosive Waste
OIC	Officer in Charge
OJT	On-the-job training
OOAMA	Ogden Air Materiel Area
OOD	Ogden Ordinance Depot
OSRD	Office of Scientific Research and Development
PDL	Production Development Laboratories
POM	Pre-Primary Operator Maintenance
POW	Prisoner of War
R&D	Research & Development
RI	Remedial Investigation
RMA	Rocky Mountain Arsenal
RTD	Research and Technology Division
RW	Radiological Warfare
SAAMA	San Antonio Air Materiel Area
SAC	Strategic Air Command
SADCAC	Sacramento Air Depot Control Area Command
SAMSO	Space and Missile Systems Organization
SM	<i>Serratia marcescens</i> , a biological simulant
SMAMA	Sacramento Air Materiel Area
SNL	Sandia National Laboratory
SSD	Space Systems Division
STI	Simulation Technologies, Inc.
STL	Space Technology Laboratories

LIST OF ACRONYMS *(continued)*

SWC	Special Weapons Command
SWMUs	Solid Waste Management Units
TEAD	Tooele Army Depot
TEAD-N	Tooele Ordnance Depot
TEU	Army Technical Escort Unit
UGNCO	Unit gas non-commissioned officers
UGO	Unit gas officers
USA	United States Army
USAF	United States Air Force
USAFSAM	USAF School of Aerospace Medicine
VOC	Volatile organic compounds
WADC	Wright Air Development Center
WADD	Wright Air Development Division
WADD/WWRPO	Limited War Liaison Office at WADD
WCLD	Aero Medical Lab
WCLE	Aeronautical Accessories Lab
WDD	Western Development Division
WP	White phosphorus
WR-ALC	Warner Robins Air Logistic Center
WRATSC	Warner Robins Air Technical Service Command
ZI	Zone of Interior

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**REPORT OF INVESTIGATION:
THE PRESENCE OF BIOLOGICAL AND CHEMICAL WARFARE
MATERIEL AT AFMC BASES WITHIN THE UNITED STATES**

EXECUTIVE SUMMARY

Background

Mr. Andrew Ghazee of the AFMC Restoration Office, requested that AFRL/HEST conduct an archival search, review, and analysis of existing records for the 1948 through 1970 time frame to determine the potential for the residual presence of BW/CW agents, munitions, and training devices at AFMC bases and related sites. This action was in response to a tasking received from AF/ILEVR in September 1997. In order to accomplish this research, AFRL/HEST contracted with STI under AF contract F41624-97-D-6002 to examine any plans, records, and reports that may indicate the presence of BW/CW materiel on AFMC bases and related sites during this time period.

Approach

Archival records and unit histories of the identified installations were reviewed at the base historian's offices. Environmental reclamation officers and individuals at the Treaty Offices at each base were contacted for any information they may have on previous reclamations and studies. The Defense Technical Information Center's on-line technical reports data base was searched for relevant data.

Links to the Army Chemical Corps BW/CW program were identified and investigated. If necessary, the Edgewood Arsenal and Fort Detrick historians were contacted. Transfer of BW/CW materiel by the Army Technical Escort Unit was tracked as records permit.

An assessment was made for the discovery potential of BW/CW materiel on the base as a result of the BW/CW program. A report was written for each installation; this final report consists of a compilation of all individual base reports.

Results

Wright-Patterson AFB, Ohio

- Air Materiel Command (forerunner of AFMC) was responsible for the management of the BW/CW program during the 1950's. The Chemical Office of Air Materiel Command (AMC) did not perform Research & Development (R&D) or tests on chemical warfare (CW) munitions and equipment. It is not expected that any residual items would be found from the program of AMC at Wright-Patterson AFB (WPAFB).
- The Special Weapons Branch of WADC (forerunner to ASC) managed the BW/CW Vulnerability Program during the 1950's. Any R&D tests conducted at Wright Air Development Center (WADC) may have had either live agents with inert explosives or simulants with live explosives. Other than the munitions found in MBS1, it is not expected that any residual items from this program would be found at WPAFB.
- A test of rapid decontamination techniques for the removal of BW agents from aircraft using a BW simulant took place at WADC in January 1955. It is not expected that any residual items from this test would be found.
- Records indicate that two 50-lb containers of sarin (GB) were transferred from WPAFB to the Newport Chemical Activity, Indiana, during 1964. A search of the records for the office/program requiring this agent was unsuccessful. The most important fact is that the proper procedures for the disposal of GB were followed.
- Chemical Agent Identification Sets (CAIS) have been recovered from other locations in Ohio; there is no indication of the presence at CAIS at WPAFB during the time frame of the search.
- Other than MBS1, there is no indication that any of the WPAFB landfills and burial sites have received any chemical warfare agents. Some industrial chemicals, which may have CW applications--i.e., phosgene, have been found.

Hill AFB, Utah

- An extensive CW training course was in place at Hill Field for at least the period of 1943 through 1948. Therefore, CAIS may have been disposed of at Hill. There was also training

at Wendover Bombing and Gunnery Range at Wendover, Utah. CAIS have been recovered at Wendover.

- Ogden Air Materiel Area (OOAMA) was assigned the prime maintenance responsibilities of the Federal Supply Classes (FSC) to include BW/CW agents and weapons in 1956. In 1965, OOAMA was the Air Force Logistics Command (AFLC) program manager for the AF BW/CW weapons program. There is no indication that OOAMA ever received BW munitions for storage and shipment. Records confirmed shipments of CW agents and munitions to and from Hill AFB. There was no evidence of CW munitions being stored or accumulated at Hill AFB.
- By-products of mustard (H) have been detected in several landfills at Hill AFB. Mustard was used in CW training at Hill.

Arnold AFB, Tennessee

- US Army CW training took place at Camp Forrest, prior to AF involvement at Arnold. After 50-plus years, any buried residual (tear gas) would pose no hazard to personnel.
- No documentation was found which would indicate that CW training was conducted at Arnold Engineering Development Center (AEDC).
- No documentation was found which would indicate that AEDC participated in the BW/CW program.

Kirtland AFB, New Mexico

- From 1943 to 1969, Kirtland AFB maintained extensive classroom training in CW, BW, and radiological warfare (RW) defense. Since training was conducted and records were found of the destruction of numerous vials of "poison gas," there is a significant probability that CAIS may be present on Kirtland.
- The Special Weapons Command provided a significant amount of support to the chemical, biological, and radiological (CBR) testing program, i.e., provision of aircraft for ferrying CBR weapons to test sites and for the delivery of CBR weapons on target grids during test trials. The majority of the drops were simulant-filled weapons. There is no evidence that any agent-filled weapons were ever present at Kirtland.

Robins AFB, Georgia

- No evidence was discovered to confirm that any CW or BW munitions were ever on Robins AFB.
- Significant evidence was found documenting that extensive training of chemical units occurred at Robins AFB, including use of gas chambers at various locations on base property. However, no evidence was found of any CW training between 1952 and 1970.

Kelly AFB, Texas

- The San Antonio Air Materiel Area (SAAMA) was assigned the responsibility for the preparation of CBR decontamination procedures in 1952; this was dropped from their mission statement in the early 1970's.
- While there is much evidence of CW training conducted at Kelly, there is little or no indication that agent identification training took place on the base; therefore, a low risk exists that CAIS will be found.
- There were several gas chambers on the base; all buildings have been destroyed. The available records indicate that the chambers used tear gas only.

Brooks AFB, Texas

- While CW training took place at the base during the 1940's and 1950's, there is no indication that any advanced training, e.g., field identification of chemical agents that would have required the use of CAIS, took place on the base.
- The BW/CW research programs under the umbrella of the USAF School of Aerospace Medicine included laboratory studies, literature searches, and review of technical information. No evidence exists that BW/CW weapons or CAIS were ever in possession of the laboratories.

McClellan AFB, California

- Extensive CW training took place at McClellan. There was a "gas instruction chamber" located on McClellan in early 1942; in 1944, approximately 9,200 personnel passed through the gas chamber. However, there is no hard evidence to support or deny the use of CAIS.

- Camp Kohler had a gas chamber and a chemical magazine in 1944. After the US Army Signal Corp left the Camp in October 1944, it is unlikely that any further CW training was ever conducted at Camp Kohler.
- There is minimal risk that any CW training was conducted at the Davis Site or the Lincoln Receiver Site.

Hanscom AFB, Massachusetts

- The lack of a Chemical Corps Officer on the Technical Service Staff and subsequent inactivation of that staff strongly indicates that the AF Cambridge Research Laboratories conducted no chemical warfare programs.
- Evidence indicates that only classroom training--lectures and film viewing--in chemical and biological warfare defense took place at Hanscom.
- There is no evidence that CAIS were ever used at Hanscom.

Tinker AFB, Oklahoma

- A map of Tinker circa 1945 indicated the location of a gas chamber.
- Extensive CW training was conducted in the 1940's and the 1950's. No mention was made of the specific training aids.
- There is no indication that CW munitions were ever on the base.

Eglin AFB, Florida

- Organizations at Eglin Air Force Base were deeply involved in the Air Force BW/CW program. This statement is proven by two of the tasks assigned to the Weapons Laboratory of the Air Proving Ground Center (APGC) by the Air Research and Development Command (ARDC): task 2317A, to develop of BW/CW agents and task 2318A, to obtain BW/CW agent munition delivery systems. The APGC Program Summaries which reported to ARDC status of all APGC efforts in the 1960's further define the multitude of programs generated as a result of this tasking. In addition, an indirect indication of Eglin's involvement was the development of the BW/CW test facilities at Eglin including a BW/CW laboratory on Auxiliary Field 6 and a BW/CW test grid. No assessment of the actual presence of the agents and munitions can be made due to unavailability of records.

- Chemical warfare training was conducted at Eglin for at least 10 years. A Gas Instruction Building was approved in 1942. CAIS were in use at APGC from 1945 through 1950. No information was found as to the total quantity of CAIS used at the base nor of the disposition of other than two sets. Therefore, the probability exists that CAIS were used and disposed at Eglin AFB.
- Various tests of CW-related hardware were conducted at Eglin AFB. Records from one test conducted in 1943 indicated the use of live agent (H and L). Tear gas and defoliant agents were used at Eglin. All other known CW testing conducted at Eglin used simulant.
- The only known BW testing using live agent at Eglin was Operation Green, which occurred in 1951. The agent used posed no hazard to humans or animal life (other than the test animals). Other known BW testing used simulants.
- BW/CW protection testing involved only simulant.

Edwards AFB, California

- Training maneuvers using simulated CW agents were conducted at Muroc AAF (Army Air Forces) in May 1937.
- The Aberdeen Bombing Mission dropped CW bombs and clusters as part of the development of bombing tables--it is unknown if actual agent or simulant was used.
- A toxic gas yard was built on Edwards; no evidence was found that bulk agents were ever delivered or that the management office of the toxic gas yard was fully staffed.
- BW tests using simulants were conducted at Rosamund Dry Lake in the 1960's.

Los Angeles AFB, California

- No BW/CW training was conducted at Los Angeles AFB, California.
- There is no evidence of involvement with the AF BW/CW program.
- There is no evidence of any BW/CW materials at Los Angeles AFB, California.

Overall Conclusions

The BW/CW program's research and development work was conducted primarily from Wright-Patterson, Hill, Kirtland, Eglin, and Edwards Air Force Bases. This work dealt with the development of the munition and how it functioned with the weapon system.

Considerable BW/CW training occurred at most air bases during the 1940's and early 1950's. Gas chambers were found on most base maps during that time frame. These chambers were either tear gas or chlorine and have long since been destroyed or dismantled. Evidence of the use of CAIS was found at most bases; however, these were destroyed using the appropriate disposal techniques.

PURPOSE

Simulation Technologies, Inc. was tasked to determine the potential for the presence of any residual BW/CW agents, munitions, and training materiel at AFMC bases and related sites. Based upon this determination, a qualitative assessment of the potential hazard of any residual BW/CW agents, munitions, or training devices was to be developed.

During a prior investigation of a cache of Air Force (AF) biological warfare bombs discovered during an excavation at Wright-Patterson AFB, Ohio, the investigation team had developed a successful methodology which involved the search, review, and analysis of archival data from various AF and Army sources. The team proposed to apply this methodology to various AFMC installations to reveal BW/CW activities.

SCOPE

This effort was limited to investigation of those specific activities and materials that were historically and programmatically related to the USAF BW/CW program conducted at the AFMC bases and related sites within the time frame 1948–1970. If the archived records indicated BW/CW materiel and activity outside the specified time frame, the review was expanded until closure was obtained, if possible.

The study included the following installations: Brooks AFB, Texas, Kelly AFB, Texas, Los Angeles AFB, California, Edwards AFB, California, McClellan AFB, California, Tinker AFB, Oklahoma, Hanscom AFB, Massachusetts, Hill AFB, Utah, Kirkland AFB, New Mexico, Arnold AS, Tennessee, Eglin AFB, Florida, Wright-Patterson AFB, Ohio, and Robins AFB, Georgia. The following additional sites were also to be investigated: (1) two tower receiver sites at McClellan AFB, California; (2) the Utah Test and Training Range at Hill AFB, Utah; (3) relevant test ranges at Kirkland AFB, New Mexico, Edwards AFB, California, and Eglin AFB, Florida; and (4) the auto hobby garage building at Los Angeles AFB, California.

The investigation and identification of biological material and toxic chemicals was limited to those directly associated with biological and chemical warfare agents. General research and development activities and conventional logistics functions (i.e., fuels, explosives, materials, manufacture, conventional ammunitions and bombs, etc.) were not investigated.

APPROACH

The archival records and unit histories for bases were reviewed at the Office of History, Air Force Materiel Command (AFMC/HO) and the various organizational history offices found at the bases. The Environmental Reclamation Offices at each base, as well other base offices including disaster preparedness, Explosive Ordnance Detachments, and treaty offices were contacted.

The Defense Technical Information Center's on-line technical report data base was searched for relevant data. Contact was made with both the Edgewood Arsenal and Fort Detrick historians to identify relevant information concerning the Army Chemical Corps BW/CW program. Existing Army Technical Escort Unit records were reviewed for the transfer of BW/CW materials.

Information, as available and related to the Air Force BW/CW program, on the unit organization, staffing levels, mission, functions, and BW/CW programs was extracted and collated in chronological order.

RESULTS

General

The results of the review of each base and its related sites are presented individually by base. The bases are presented in the order of review. Since evidence of Chemical Agent Identification Sets (CAIS), a training aid, were found at almost every base, an appendix with a short explanation of the contents, use, and disposal techniques is included as part of this report.

Wright-Patterson AFB, Ohio

Background

The review of the historical records at the history offices at WPAFB revealed one constant: the period from 1948 to 1970 was one of continual reorganization. The USAF was established in 1947; thus, during most of the 1950's much of the reorganization involved transitioning Army Air Force functions into USAF. During the 60's, the functions at WPAFB were reorganized multiple

times to obtain better efficiency using fewer personnel and resources as well as accommodating an expanding scope of work.

During this period, the BW/CW program was extremely active at WPAFB. Initially, the Air Materiel Command's (AMC's) Chemical Office served several functions. It provided a central liaison with the US Army Chemical Corp; made recommendations concerning qualifications and placement of CW trained personnel; and conducted surveillance and technical consulting on all research and development projects and proposals affecting BW/CW type materiel. AMC's Directorate of Research and Development added the mission of the research and development of chemical items of equipment in April 1950. In October 1950, AMC was assigned the mission of supervision of research and development in biological warfare; the command assigned this responsibility to the Aero-Medical Laboratory.

In 1951, all research, development, and engineering activities were moved from AMC to the newly formed ARDC. During the 50's, research was conducted in the Laboratories (including the Aero-Medical Laboratory) at ARDC's WADC. The responsible laboratories contracted most of this research and development either to the US Army Chemical Corp or to private contractors. Any actual tests at WPAFB involved either simulant or the use of live agent in a controlled laboratory situation. There is no mention of AMC activity involving BW/CW munitions research after the research and development functions were transferred to ARDC.

WADC's Armament Lab was reorganized in 1955. Its Bomb and Warhead Branch (which had responsibility for BW/CW munitions and ancillary equipment) was moved to the Air Force Armament Center (AFAC), Eglin AFB, Florida. The management of the remaining tasks of the BW/CW Vulnerability Project was moved from WADC's Special Weapons Branch to the Aero-Med Laboratory.

HQ ARDC initiated a System Study Directive in June 1959, directing that the feasibility of a Non-Lethal BW/CW Weapons System Concept be explored. In April 1960 the BW/CW and Limited War Liaison Office at Wright Air Development Division (WADD) assumed the management responsibility for this effort from the Directorate of Laboratories. (WADC had been renamed WADD in late 1959.)

The BW/CW and Limited War Office (ASD/ASR) was responsible for accomplishing and monitoring the planning and evaluation activities associated with BW/CW and limited war weapons systems. In mid 1960, the office was transferred to the Office of Limited Warfare (ASD/ASJ). By 1964, the Office of Limited War was upgraded to a deputy responsible for overall Air Force Systems Command (AFSC) planning for limited war and special air warfare. This included chemical/biological (CB) effects assessment, tactical biological munitions, CB detection and warning, CW screening munitions as well as other CB programs. The Munitions Division (ASD/ASJB) of the Office of Limited War managed those items from the engineering development stage through the acquisition and initial procurement stages. The development of the various items was contracted out and accomplished at locations other than WPAFB.

In August 1968 the Munitions Division was moved to the Armament Development and Test Center (ADTC) at Eglin AFB, Florida, thus moving the management responsibilities from WPAFB. In 1969, President Nixon, at a national level, directed that all of the services' efforts in BW/CW cease, thus canceling the program.

Review of Research and Development Efforts

On 9 March 1946 the Army Technical Service Command was organized into the AMC (located at what became known as Wright-Patterson AFB, Ohio).¹ AMC was comprised of three directorates: Research and Development (of which the engineering division was its largest component); Procurement and Industrial Mobilization Planning; and Supply and Maintenance. The USAF was established and separated from the US Army (USA) in July of 1947.

AMC established the Directorate of Supply and Maintenance² with four technical service staff offices: (1) Air Communications, (2) Chemical, (3) Ordnance, and (4) Quartermaster. Chemical, ordnance, and quartermaster projects included the development of chemical

¹ Engineering History, 1917-1978, McCook Field to the Aeronautical Systems Division (4th Edition), AFSC Historical Publication, February 1979, p 2.

² History of AMC-1948, p 81.

materials for Air Force usage as well as the training of selected officers in Air Force radiological defense doctrine and in biological warfare.³

The Chemical Office (AMC/MCMK), staffed with five civilians and three officers, was organized with three sub-offices: Personnel & Operations, Materiel, and R&D and Technical Liaison.⁴

The mission of the Chemical Office⁵ was to "provide guidance, liaison, and technical assistance on, and maintain staff surveillance and cognizance of programs and activities pertaining to chemical warfare; i.e., chemical warfare, biological warfare, and radiological defense responsibilities of the AMC." The Chemical Office was to provide:

1. Centralized technical liaison with USA Chemical Corps activities.
2. Staff analysis of AMC CW problems.
3. Recommendations concerning qualifications for and placement of CW trained personnel.
4. Staff surveillance for the establishment of requirements, receipt, storage, issue, maintenance, and transportation of CW items.
5. Technical advice regarding CW training, personnel, funds, and standard equipment.
6. Plans, policies, and procedures pertaining to AMC CW responsibilities.
7. Staff surveillance and technical consulting service on all R&D projects and proposals affecting or affected by CW type materiel.

In the context of the definition of the mission statement above, the term CW is inclusive of chemical and biological warfare, and radiological defense.

In September 1949 the Directorate of Supply and Maintenance added an Armament Office (AMC/MCMA) that was to advise the Command on all armament matters and provide centralized technical liaison service with the Army Chemical Corps and Army Ordnance

³ History of AMC, 1 January-30 June, 1949, p 127.

⁴ Organization Directive No. 20-602, Chemical Office, Dir. Supply & Maintenance, September 1948.

⁵ History of AMC, 1 January-30 June, 1949, p 127.

Department activities. The Technical Development Section (AMC/MCMCXT) was responsible for these liaison activities.⁶

During 1948, AMC divided the Zone of Interior (ZI) into seven Air Materiel Areas (AMA) for maintenance and supply. AMA's were located at Middletown, Pennsylvania; Mobile, Alabama; Ogden, Utah; Oklahoma City, Oklahoma; Sacramento, California; San Antonio, Texas; and Warner-Robins, Georgia.⁷ By 1949 AMC consisted of seven major depots, five specialized air depots, eight development and test centers, two storage fields, five aircraft plants, nine inactive air fields, and six miscellaneous activities.⁸

In the period of January–June of 1950 the integration of Army functions into the AMC Armament Office was accomplished.⁹ The Directorate of Supply and Maintenance received the additional functions of USAF-wide ammunition surveillance; the Maintenance Division added the functions of servicing armament ordnance and chemical items; and the Directorate of Research and Development added the research and development of chemical items of equipment.¹⁰ Research and development were carried out by AMC for first six months of 1950 while ARDC was formed.¹¹ All Air Force procurement was conducted by AMC.¹²

In October 1950 AMC was given supervision of research and development in biological warfare; part of the research was to be conducted by the Aero Med Laboratory.¹³ The Engineering and Development Branch of the Aero Med Lab was to develop the research and development program on respiratory protective devices; however, no progress was reported.

⁶ Organization Directive No. 20-602, Armament Office, Dir. Supply & Maintenance, September 1949.

⁷ History of AMC–1948, p. 108.

⁸ History of AMC, 1 January–30 June, 1949, p. 5.

⁹ History of AMC, 1 January–30 June, 1950, p. 14.

¹⁰ AMC Notice 72, 14 April 1950, App A.

¹¹ History of AMC, 1 January–30 June 1950, p. 130.

¹² History of AMC, 1 January–30 June 1950, p. 142.

¹³ History of AMC, 1 January–30 June 1951, vol. 1, p 126.

The Air Force equity in Army Quartermaster depots was integrated into the USAF supply system in the first half of 1951.¹⁴ The Army Chemical Corps items were not transferred until 1 September 1952.

The AMC research, development, and engineering functions were reassigned to form the ARDC in 1951.^{15, 16} The engineering function had three major areas: experimental engineering, acquisition engineering, and service engineering. On 2 April 1951, WADC was formed under ARDC and was located at Wright Field.¹⁷ It was composed of three divisions (engineering, flight-testing, and all-weather flying) and one office (Office of Air Research). The 12 laboratories, including the Aero Med Laboratory, were assigned to the Engineering Division. During the early 50's, numerous realignments occurred; however, there remained a constant of 12 laboratories.

ARDC extensively used Army Chemical Corps (CmIC) facilities to develop methods, procedures, and equipment to test the dispersion of biological warfare (BW) munitions so that their toxic properties might be better utilized.¹⁸ The CmIC, using ARDC funds, contracted for the development of a free-flight balloon for long-distance delivery of such munitions. The CmIC also conducted investigations for ARDC into the basic principles for the design of munitions to contaminate the air with BW agents. Additional projects called for the development of an aerosol generator and a clusterable munition with a particulate bomb utilizing a conical base ejection design. The CmIC submitted to ARDC a proposal for a contract to develop and build a 750-pound nose ejection cluster adapter with CW-filled munitions. The CmIC also modified a fuze for a 10-pound incendiary bomb for the Air Force.¹⁹

¹⁴ History of AMC, 1 July-31 December 1951, p. 220.

¹⁵ Engineering History, 1917-1978, McCook Field to the Aeronautical Systems Division (Fourth Edition), AFSC Historical Publication, February 1979.

¹⁶ The provisional headquarters of ARDC was temporarily located at Wright Field, and eventually relocated to Bolling AFB, Washington, DC.

¹⁷ Engineering History, 1917-1978, McCook Field to the Aeronautical Systems Division (Fourth Edition), AFSC Historical Publication, February 1979, p 16.

¹⁸ ARDC History, 23 January 1950-30 June 1951, BW-CW Munitions.

¹⁹ History of ARDC, 23 January 1950-30 June 1951, p. 475-476.

The Technical Escort Unit (TEU), Edgewood Arsenal, Maryland, was responsible for escorting the shipment of any BW/CW materiel to the customer. A search of TEU shipping records identified a shipment of classified material (no weight given) for delivery to Air Development Center, Bldg. 63, Wright Field, Dayton, Ohio, departing Army Chemical Center (ACC) on 25 August 1951 and returning to ACC on 29 August. The Air Development Center was the provisional organization that became WADC in July 1951. Building 63 was a secure building located on a rail spur. No other information is available on the contents of the shipment. It was probably neither CW agent nor chemical munitions since these items were usually identified in TEU shipment shipping records. Another TEU shipment, described as classified material, was made to Oak Ridge, Tennessee, on 28 August 1951. A conjecture may be made that the contents of that shipment would most likely be radioactive material considering the delivery address; however, no such conjecture can be made of the shipment to WADC.

Air Force CW operations of 1951 included the employment of incendiary and flame, smoke, and CW agents. The nerve agent GB was the CW agent of choice. The Joint Chiefs of Staff policy of "CW use in retaliation only" affected the rapid development of a CW delivery capability for GB.²⁰

In the conclusion section of the History of AMC, 1 January-30 June 1952, the writer states that "The introduction of biological warfare and additional items of chemical warfare munitions into the logistics system promised to generate new materiel and service problems." However, there is no other mention of AMC participation in the BW/CW program in this history during the January-June 1952 period.

By November 1952 the organizational structure of HQ AMC and the Directorate of Supply and Services included an Assistant for Special Weapons. This office was assigned to control and supervise the AMC special weapons program, including facilities and organizations assigned to AMC to accomplish this program. The office included a Special Weapons Center Resident Representative, an Atomic Weapons Branch, and a Biological and Chemical Weapons

²⁰History of ARDC, 23 January 1950-30 June 1951, p. 215.

Branch.²¹ The field contact point for the USAF with the Atomic Energy Commission and the Armed Forces Special Weapons Projects was at Kirtland AFB, New Mexico. The flight test facilities for these activities was also located at that base.²²

The Air Force BW/CW program during 1951-1952 was to provide improved BW/CW munitions compatible with newer high performance aircraft used in the modern tactical and strategic warfare. The program for surface-contaminating BW munitions included the research and development of anti-personnel, anti-crop, and anti-animal agents for use against tactical and strategic targets. Investigation of new methods of agent applications by munitions and spray tanks as well as methods of munitions ejection from aircraft were conducted. The M-33 cluster bomb (BW) was tested for operational suitability. By directives from HQ USAF, the BW program would continue to develop dry agent dissemination, aerosol generators, explosive bombs, and dispersion systems for component bombs that could be used as lethal anti-personnel weapons and as anti-crop weapons. ARDC developed no specific anti-animal munitions because of the lack of guidance and targeting information from Washington.²³

The project, "Logistics System Support for BW Munitions Supply to the Theater of Operations" (managed by WADC in 1952), directed the development of proposed military characteristics for the support items required for supplying BW munitions.²⁴ WADC, AMC, Strategic Air Command (SAC), and Military Air Transportation Service (MATs) were involved in the project. At a preliminary conference held in April 1952, their representatives agreed that the system proposed by the ARDC Liaison Officer to Camp Detrick (US Army Biological Laboratories) would be reviewed at a conference to be held at AMC on 17 April. Some of the components proposed were a trailer-mounted automatic bomb filling plant with safety features; decontamination, refrigerated storage in depot and transit; and bomb leak detectors. Reprogramming of FY52 funds was directed for the 31 December 1952 operational target date.

²¹ Organizational Structure of HQ AMC & Directorate of Supply and Services, 11/1/52.

²² History of AMC, 1 January–30 June 1950, Special Weapons Command X Headquarters.

²³ History of ARDC, 1 July 1951–31 December 1952, p. 213–214.

²⁴ WADC Weekly Information Report, 1952.

A conference, organized by the Special Weapons Branch of WADC as part of the BW/CW Vulnerability Program, managed by that office, was held at WADC in April 1953. The subject matter concerned the modifications for external carriage of the E101 1,000-lb GB cluster bomb.²⁵ Tests were conducted at WADC with 15 E101R3 bombs equipped with various mock-up fairing configurations. The CmlC and AFAC tested 20 modified E101R3 bombs at Eglin AFB. AFAC provided F-84 type aircraft for the tests.

Under WADC's CW program, two 3,000-lb GB clusters were assembled at Walker AFB and used for the GB warhead drops with the Matador missile. Prototype adapters with the GB warhead for the RASCAL missile were sent to Kirtland AFB, New Mexico.

As part of the BW/CW vulnerability program, tests conducted at Scotia, New York, determined the efficiency of ground heaters to decontaminate Air Force buildings, i.e., warehouses and hangars.²⁶ Tests for secondary aerosol generation from various types of BW-contaminated terrain was conducted at Eglin AFB in May and at Ft. Belvoir, Virginia, in July 1953.²⁷ Where possible, BW vulnerability tests using simulant agents were made at AF installations. Tests to determine the hazards from leaking BW munitions were conducted at Eglin AFB in December 1953.

The E133 BW cluster (E61), the E101 CW cluster with E54, and the Anti-Crop Balloon Bomb (E77) were in the early stages of development.²⁸ The Special Weapons Branch of WADC managed these programs.

As part of the BW/CW vulnerability program, tests were conducted to determine hazards to AF bases and materiel contaminated by CW agents. Laboratory tests were conducted at ACC, Maryland, and field tests were conducted at Dugway Proving Ground (DPG), Utah. A B-47A was used at DPG on CW vulnerability tests in September 1953 and a flyable B-29 was used at DPG on CW vulnerability tests in November 1953. SAC cooperated with WADC in the BW

²⁵ Semi-annual History, Special Weapons Br, 1 January–30 June 1953.

²⁶ Semi-annual History, Special Weapons Br, 1 January–30 June 1953.

²⁷ Semi-annual History, Special Weapons Br, 1 July–31 December 1953.

²⁸ Semi-annual History, Special Weapons Br, 1 July–31 December 1953.

decontamination equipment tests conducted at Lockbourne AFB.²⁹ WADC conducted tests on the efficiency of aircraft interior decontamination with vapor and aerosol decontaminants at Wright Field. The BW simulant *Bacillus globigii* (BG) was used in the crew compartments of a B-29 and B-50 aircraft in September 1953.

The TEU shipping records³⁰ showed two shipments to WPAFB. The first, on 5 November 1953, was described as a classified cargo from Camp Detrick, Maryland, with delivery to WPAFB. The second, on 5 December 1953, was a classified cargo weighing 3,000 lb from Camp Detrick, Maryland, with delivery to WPAFB. No other identifying description of the items shipped was given.

Funding of the BW/CW program in 1954 was based on the assumption by the Air Force of responsibility for the development of BW/CW weapons support equipment and defensive items.³¹ There was a reduction in reliance on the CmlC for developments where aerodynamics and aircraft compatibility were dominant. Funds for CW munitions were applied to the GB-filled munitions program. The BW program was directed toward air contaminating anti-personnel munitions and anti-crop capabilities. No funds were provided for FY54 or FY55 for BW/CW warhead end items.

The BW/CW Defensive Program Review was held at WADC in February 1954 and was attended by representatives from HQ USAF, ARDC, and WADC.³² The assessment function was transferred from the WADC Materials Laboratory (BW/CW decontamination) to the WADC Special Weapons Branch, WCOES-1. Tasks were assigned to the WADC Material, Aero-Med, Equipment, and Armament Laboratories. The determination of the toxic effects of BW/CW agents on aircrews at high altitude was assigned to the Aero-Med Laboratory.

The BW/CW vulnerability study, managed from WADC, for the B-29, B-47, and B-50 aircraft was completed at Eglin AFB in April of 1954. Phases II and III of the BW assessment study

²⁹ Semi-annual History, Special Weapons Br, 1 July–31 December 1953.

³⁰ Historical Program 2nd Quarter FY 1954 (RCS CMLHO-194) .

³¹ Semi-annual History, Special Weapons Br, 1 January–30 June 1954.

³² Semi-annual History, Special Weapons Br, 1 January–30 June 1954.

with the B-36H aircraft were completed in July-August 1954 at Air Force Special Weapons Center (AFSWC), Kirtland AFB, New Mexico. There was an effort to utilize the BW test facilities at AFAC. Low altitude jettison and destruction by fire (simulated crash) tests of BW munitions were planned for the spring of 1955 at DPG, Utah.³³ SAC cooperated with WADC in the residual BW contamination tests conducted at Lockbourne AFB.

Twenty-six E101R3 clusters, simulant-filled, were scheduled for shipment to DPG for use in the CW Vulnerability series of tests. The low altitude jettison trials of E101R3 GB-filled clusters were completed by DPG³⁴ in the fall of 1954.

Operation White Floor was managed and conducted by personnel of the Special Weapons Section of the Armament Laboratory of the WADC (WADC/WCLGW) at WPAFB. The operation ran from June to October 1954. (See discussion at the end of this section.)

Tests of effects on aircrew members from continued exposure to low concentration of GB was conducted at WADC by the Aero Med Laboratory in February 1955.³⁵ Rats and dogs were used as test animals for these experiments. The effect of altitude on the physiological reactions of flight personnel to toxic CW agents was measured. Carbon monoxide (CO) was used as a test gas and simulant for the CW nerve agent GB. Tests on donning times for mask at warning were conducted. The amount of agent (CO) inhaled and retained was measured.

The Materials Laboratory performed tests at WADC on the effectiveness of formaldehyde-dispersing devices used to decontaminate an air force barracks type building in February 1954.

The efficiency of flying to remove CW contamination in a B-29 was scheduled by the WADC Special Weapons Branch, WCOES-1 for DPG, Utah. Previous tests had been conducted at AFAC with simulant agents on the surfaces of a B-47. Rapid decontamination techniques for

³³ Semi-annual History, Special Weapons Br, 1 July-31 December 1954.

³⁴ Semi-annual History, Special Weapons Br, 1 July-31 December 1954.

³⁵ Semi-annual History, Special Weapons Br, 1 July-31 December 1954.

removal of BW agents from aircraft by the use of an ethylene oxide–Freon mix was tested at WADC in January 1955.³⁶

The HQ USAF and ARDC offensive CW Armament Program consisted of:

- CW munitions: 1000-lb cluster GB bombs, 750-lb new series GB bomb massive (contracted directly with industry), 750-lb new series GB bomb cluster, GB warhead (Matador), GB spray tank, GB warhead for 2.75" rocket (feasibility study only).
- Nontoxic: 750-lb new series cluster incendiary bombs, field filling, and mixing equipment for fire bombs, improvement of fire bomb assembly methods.
- BW munitions: early development of E133 cluster BW bomblets, E77 anti-crop balloon bomb, E137 cluster, E-99 bomblets, E-86 750-lb anti-crop bomb.

On 22 April 1954 HQ ARDC deleted the requirement for USAF CW agent HD (mustard).

A proposal, dated 24 May 1955, for the transfer of research and development responsibilities for basic ordinance to the AFAC, Eglin AFB, was sent to the Commander, ARDC, Baltimore, Maryland, from the Commander, WADC.³⁷ This transfer included the Bomb and Warhead Branch which had the responsibility for (1) high explosive, BW and CW bombs, and fuzes, (2) munitions handling and transport equipment and specialized surveillance equipment for conventional and BW/CW bombs, (3) release mechanisms, interval controls, and munitions installation engineering for conventional and BW/CW bombs, and (4) warheads and fuzes for guided missiles, carriage release and separation of bombs, and techniques to insure compatibility of munitions with weapons systems. The proposed transfer was approved by message from ARDC, dated 22 July 1955, and was to be accomplished over an eight-month period, August 1955 to March 1956. With this reorganization, the BW/CW munitions and ancillary equipment program was transferred from the Armament Laboratory at WADC to the AFAC, Eglin AFB, Florida. The physical transfer was completed by 10 January 1956.³⁸ The

³⁶ Semi-annual History, Special Weapons Br, 1 July–31 December 1954.

³⁷ Letter, Cdr., WADC to Cdr., ARDC, Transfer of R&D Responsibilities for Basic Ordinance, 5/24/55.

³⁸ WADC Weekly Technical Information Report, 2/3/56.

AFAC Air Munitions R&D organization had four branches including a BW/CW Branch. The Armament Laboratory at WADC was renamed and reorganized as the Weapons Guidance Laboratory, WADC effective 3 July 1955.

The management of the residual functions of the BW/CW Vulnerability Program was moved from the WADC, Special Weapons Branch to the WADC, Directorate of Research, Aero Med Laboratory. The BW/CW Vulnerability Advisory Committee conference was held at the Aero Medical Laboratory in March 1956, to review the BW/CW defensive R&D program at WADC.³⁹ There were presentations on decontamination, detection, personnel protection, defensive equipment, intelligence information, and vulnerability assessment.

Various BW cold weather field tests using exposures to simulated overt BW primary aerosols to satisfy the cold weather phase of the BW Vulnerability Program were completed at temperatures less than or equal to 26°F at Loring AFB, Maine.⁴⁰

The responsibility for handling all USAF explosive ordnance--including nuclear--was assigned to AMC at the beginning of 1956.⁴¹ The Explosive Ordnance Disposal (EOD) Group with five squadrons was assigned the function. Three of the EOD squadrons were located in Continental United States (CONUS), and one each in the European and Pacific areas. Ogden was to be responsible for operational control and training of these organizations.

The Aero Medical Laboratory experiments for Operation Payoff were reported as complete in October 1956.⁴² The object of the study was to determine the effects of altitude on susceptibility of test subjects to the CW nerve agent GB. Rats, pigeons, and dogs were used as test subjects. The tests were conducted in one of the stratospheric chambers at WADC. Preliminary data did not indicate any difference in susceptibility of test subjects from ground level to 40,000 feet altitude.

³⁹ WADC Weekly Technical Information Report, 3/9/56.

⁴⁰ Activity report for Aero Medical Laboratory, 2/17/56.

⁴¹ History of AMC, 1 January – 30 June 1956, vol. 1, p. 9.

⁴² WADC Weekly Technical Information Report, 10/19/56, p. 17.

An AF development program for an airborne BW sampler was reported by the Aeronautical Accessories Lab (WCLE) as nearing completion in February 1958.⁴³ The production models of five BW sampling assemblies were fabricated by Minneapolis-Honeywell under a contract with the CmIC, BW Laboratories at Fort Detrick, Maryland, using AF funds for the contract. Three samplers were delivered to the BW Labs for functional testing; two samplers were to be used for environmental tests by the contractor. Three BW samplers for collecting air samples from the interior of aircraft were delivered to the Aeronautical Accessories Lab in June 1958⁴⁴ for final evaluation. The AF contract was continued for redesign of the samplers for fabrication by standard commercial methods. Type classification of the sampler was to be initiated on completion of evaluation by WADC.

A completed series of field trials to adapt an available aerosol sampler as a component in a system for detection of biological organisms was reported by the Aero Medical Lab (WCLD).⁴⁵ The trials were conducted at DPG under an AF contract. Hamilton AFB, California, was utilized as a test site. The device showed promise as being effective in detecting the presence of a bacterial aerosol in a relatively short time.

The BW/CW Vulnerability Assessment Program was terminated on 23 May 1958 and the remaining research and development tasks were merged into another project. The entire BW/CW program was phased out until late 1960 when it was restarted at the Aeronautical Systems Division (ASD) in response to TAC QOR-60-4-BCW, per HQ USAF and HQ AFSC direction.⁴⁶ ARDC Technical Objectives (Table 1) were issued in September 1960.

⁴³ WADC Weekly Technical Information Report, 2/14/58, p. 8.

⁴⁴ WADC Weekly Technical Information Report, 6/27/58, p. 14.

⁴⁵ WADC Weekly Technical Information Report, 2/14/58, p. 11.

⁴⁶ "Biological Chemical Warfare 'State of the Art Evaluation'", Air Force Systems Command Biological Chemical Warfare Office, Wright-Patterson AFB Ohio, 2 October 1961.

Table 1. ARDC Technical Objectives, September 1960

Tech Objective	Title	Number	Description	Responsible Organization
740A	Advanced Weapons	2317A	To develop lethal and non-lethal BW/CW agents	APGC, Eglin AFB FL
		2318A	To obtain BW/CW munitions delivery systems	APGC, Eglin AFB FL
750A	Mechanics of Flight	2319A	To develop a CW detection and identification system	WADD, Flight Accessories Lab
		2320A	To develop a BW ground detector	WADD, Flight Accessories Lab
		2321A	To develop a BW flight detector	WADD, Flight Accessories Lab
780A	Biologistics	2324A	To develop BW/CW detectors and protective clothing	WADD, Aero-Med Division
		2323A	To establish procedures for handling lethal and non-lethal BW/CW agents	WADD, Aero-Med Division
780E	Human Performance	1094A	To develop and evaluate data presentation to depict capabilities and effects of BW/CW	AFCCDD & RADC

In December 1959, WADC was renamed the WADD and was composed of three directorates: (1) Directorate of Systems Management, (2) Directorate of Systems Engineering, and (3) Directorate of Advanced Systems Technology.⁴⁷ The laboratories were assigned between the Directorates of Systems Engineering and Advanced Systems Technology. The in-service engineering functions (i.e., engineering related to fielded systems) were moved to AMC.

HQ ARDC initiated a System Study Directive,⁴⁸ dated 10 June 1959, directing that the feasibility of a Non-Lethal BW/CW Weapons System concept be explored. The study requirements

⁴⁷ AFSC Historical Publication. Engineering History, 1917-1978, McCook Field to the Aeronautical Systems Division. (Fourth Edition), February 1979, p. 32.

⁴⁸ Dir., Advanced Systems Technology, Unit History Reports, 1 January-30 June 1960, Offensive Systems Branch (WWRPO).

request for proposal was issued to industry on 1 September 1959, and proposals were received from 15 contractors. On 15 April 1960 management responsibility was assumed by the BW/CW and Limited War Liaison Office at WADD (WADD/WWRPO, later renamed ASD/ASRS) from a laboratory (WCLF). The study was published as ASD-TDR-62-290 in June of 1962.

Effective 1 April 1961, the AFSC was established by the combination of ARDC and the procurement and production elements of AMC.⁴⁹ The AFLC was concurrently established. ASD was established by combining WADD's research and development functions and AMC's Aeronautical Systems Center's procurement and production duties. All of WADD's directorates became deputates, i.e., Directorate of Systems Engineering became the Deputy for Systems Engineering; Directorate of Systems Management became the Deputy for Systems Management, and the Directorate of Advanced Systems Technology became the Deputy for Advanced Systems Technology. The laboratories were assigned to the Deputy of Advanced Systems Technology.

In the later portion of 1961, the BW/CW and Limited War Office in ASD/ASR was responsible for accomplishing and monitoring the advanced planning and evaluation activities associated with BW/CW and Limited War weapons systems. The Office maintained liaison with the operational commands for new operational concepts and requirements in the planning for BW/CW and Limited War matters.⁵⁰ In mid 1960, this office was transferred to the ASD/ASJ.⁵¹

AFSC formed the Research and Technology Division (RTD) on 4 April 1962.⁵² The technology and engineering missions were removed from ASD and assigned to the RTD. The various laboratories were formed into four organizations: the Materials Laboratory, the Avionics

⁴⁹ AFSC Historical Publication. Engineering History, 1917-1978, McCook Field to the Aeronautical Systems Division. (Fourth Edition), February 1979, p. 39.

⁵⁰ ASD Deputy Commander/Technology (ASD/ASR), July-December 1961, Directorate of Advanced Systems Planning (Atch. 3).

⁵¹ Ltr, from ASD/ASRSM to ASD/ASRSOO, Subject: Semi-Annual History, Systems Study Division, 1 January-30 June 1962.

⁵² AFSC Historical Publication. Engineering History, 1917-1978, McCook Field to the Aeronautical Systems Division. (Fourth Edition), February 1979, p. 40.

Laboratory, the Flight Dynamics Laboratory, and the Aero-Propulsion Laboratory. The Systems Engineering Group was formed from the Deputy for Systems Engineering.

In August 1963 ASD/ASJ, Detachment 4, located at AFAC, obligated \$3.5 million via MIPR to Deseret Test Center (DTC) for the AF BW/CW test program.⁵³ Det 4 was created from the ASD Directorate of Armament Development (Eglin AFB, Florida) and the Ballistics Directorate, APGC, Eglin AFB, Florida, in 1963.⁵⁴

The following projects were managed either by ASD/ASJ at WPAFB or ASD/ASJ (Det 4) at Eglin AFB, Florida:

- Det. 4 Test Section personnel monitored tests for Project Night Train conducted by DTC in Alaska. Tests of the A/B 45Y-1 wet biological agent spray tank mounted on an F-105D aircraft were completed. Representatives from Det 4 attended the FY65 DTC planning conference in November 1963 at Ft. Douglas, Utah. Subject of the meeting was the joint USA, USAF, and USN proposed test program. The test requirements for BW/CW weapons were presented by the representatives.
- The E41 dry agent dispenser tank was flight tested on F-100/F-105 aircraft. Preliminary flight tests on the F-105 aircraft were done at Eglin AFB, Florida.
- Project 2503, Safety and Handling (Chemical Operations) provided the AF with the latest safety and handling procedures so that CW munitions and agents could be stored, shipped, and tactically delivered with minimum risk to friendly personnel. Disaster plans to cover emergency situations involving inadvertent release or crash of aircraft carrying CW munitions or agents on friendly forces were developed. The AF awarded a one-year contract to develop the disaster plans. Tentative safety and handling procedures were developed for the TMU-28/B spray tank in December 1963.

⁵³ ASD Historical Reports, 1 July–31 December 1963.

⁵⁴ History of the Research and Technical Division, Volume 1, Administrative Data. AFSC Historical Publications Series 65-200-1, 4 April 1962-30 June 1964.

- Project 2504 would insure proper instructions, procedures, and devices were available for safe storage, handling, and operational use of BW weapons. The AF awarded a contract to: (1) review and collect technical data on BW weapons under development, (2) design logistic concepts and flow charts for BW weapons, (3) identify possible weapon incidents in hazardous conditions, and (4) conduct an investigation of possible leak detection methods.
- Project 2512, Non-Lethal Munitions⁵⁵ was directed toward the Non-Lethal Cluster Bomb, CBU-5B. An AF MIPR for \$483,000 was transferred to USA Chemical-Biological Defense Command (CBDCOM) to provide the AF with a 750-lb cluster bomb to deliver the CW agent BZ from an AF F-100/F-105 aircraft. Modifications to the munitions were developed to make the bomb compatible with the aircraft. Thirty-three simulant-filled bombs were provided for testing at APGC; 10 live agent bombs were provided for testing at DPG; 17 simulant-filled bombs were provided for special firepower demonstrations or for TAC testing; and 17 dummy bombs were designated for flutter/vibration tests at APGC. Tests previously completed include: (1) fit tests on F-100, F-105 and CAG-type aircraft; (2) five jettison test missions at APGC; (3) flutter and vibration tests; (4) vibration, surveillance, and static firing tests at DPG except for the drop tests of six CBU 5/B's surviving the storage tests. A contract was issued, under sub-task 251202, to design BZ bomblets, modeled after the M138/BZ bomblet, that would fit the SUU-13A dispenser.
- Project 2522, Tactical BW Munitions,⁵⁶ included the task for development of the BW Spray Tank (Wet), A/B 45Y-1. The liquid BW spray system would deliver an elevated line source of anti-personnel agents over a relatively large target area. The spray tanks required modifications for compatibility with F-100, F-105, and F-4C. The tanks were flown on outboard stations of the F-105 and flight restrictions were determined.
- The goal of Task 252202, BW Bomblets for Tactical Aircraft, was to obtain BW bomblets capable of containing wet and dry BW agent that were compatible with the

⁵⁵ ASD Historical Reports, 1 July–31 December 1963.

⁵⁶ ASD Historical Reports, 1 July–31 December 1963.

SUU-13/A dispenser. The system was expected to provide a ground line source for saturation of defined targets where control of the target area coverage was required. The engineering studies for the ground line source system was contracted with industry.

- Task 252203, Dry Agent Spray Tank, was to modify the US Army developed E-41 spray tank into a simplified and lighter spray tank designated the A/B 45Y-4. Modifications to the spray tank were also required for compatibility with the pylons on the F-100, F-105, and F-4C aircraft. One contract provided for the modifications to the E-41 tank, and a second contract provided for the modifications of the A/B 45Y-4 for compatibility with the pylons of the designated aircraft.
- The objective of Task 252301, Project 2523, Anti-Crop Systems,⁵⁷ was the flight tests of the A/B 45Y-4 anti-crop dispenser on the F-100, F-105, and the F-4C aircraft. Flutter tests were conducted at DPG by a contractor. Data was obtained on various combinations of tanks, pylons, and airspeeds.
- Under Project 2525, Airborne Defoliation Systems, the A/B 45Y3, with a field-filled capability, underwent preliminary tests at Eglin AFB, Florida. The tanks were returned to the contractor for corrective action.
- The Fixed-Wind Insecticide Dispenser Apparatus Liquid was developed under task 252501. The tanks were modified and were successful on retesting. Two modified units were tested by the AF.
- Task 252502, provided for the development of internal defoliant dispensers, e.g. A/A 45Y-1, to remove enemy vegetative cover. The systems were designed by contract for the C123 and C130 aircraft. Six flights were conducted over water and 11 dissemination trials were made over a test grid.
- Detachment 4, WADC, had a requirement for a B-26 defoliant spray system. A spray tank had been developed by Ft. Detrick for use on the OV-1 helicopter. Agreements were made between the Army and AF for joint development of the spray system for the OV-1 and B-26. In return for technical documents, prototype,

⁵⁷ ASD Historical Reports, 1 July–31 December 1963.

and preproduction spray systems, the AF provided Government Furnished Equipment, hardware, and certain test facilities.

- Project 2534, CB Defensive Techniques, required a feasible solution for AF BW/CW decontamination problems. New materials, techniques, and concepts for AF equipment and ramps and runways were needed. The Aircrew Collective Protection concept was to protect the aircrew and passengers of AF aircraft from BW/CW agent during in-flight operations.
- Task 283301, of Project 2833, provided for the development of a VX spray tank for AF high performance aircraft. The project was initiated by a \$1.56 million MIPR to CRDL. The project was subcontracted by CRDL to industry. The E-40 spray tank, developed for the Army SD-5 drone, was to be used for the basic design. On completion of modifications, the tanks were tested at Eglin AFB, Florida, followed by VX, BIS (nerve agent simulant), and defoliant trials at DPG. Sixteen tanks were initially fabricated and new MIPR funds purchased an additional 24 tanks.
- Task 283302, CW Bomblets, placed a \$111,600 contract for the development of GB bomblets to fit the SUU-13/A dispenser. Studies were done to improve the bomblet spacing.
- Project 5400, USAF Evaluation of BW/CW, contracted a supplemental agreement for \$500,000 to the University of Pennsylvania for Project Big Ben located at Eglin AFB, Florida.
- Project 5957, Internal Defoliant Dispenser, contracted for the development of BW disseminator of defoliating agents from the C-123 and C-130 aircraft. Preshipment tests of two modules were completed.

Det 4, ASD/ASJ was absorbed into the Directorate of Armament Development, Air Force Armament Laboratory (AFATL) in July 1964.⁵⁸ ASD/ASJ became a deputy level office in February 1964.⁵⁹ The Deputy was responsible for the overall performance of AFSC planning for limited war and special air warfare. The efforts included: CB effects assessment, tactical

⁵⁸ Research Technology Division Technical Briefs, 1965-1969.

⁵⁹ Semiannual History, Deputy for Limited War, January-June 1964.

biological munitions, CB detection and warning, CW screening munitions, and other CB programs.⁶⁰ The Directorate of Munitions was moved into ASD/ASJ on 15 November 1965 and was given the symbol ASD/ASJB. All subdivisions of the directorate were transferred intact.⁶¹ The mission of the Directorate was the management of all USAF assigned conventional non-nuclear munitions programs in the engineering development stage through the acquisition phase and initial procurement.⁶² The Project Management Group managed 26 projects of which 22 were in the BW/CW area.⁶³

A search of the reports of TEU shipments identified two reports of GB transferred from WPAFB to Newport Army Ammunition Plant (NAAP), Indiana (now Newport Chemical Activity). One shipment was of a 50-lb container of GB, transferred on 8 July 1964 (report number 12-65) and another was the shipment of a 50-lb container of GB, transferred on 29 December 1964 (report number 178-65).⁶⁴ The Aero Med Lab conducted two tests that are most likely to have used the GB from these containers: (1) the effects of continued exposure to low concentrations of GB, February 1955, and (2) Operation Payoff--the effects of altitude on susceptibility of test subjects to GB, October 1956. However, there is a nine-year span between that series of tests and the disposal of the GB. It is important to note that the GB was disposed of in accordance with existing standard procedures for the disposal of CW agents and not just simply improperly disposed of in a landfill on WPAFB property.

The Newport Chemical Activity stated that the records of the subject GB shipments were no longer available. All records of shipments to NAAP were transferred to the Tech Escort Unit in 1969. The GB would have been disposed of in keeping with the practice at the time and no permanent records would have been kept. The general procedure was to mix the GB with a decontaminant, e.g., Sub-Tropical Bleach, and the resultant dumped in an industrial waste

⁶⁰ Semiannual History, Deputy for Limited War, July-December 1964.

⁶¹ Historical Reports, ASD, 1 July-31 December 65, Vol 1: Semi-Annual History, Deputy for Limited War, July-December 1965.

⁶² Historical Reports, ASD, 1 January-30 June 1966, Vol 1: Semi-Annual History, Directorate of Munitions (ASJB) Deputy for Limited War, 1 January-30 June 1966.

⁶³ Historical Report, 1 January-30 June 1966, ASD/ASJB.

⁶⁴ MEMO: TO: C. R. Replogle, FROM: T. Collins, SUBJECT: Reports of Shipments, 19 June 1966.

disposal system designed for that purpose. There are no reports available to indicate the shipping date of the GB containers from Edgewood Arsenal to WPAFB. Chemical agents were usually packaged for shipment in steel drums of varying sizes depending on the quantity of agent. The agent would most likely have been subpacked in aliquot amounts (e.g. 1 ml. to 1 liter) as specified by the requesting agency. Had the GB been weaponized, this information would have generally been on the shipping report description of the material. For example, a shipment from Hill AFB to Rocky Mountain Arsenal (RMA) was identified as GB bomblets, shipped by road; another shipment from Tooele Ordnance Depot to RMA is listed as Shell, Gas, Non-Persistent, 4.2" (mortar), 1,949,220 pounds, shipped by rail.

Actions by the ASD/ASJB Munitions Division promised to give the AF a greatly increased offensive and defensive capability in the area of BW/CW warfare.⁶⁵

- A contract was awarded for a one-year effort in developing the Direct Injection Toxic Ammunition (DITA) for use against enemy personnel wearing individual protection. The lethality of the DITA was projected to be increased by a factor of 2-3 over conventional ammunition.
- Prototype BW/CW detection/warning devices, AN/GAQ-1, were received from the contractor. The device received good signal strength over a three-mile line-of-sight path. Six units were ordered for additional evaluation.
- Test and production schedules for the A/B 45Y-1 spray tank were accelerated. The A/B 45Y-1 line source disseminator for wet anti-personnel BW agents was to be used in support of TAC air missions. A procurement order of 100 A/B 45Y-1 tanks was placed in July 1967. Shipping containers for the A/B 45Y-1 tanks were also tested.
- Initial deliveries of the CBU-22/A smoke screening munitions were delivered to Southeast Asia.

On 1 August 1968, the ASD/ASJB was transferred to ADTC, Eglin AFB. All activities ceased on 28 August 1968 at WPAFB with resumption of the activities on 3 September 1968 at Eglin AFB,

⁶⁵ History of ASD , 1 January–31 December, 1966, Vol. 1, Ch. 2, Limited War Office, p. 145.

Florida, thus moving the management responsibilities off of WPAFB.^{66, 67} In 1969, President Nixon, at a national level, directed that all of the services' efforts in BW/CW cease, thus canceling the program.

Management Action Plan for the Installation Restoration Program

The Management Action Plan for the Installation Restoration Program at WPAFB was reviewed.⁶⁸ Approximately 66 sites at WPAFB have been investigated and classified as to location, size, dates of use, type of waste, risk factors, and further actions required. Only two of the 66 sites have any suggestion of a connection to CW agents--Burial Site 4 and Landfill 12.

Burial Site 4 is located in Areas A and C along a narrow, wooded stretch of Marl Road. The site was identified on a base map dated July 1945. At one time, a temporary chemical warfare structure, believed to have been used for tear gas training, was thought to have been located near the site. No information exists to verify that such a structure was ever associated with the site. No detection of any CW residues at the site has been reported. It was determined that no significant risk or threat to public health and the environment exists and that no further action is required. This site is included in the 1996 Record of Decision for 21 No Action Sites.

Landfill 12 is located in the western portion of Area C near the Mad River. The landfill covers approximately 0.27 acres. Landfill 12 was initially used for chemical disposal, acid neutralization, and hazardous material storage. The landfill received chemicals from the research laboratories in Area B and from Areas A and C. Excavation of the site began on 10 October 1997, and 1,946 containers and 31 compressed gas cylinders were recovered. The containers were laboratory bottles, sometimes called "lecture bottles," in various stages of disrepair. The contents of the containers were analyzed and three of the lecture bottles were found to contain residual phosgene. However, the phosgene should not be considered a CW agent in this case since it was obtained from commercial sources for commercial purposes.

⁶⁶ Semi-Annual Historical Reports, ASD (July-31-December 1968), ASC/ASL, Vol 3: Ltr from ASD/ASJA to ASD/ASEH, Subj.: Semiannual Historical Reports, dated 25 February 1969, Atch 1, Semiannual History, Deputy for Limited War, July-December 1968.

⁶⁷ History of the Aeronautical Systems Division, July 1968-June 1969, Vol 1, Narrative.

⁶⁸ Installation Restoration Program, 1997 Management Action Plan Update, 88th ABW/EMR, Office of Environmental Management, WPAFB, March 1998.

Phosgene (COCl_2), is produced worldwide and is extensively used commercially in organic synthesis and in the manufacture of dyes, pharmaceuticals, herbicides, insecticides, synthetic foams, resins, and polymers. First prepared in 1811, phosgene is manufactured by the reaction of carbon monoxide and chlorine in the presence of a catalyst. Other common names are: Carbonyl Chloride, Carbonic Dichloride, Carbon Oxychloride, and Chloroformyl Chloride. The CW agent phosgene is referred to as CG. The chemicals were characterized on site and prepared for off-site disposal.

A site, later named Munitions Burial Site 1, was discovered on 29 November 1995 during the excavation of a trench for installation of a sanitary sewer line in Area B near to corner of 13th and P Streets of WPAFB.^{69, 70} The items were identified as M-114 BW bomblets, filled with the agent *Brucella suis*, and having inert bursters and inert fuzes. The M-33 cluster components were identified from stencil markings on the end plates as to the loader identification (Production Development Laboratories, Pine Bluff Arsenal, Arkansas), loading date (6/26/54), and contents (108 M-114, filled with AB-1 [*B. suis*]). The items were identified as being used for the "Operation White Floor" project.

Operation White Floor was managed and conducted by personnel of the Special Weapons Section of the Armament Laboratory of the WADC (WADC/WCLGW) at WPAFB. The operation ran from June to October 1954. The project had several goals:

1. Establish the AF capability for field surveillance of BW munitions.
2. Quantify effects of transport on the munitions and agent from the stockpile-to-target sequence.
3. Evaluate the use of the M-114 bomblet container for surveillance sampling.
4. Develop techniques for the use of the MA-1, mobile surveillance laboratories.
5. Evaluate the feasibility of training enlisted personnel as laboratory operators.

⁶⁹ Installation Restoration Program, 1997 Management Action Plan Update, 88th ABW/EMR, Office of Environmental Management, WPAFB, March 1998.

⁷⁰ Report of Investigation: Buried M-114 Bombs, 4 lb., Biological, Found at Wright-Patterson AFB, Ohio, AL/CFDA, June 1996.

6. Perform functional testing of the MA-1.
7. Validate methods for disposal of the M-114s in a simulated combat environment.

The clusters were tested for agent effects in the laboratory temperature-altitude chamber simulating the flight profiles of various delivery aircraft. On completion of all tests and assays the agent was sterilized and the test items were buried in the now-designated site, Munition Burial Site 1. None of the debris buried at that site posed a hazard to personnel.

Assessment

- In 1946, the AMC/MCMK was responsible for management of the chemical, biological, and radiological programs for AMC and for liaison with the USA CmlC.
- When the AMC/MCMA was formed in 1949, a centralized technical liaison service with the Army CmlC and Army Ordnance was assigned.
- In the first half of 1950, the ARDC was formed.
- In October 1950 AMC was given supervision of R&D in BW. The R&D program on respiratory protective devices was assigned to the Aero Med Lab.
- The AF equity in Army CmlC items in the Army Quartermaster depots was transferred 1 September 1952.
- The AMC research, development, and engineering functions were reassigned to form the ARDC in 1951. WADC, formed under ARDC in April 1951, was composed of three divisions (engineering, flight-testing, and all-weather flying) and the Office of Air Research. The 12 laboratories were assigned to the Engineering Division.
- ARDC extensively used facilities, via contracts, of the Army CmlC to develop methods, procedures, and equipment to test the dispersion of BW munitions. The CmlC conducted investigations for ARDC for the design of BW munitions, and solicited contracts for the development of CW filled munitions.
- The TEU delivered a shipment, from the Army Chemical Center, of classified materiel to the Air Development Center, Bldg. 63, WPAFB, on 25 August 1951. No other information was available.

- By November 1952 the Directorate of Supply and Services, AMC, included an Assistant for Special Weapons. The office included a Biological and Chemical Weapons Branch.
- The AF BW/CW program was to provide improved BW/CW munitions compatible with the newer high performance aircraft. The program included anti-personnel, anti-crop, and anti-animal agents. Investigation of new methods of agent application by munitions, spray-tanks, and methods of munition ejection from aircraft was done. The BW program would continue to develop dried agent dissemination, aerosol generators, explosive bombs, and dispersion systems for component bombs.
- In 1952, WADC, AMC, SAC, and MATS were involved in a project, "Logistic System Support for BW Munitions Supply to the Theater of Operations." This involved trailer-mounted bomb filling plants, decontamination, refrigerated storage, and leak detectors.
- The Special Weapons Branch of WADC, manager of the BW/CW Vulnerability Program, sponsored a conference concerning the modifications for external carriage of the E101 1,000 lb. GB cluster bomb. Tests were conducted at WADC with 15 E101R3 bombs equipped with various mock-up fairing configurations. The CmIC and AFAC tested 20 modified E101R3 bombs at Eglin AFB. AFAC provided the F84 for the tests.
- Under WADC's CW program, two 3,000-lb. GB clusters were assembled at Walker, AFB and used for the warhead drops with the Matador missile.
- As part of the BW/CW vulnerability program, tests conducted at Scotia, New York, determined the efficiency of ground heaters to decontaminate AF buildings. Tests for secondary aerosol generation from BW-contaminated terrain was conducted at Eglin AFB in May and at Ft. Belvoir, Virginia, in July 1953. Tests of hazards from leaking BW munitions were conducted at Eglin AFB in December 1953.
- The Special Weapons Branch of WADC managed the development of the E133 BW cluster, the E101 CW cluster w/E54, and the E77.
- As part of the BW/CW vulnerability program, tests to determine hazards to AF bases and materiel contaminated by CW agents were conducted at ACC, Maryland, and

field tests at DPG, Utah. SAC cooperated with WADC in the BW decontamination equipment tests at Lockbourne AFB. WADC conducted tests on the efficiency of aircraft interior decontamination with vapor and aerosol decontaminants at Wright Field. Simulant BW agents, BG, were used in the crew compartments of the aircraft in September 1953.

- The TEU show one classified shipment from Ft. Detrick, Maryland, to WPAFB on 5 November 53 and another on 5 December 1953 weighing 3,000 lb. No other identifying description was given.
- The BW/CW Defensive Program Review was held at WADC and attended by HQ USAF, ARDC, and WADC in February 1954. The assessment function was transferred from WADC Materials Laboratory to the WADC Special Weapons Branch. The determination of the toxic effects of BW/CW agents on aircrews at high altitude was assigned to the Aero Med Lab.
- The BW/CW Vulnerability study managed from WADC, for the B-29, B-47, and B-50 aircraft was completed at Eglin AFB in April of 1954. Phases II and III of the BW assessment study with the B-36H were completed in July-August at Kirtland AFB.
- The low altitude jettison trials of E101R3 GB-filled clusters were completed by DPG in the fall of 1954.
- Operation White Floor was conducted at WPAFB from June to October 1954. The project was managed and conducted by personnel of the Special Weapons Section of the Armament Laboratory of the WADC (WADC/WCLGW) at WPAFB.
- Tests of effects on aircrew members from continued exposure to low concentrations of GB was conducted by the Aero Med Lab, WADC, in February 1955. Rats and dogs were used as test animals. The effects of altitude on flight personnel to CW agents were measured, using CO as a simulant for the GB. The tests were conducted in a stratospheric chamber at the Center. The tests were completed in October 1956.
- The Materials Laboratory performed tests at WADC on the effectiveness of formaldehyde to decontaminate an Air Force barracks type building in February 1954.

- The efficiency of flying to remove CW contamination in a B-29 was scheduled by WADC Special Weapons Branch for DPG. Rapid decontamination techniques for removal of BW agents from aircraft by use of ethylene oxide-Freon mix were tested at WADC in January 1955.
- The BW/CW munitions and ancillary equipment program was transferred from the Armament Laboratory to the AFAC, Eglin AFB. The physical transfer was completed by 10 January 1956. The Armament Laboratory at WADC was renamed as the Weapons Guidance Laboratory.
- The responsibility for handling all USAF explosive ordnance--including nuclear--was assigned to AMC at the beginning of 1956. The EOD Group, with five squadrons, was assigned the function. Ogden was responsible for operational control and training of these organizations.
- An AF development program for an airborne BW sampler was reported by the WCLE as nearing completion in February 1958. The five BW sampling assemblies were fabricated by an industrial contractor under contract to the CmlC BW Laboratories at Ft. Detrick, Maryland. Three samplers were delivered to the BW Labs for functional testing. Three BW samplers for collecting air samples from the interior of aircraft were delivered to WCLE in June 1958 for final evaluation. The AF contract was continued for redesign of the samplers for fabrication by standard commercial methods.
- Field trials of an aerosol sampler were conducted by DPG under an AF contract (WCLD). Hamilton AFB, California, was used as the test site.
- On 23 May 1958 the BW/CW Vulnerability Assessment Program was terminated and the remaining R&D tasks merged into another project. The entire BW/CW program was dormant until late 1960 when it was restarted at ASD per HQ USAF and HQ AFSC direction.
- HQ ARDC initiated a System Study Directive, dated 10 June 1959, directing that the feasibility of a Non-Lethal BW/CW Weapons System concept be explored. The study requirements documentation was issued to industry 1 September 1959 and 15 contractors provided proposals. On 15 April 1960, management responsibility was

assumed by the BW/CW and Limited War Office at WADD. The study was published in June 1962.

- In 1961, the BW/CW and Limited War Office in ASD/ASR maintained liaison with the operational commands for new operational concepts and requirements in the planning for BW/CW and Limited War matters. This office was later transferred to the ASD/ASJ. ASD/ASJ, Detachment 4, was located at AFAC, Eglin AFB.
- In August 1963, the ASD/ASJ Det. 4, obligated \$3.5 million via MIPR to DTC for the AF BW/CW program.
 - Det. 4 Test Section personnel monitored tests of the A/B 45Y-1 wet BW agent spray tank on an F-105D aircraft conducted by DTC in Alaska.
 - The E41 dry agent dispenser tank was flight tested on F-100/F-105 aircraft at EAFB.
 - A one-year contract was awarded for the development of disaster plans under Project 2503, Safety and Handling (CW).
 - Under Project 2504, the AF awarded a contract to provide for investigations and data collection relative to storage, handling, and operations of BW weapons.
 - An AF MIPR to the USA CBD COM was to provide the AF with a 750-lb. Cluster bomb to deliver BZ from F-100/F-105 aircraft. Simulant-filled bombs were tested at APGC; agent-filled bombs were provided for testing at DPG; simulant-filled bombs were provided to TAC and firepower demonstrations; and dummy bombs were for flutter/vibration tests at APGC. A contract was issued to design BZ bomblets that would fit the SUU-13A dispenser.
 - Project 2522, Tactical BW Munitions, included the task for development for the BW Spray Tank (wet) A/B 45Y/1. Task 252203, Dry Agent Spray Tank, was to modify the Army developed E-41 spray tank into the A/B 45Y-4 for compatibility with designated aircraft.

- Project 2523, Anti-Crop System task was to flight test the A/B 45Y-4 anti-crop dispenser on designated aircraft. Flutter tests were conducted at DPG by a contractor.
- Preliminary tests at Eglin AFB of the A/B 45Y-3 were conducted under Project 2525, Airborne Defoliation Systems. The tanks were returned to the contractor for corrective action. Task 252502 provided for the development of internal defoliant dispensers, A/A 45Y-1, to remove enemy vegetative cover. The system was designed by a contractor for the C123 and C130 aircraft.
- Det. 4, WADC had a requirement for a B-26 defoliant spray system. Ft. Detrick had developed a spray tank for the OV-1 helicopter. The Army and AF entered into a joint development of the spray system for the OV-1 and the B-26.
- Task 283301, Project 2833, provided for the development of a VX spray tank for AF high performance aircraft. The project was initiated by a \$1.56 million MIPR to CRDL, who subcontracted to industry. The E-40 spray tank developed for the Army SD-5 drone provided the basic design. The modified tanks were tested at EAFB, followed by VX, BIS, and defoliant trials at DPG.
- Task 283302, CW Bomblets, placed a contract for the development of GB bomblets to fit the SUU-13/A dispenser in the last half of 1963.
- Project 5957, Internal Defoliant Dispenser, contracted for the development of a BW disseminator for defoliating agents from the C-123 and C-130 aircraft in the last half of 1963.
- Det. 4, ASD/ASJ was absorbed into the Directorate of Armament Development, AFATL, in July 1964. All subdivisions were transferred intact. The mission was the management of all USAF assigned conventional nonnuclear munitions programs in the engineering development stage through the acquisition phase and initial procurement. The Project Management Group managed 26 projects of which 22 were in the BW/CW area.
- Two 50-lb. containers of GB nerve agent were transferred by the TEU from WPAFB to the Newport Chemical Activity, Indiana, for disposal on 8 July 1964 and

12 December 1964. The GB was disposed of in accordance with existing standard procedures.

- ASD/ASJB awarded a one-year contract for the development of the DITA for use against enemy personnel wearing individual protection. Test and production schedules for the A/B 45Y-1 spray tank were accelerated. A procurement order for the tanks was placed on contract in July 1967.
- On 1 August 1968, ASD/ASJB was transferred to ADTC, Eglin AFB. All activities at WPAFB ceased on 28 August 1968 with resumption of the activities on 3 September 1968 at Eglin AFB, Florida.
- The CAIS have been recovered in three Ohio locations--Columbus, Lockbourne Army Air Base, and Newark. There is no indication of the presence of CAIS at WPAFB in any time frame of interest.
- Burial Site 4 was believed to have had a temporary chemical warfare structure, thought to have been used for tear gas training that may have been located near the site. No information exists to verify that such a structure was ever associated with the site. No detection of any CW residues at the site have ever been reported.
- Landfill 12 was excavated and 1,946 containers were recovered. Three of the containers had residual phosgene. The phosgene was procured from industrial sources and not from military channels. Phosgene is used in the manufacture of resins and polymers, among other uses. In this context, the phosgene should not be considered as a CW agent. The chemicals were characterized on-site and prepared for off-site disposal.
- Munition Burial Site 1 contained the residue of M-33 clusters and approximately 2,300 M-114 munitions that were identified with Operation White Floor. The munitions were filled with *B.suis* (AB-1) that had been sterilized at the end of the test program. The munitions had been fitted with inert fuzes and bursters. None of the debris at that site posed a hazard to personnel. Munition Burial Site 1 has been successfully remediated.

Conclusions

- The Air Materiel Command was responsible for the management of the BW/CW program. The Chemical Office provided technical liaison with the USA Chemical Corps, performed staff analysis of AMC CW problems, provided technical advice regarding CW training, personnel, and standard equipment, and staff surveillance and technical consulting service on all R&D projects affecting CW type materiel. The office did not perform R&D or tests on CW munitions and equipment. It is not expected that any residual or buried items would result from this organization's activities at WPAFB.
- The Special Weapons Branch of WADC, ARDC, was manager of the BW/CW Vulnerability Program. This branch managed the development of the E133 BW cluster, the E101 CW cluster with E54 and the E77 anti-crop balloon bomb. Tests with the E101R3 with various modified fairing configurations were conducted at WADC. Other tests with this munition were conducted by the CmIC and AFAC at Eglin AFB. The open-air tests with live agent or with explosives were never conducted at WPAFB. Other test facilities such as DPG, Utah, were used to test full-up munitions systems with agent in open air; test facilities such as Eglin AFB were used to test full-up munitions systems with simulant agent. Any tests conducted at WADC would not have had explosives or agents but may have had limited amounts of simulants. It is not expected that any residual or buried items would result from these test activities at WPAFB.
- Rapid decontamination techniques for removal of BW agents from aircraft by use of ethylene oxide-Freon mix were tested at WADC in January 1955. The BW agent was the simulant, *B. globigii*. It is not expected that any residual or buried items would result from these test activities at WPAFB. A similar test to remove CW contamination in a B-29 was scheduled for DPG.
- In July 1955 the BW/CW munitions and ancillary equipment program was transferred from the Armaments Lab to the AFAC, Eglin AFB. While this reorganization severely limited the type of tests that would be conducted at WPAFB, more importantly it significantly reduced the probability that any significant amount of munition or agent could be buried at WPAFB.
- In July 1964 a 50-lb. container of GB nerve agent was transferred from WPAFB to the Newport Chemical Activity, Indiana, for disposal. A second 50-lb. container of GB was

transferred on 12 December 1964 from WPAFB to the Newport Chemical Activity, Indiana, for disposal. A record search for the source of the GB was not successful. It is important to note that the proper procedures for the disposal of GB were followed. The most important observation is that the probability of GB being placed in a land fill at WPAFB rather than having been disposed of at an approved disposal site is extremely low. The containers of GB probably had the agent sealed in small glass ampoules for use in laboratory work.

- On 1 August 1968, ASD/ASJB was transferred to the ADTC, Eglin AFB. All activities at WPAFB ceased on 28 August 1968 with resumption of the activities on 3 September 1968 at Eglin AFB, Florida.
- CAIS have been recovered from three Ohio locations--Columbus, Lockbourne AFB, and Newark. There is no indication of the presence of CAIS at WPAFB in the time frame of interest.
- Burial Site 4 is located in Areas A and C along a narrow, wooded stretch of Marl Road. The site was identified on a base map dated July 1945. At one time a temporary chemical warfare structure, believed to have been used for tear gas training, was thought to have been located near the site. No information exists to verify that such a structure was ever associated with the site. No detection of any CW agent residues at the site has been reported. It has been determined that no significant risk or threat to the public health and the environment exists and that no further action is required.
- Landfill 12 received chemicals from the research laboratories in Area B and from Areas A and C. Excavation of the site recovered 1,946 containers and 31 compressed gas cylinders. Three of the containers contained residual phosgene. The phosgene was obtained from a commercial source and in all probability was used in a commercial manner at one of the laboratories. Phosgene is extensively used commercially in organic synthesis and in the manufacture of herbicides, insecticides, synthetic foams, resins, and polymers. The chemicals were characterized on-site and prepared for off-site disposal.
- Munition Burial Site 1 was discovered in November 1995 during the excavation of a trench. The items were identified as M-114 BW bombs, filled with agent *Brucella suis*, and having inert bursters and fuzes. The M-33 cluster components were identified from stencil markings on the end plates. The items were identified as part of the "Operation White

Floor" project, managed by the Special Weapons Section of the Armament Laboratory, WADC. The project ran from June to October 1954. The agent had been sterilized prior to burial at the close of the project. The sterilization of the agent and burial of the munitions was included in the test plan for the project. With inert fuzes and bursters and sterilized BW agent, none of the debris buried at the site posed a threat or hazard to personnel.

No other projects were found that would have resulted in the munitions being buried on WPAFB.

Hill AFB, Utah

Background

Hill Field⁷¹

A 386-acre site east of Ogden Arsenal was purchased by the Ogden Chamber of Commerce and donated to the federal government in March 1938 for an air base and depot. Ogden Air Depot was selected as one of the principal air logistical supply points serving the West Coast. The major activities included receiving, storing and supplying air materiel, and maintaining and repairing aircraft. The Supplemental Military Appropriations Act of 1940, approved 1 July 1939, provided \$11.5 million to develop the Ogden Air Depot into a major logistical facility. In December 1939 the airfield was designated as Hill Field. Over the next two years buildings were constructed for aircraft repair, storage and disbursement of parts and other supplies, and an engineering department for installation, service, and repair work. Two 7,500- by 150-foot runways and taxiways were in service by the end of 1940, and the final two runways were completed by September 1941.

An Engine Repair Shop Building, completed in 1941, provided facilities for the complete disassembly, overhaul, and reassembly of aircraft engines. The repaired engines were checked in an engine test building. A second engine test building was completed in December 1942. The complex of four hangars, Bldg. 225, completed in 1942 and 1943, was important to the repair of the B-24 "Liberator" bombers. Other rehabilitated aircraft types included the B-17, P-61, P-47, and A-20. In 1942 a sub-depot was established at Wendover Field, Utah. Wendover Field was a training base for bomber groups--eight B-17 groups trained there through January 1944. Late in the war Wendover Field was the site for the training of the B-29 bomber group for atomic warfare. A complex of five warehouses with 1.2 million square feet was completed in the 1944-1945 time frame.

By 1947 over 400 trainers, 144 B-29s, and 700 A-26 attack bombers had been sent to Hill, then designated as OOAMA, for storage.

⁷¹ From Arms to Aircraft, A Brief History of Hill Air Force Base, September, 1996.

The Army Air Forces became the USAF on 18 September 1947 and on 5 February 1948 Hill Field was designated Hill AFB. In 1951 Hill AFB was assigned worldwide USAF responsibility for air munitions and explosive ordinance disposal. The Ammunitions Supply Squadrons were activated, assigned, and moved to Hill's jurisdictional and operational control. The lack of facilities for the ammunition work required assignment and actual work at Army ordinance depots at Tooele Ordnance Depot (now TEAD-N) or at Pueblo Ordnance Depot, Colorado. The air munitions for Hill AFB were actually stored at TEAD-N; air munitions personnel were assigned to TEAD-N as well. The 2949th Support Group⁷² mission was to operate under the administration of the TEAD-N Base Executive and, under technical direction of the Personnel and Administration Office, would act as a carrying vehicle for military personnel providing staff supervision and support to the ammunitions supply squadron. The 2949th Support Group, located at Tooele Ordnance Depot, was responsible for the 25th, 29th, 30th, 75th, and 85th Ammunition Supply Squadrons which were all located at TEAD-N.

Training in the field of munitions and explosives consisted of academic and on-the-job training. An 81-day indoctrination training course and a 120-day refresher course was held at a munition school at TEAD-N. The indoctrination course taught at TEAD-N and Pueblo was to prepare airmen for advancement to the position of Apprentice Munitions Specialist and Senior Munitions Specialist. The course had 486 total academic hours with 24 hours for chemical agents. Academic CW munitions training was supplemented by assigning personnel on temporary duty to the Rocky Mountain Arsenal, Colorado, for a five-week course in all phases of chemical explosives and operations.

The EOD function came to Hill in November 1953 with a detachment from the 1st EOD Squadron, WPAFB, Ohio. In May 1954 it was replaced by Det. 3 of the 2700th EOD Squadron, WPAFB.

In August 1955 the 2949th support group and ammunitions supply squadrons were transferred from TEAD-N to Hill AFB. In July 1955 the 2700th EOD Squadron was relieved of its assignment to AMC, WPAFB, and reassigned to OOAMA. With this change OOAMA was the

⁷² Organizational History of the Ogden Air Materiel Area, 1 July-31 December 1952, Installment XXIV, Vol I Text.

sole agent for the USAF in the ZI to perform reconnaissance, detection, recovery, field evaluation, and safe disposal of all US and overseas unexploded ordinance and explosives, including special weapon and BW/CW weapons.

Ogden Arsenal^{73, 74}

At the end of WW I the USA Ordnance Department (OD) had a large amount of surplus ammunition that required distribution and storage. The OD planned for about 15% of the ammunition to be stored where it could be easily shipped to the West Coast. The present site of the Ogden Arsenal was selected primarily because of the availability of five railway lines, low-priced land that was practically level for one square mile, seven miles away from the nearest city (Ogden), and a reasonable water supply. The tract of land purchased in 1920 was one mile wide and two miles long (approximately 1,500 acres) and is located in what is now the northwest corner of Hill AFB. Thirty-five standard ammunition magazines, each 220 by 50 feet, were built with 11 other permanent buildings, railroad track and roads, walks and fencing, a water supply, and a sewer and water system by the end of 1923.

The Arsenal was dormant for the period of 1923 to 1938 after being placed in inactive status and used as a general storage depot. In March of 1926 a Technical Sergeant, OD, assumed command of the post for nine years.

In July 1935, the State of Utah Works Project Administration was allotted \$300,000 for the construction of new buildings and other improvements. An additional 4,265 acres was offered to the government with an option to buy. The name was changed to Ogden Ordnance Depot (OOD) and a Captain relieved the Sergeant to become the Commanding Officer of OOD in December 1935.

During the WW II period (1939–1945) the OOD was modernized as required for its expanded mission. The new mission included the manufacture and loading of explosives into bombs, shells and other munitions, and the stocking and distribution of motorized and related equipment in addition to the mission of ordinance storage. This led to a large expansion in

⁷³ Ogden Arsenal History, June 1920–1943.

Ordinance operations. New warehouses stored a million empty practice bombs and inert components for 36-mm ammunition. In 1942 OOD was designated as a Motor Base for ready storage of combat vehicles--tanks, half-tracks, and trucks were parked outside and maintained prior to shipment overseas. OOD also received and rehabilitated combat-damaged small arms, mortars, machine guns, and artillery pieces to serviceable condition. At the end of the war in 1945, the Ogden Arsenal reverted to serve primarily as a collection depot for reserve materiel. Tooele Ordinance Depot provided oversight and administrative functions for the arsenal.

In July 1950 following outbreak of the Korean War, the Ordinance Department removed the Ogden Arsenal from supervision by the Tooele Depot. The arsenal assembly lines were reopened for the manufacture of 60 mm and 81 mm mortar rounds. During the Korean Conflict (1950–1953), the arsenal produced small armaments, grenades, and tracer ammunition.

As early as 1941 it had been recognized that the Hill Field, Ogden-Salt Lake City highway, and farm and orchard land hemmed in the Ogden Arsenal, leaving no means of enlarging the Ogden Arsenal facility. Subsequently, the Army acquired 20,000 acres near Tooele, Utah, that became the TEAD-N. In 1955 the new role of Hill AFB required a major expansion of the base. The Ogden Arsenal had been undergoing a significant decrease in its activities. Negotiations between the Army and the Air Force resulted in the Army turning over the arsenal grounds to the Air Force. On 1 April 1955 the functions of the Ogden Arsenal were transferred to TEAD-N. Some of the routine operations were moved to TEAD-N and the manufacturing facilities were transferred to other arsenals. The Army surveyed the arsenal property and removed any remaining explosives and munitions. The physical plant and facilities of the Ogden Arsenal were then transferred to the Ogden Air Materiel Area at Hill AFB. As part of the OOAMA, operations with the Ogden Arsenal continued to include the ammunition storage and handling but also added missile storage, testing, maintenance and repair, aircraft and vehicle maintenance, and testing processes. The arsenal was modified to accommodate the storage of guided missiles, rockets, and components. The Air Force also developed areas within the newly acquired arsenal grounds for testing the items.

⁷⁴ From Arms to Aircraft, A Brief History of Hill Air Force Base, September, 1996.

Utah Test and Training Range

The UTTR complex is divided into a north area and south area.⁷⁵ The UTTR-North Range (Hill Air Force Range) consists of two tracts, each 12 x 24 miles comprising 366,000 acres. The UTTR-South Range (Wendover Air Force Range) consists of a 20 x 40-mile area comprising 590,000 acres. The DPG adjoins the South range with a 20 x 58-mile area comprising 852,000 acres. These three range complexes, on Department of Defense owned land areas, control and occupy approximately 1,800,000 acres. Additionally, Wendover Air Force Range, R6405, is located south of DPG and is limited to airspace only with no DoD-owned land underneath. There are approximately 11 million acres of combined range airspace.

The Wendover Air Force Base had its beginning with expansion of the Army Air Force in 1939.⁷⁶ Bombing and gunnery ranges were needed. Wendover was selected as one of the three such locations and construction was started on November 4, 1940. In the spring of 1941 four runways were paved and four 63-man barracks with all the necessary support buildings were built. Activation of a bombing and gunnery range detachment occurred on 20 July 1941. In March 1942 the Air Corps activated an air base at Wendover. It served as a site for R&D of guided missiles, pilotless aircraft, and remote controlled bombers. It also served as a training site for heavy bomber crews of World War II; B-17, B-21, and B-29 groups trained at Wendover. By late 1943, there were 2,000 civilians and 17,500 military personnel at Wendover. By early 1945, the 1027th Air Materiel Squadron procured and issued all Air Corps, Quartermaster, Signal, Chemical and Ordnance supplies for the unit, including food, clothing, and ammunition. The 390th Air Service Group trained the unit in combat procedures, CW, first aid, and use of firearms and camouflage techniques. The 509th Composite Group, flying B-29s, trained at Wendover for nine months. In May 1945 the 509th Group left Wendover for Tinian Island to fly bombing missions over Japan. On 6 August 1945 the 509th delivered the atomic bombs on Hiroshima and Nagasaki.

⁷⁵ Five-Year Utilization/Resource Requirements Plan for AF Hill/Wendover Ranges and Joint Use of Army DPG, October 1976, Ogden ALC Range Management Office, Hill AFB, Utah.

⁷⁶ Excerpt from OOAMA Environmental Assessment for AFLC Test Range Complex, Hill AFB, 18 February 1972, prepared by 2849th ABG/DE.

On 2 September 1945 the Army Air Forces activated a test facility at Wendover Army Air Base to evaluate captured World War II bombs and rocket systems and performed special tests with experimental items. From 1950-1954 the Wendover Base was maintained in a stand-by basis. Beginning in July 1954 the 461st Bombardment Wing of TAC, using B-26's, practiced operational techniques in rocketry, bombing, gunnery, armed reconnaissance, etc. In October 1954, under TAC jurisdiction, the base was reactivated as a gunnery and mobility staging area. Aircraft using the base included B-57's, F-100's, and F-102's.

On 1 January 1958 the Air Force transferred jurisdiction, control, and accountability of Wendover AFB and certain off-base installations to OOAMA. Included in the transfer was the Newfoundland Mountain Range R-358. On 31 January 1958 the Wendover base was renamed Wendover Air Force Auxiliary Field. On 1 October 1958 USAF transferred to OOAMA jurisdiction of Wendover Weapons Range R-259, an area south and east of Wendover AFAF (R-508). On 13 January 1959 the Department of Interior transferred from USAF to the USA (DPG) jurisdiction of the lower part of Range R-259, approximately 594,000 acres of land. Hill AFB retained control of the upper portion of R-259, approximately 376,000 acres of land, and the air space control of the 1,460,000 acres. On 11 February 1960 the Federal Aviation Agency redesignated the northern half of R-259 as R-259A, Wendover Weapons Range. On 1 October 1960 AMC redesignated the Newfoundland Mountain Range (R-258) as Hill Air Force Range in the Wendover Weapons Range Complex. The Hill Air Force Range is now designated as the UTTR-North Range; the Wendover Air Force Range is now designated as the UTTR-South Range.

In March 1975 as the lead Air Force Command, AFLC was instructed by CSAF/RDP to develop range management procedures and provide a range improvement program. On 24 July 1974 AFLC and AFSC agreed that Ogden ALC would remain range manager and that range modifications and improvements should not be constrained. AFLC/OO-ALC would assume total management and funding obligation responsibility for the Hill, Wendover, and Dugway Range Operation and Maintenance in FY77 and range improvements in FY78. In October 1975 a Memorandum of Agreement was finalized between AFLC/AFSC and the Army Test and Evaluation Command concerning the common/joint use of the three-range complex.

On 9 July 1976 the Wendover Air Force Auxiliary Field was conveyed by quitclaim deed to the town of Wendover and is now the Wendover Municipal Airport.

Discussion

Chemical Staff Organization

The organizational charts, 1943 through 1945, for Hill Field and the Ogden Air Service Command were reviewed for the presence of Chemical Officers on the staff:

- The Office of the Commander, Hill Field, lists a Chemical Officer in the Special Staff and Services as of 10 February 1943 through 15 September 1944.
- Ogden Air Depot, Control Area Command, lists a Chemical Section reporting to the Commanding General as of 15 February 1943.
- Supply Division, Ogden Air Service Command lists a Chemical Warfare Section reporting to the Chief, Supply Division as of 29 November 1943.
- The Ogden Air Service Command organizational chart listed a Chemical Warfare Officer in the Special Staff as of 13 December 1943 through 29 January 1945. The Ogden Air Service Command organizational chart did not indicate a Chemical Officer on staff as of 28 September 1945.

The Chemical Section of the OASC was organized and established on 19 February 1943. Continued liaison was carried on between this section, the Command Section, and the Adjutant General Section relative to the setting up of the CW Training and Supply program. In November 1943 the section was designated a staff section with one Chemical Officer. The Chemical Personnel and Training Officer was transferred to the Personnel and Training Division; the Chemical Supply Officer was transferred to the Supply Division. The OASC Chemical Officer became the Chemical Officer for both the OASC and Base Chemical Warfare Officer. The Base CW Officer assignment was an additional duty.

Chemical Warfare Training

Mass CW demonstrations were witnessed by 300-800 officers and enlisted men at Hill AFB. These demonstrations were planned to show four phases of the defense against CW attack: orientation, decontamination, incendiaries, and use of the M4 decontamination apparatus. The

orientation phase introduced the munitions used to disperse CW agents; the type of CW agents and their physiological effects; possibilities of CW agents being used; and the necessity of preparedness. The decontamination phase introduced protective clothing, field decontamination of clothing, shell craters, buildings, weapons, and aircraft, and field first aid. The incendiary phase showed the action of the various types and the procedures of removal of an incendiary from a building.

In each squadron or similar unit an officer is assigned the duties of a Unit Gas Officer with assistance from two gas noncommissioned officers (NCOs). The Unit Gas Officer was responsible to his Commanding Officer for the training of the unit in all matters of CW defense. Unit Gas Officers received a 52-hour course and Unit NCO's received a 42-hour course of training in the defense against chemical attack. The Base Chemical Officer and the Chemical Section of the Base Headquarters (HQ) and Air Base Squadron was charged with the responsibilities of the supply of CW equipment and the supervision of the CW training. The Base CW Office had charge of all CW property on the base but the storage area was detached from the actual area given to the warehousing of CW supplies. In time a CW warehouse was assigned to the Base CW Officer for storage and maintenance of the CW equipment. A CW gas chamber was built and completed in September 1943. The construction of a CW magazine for the storage of CW munitions was completed in September 1943. A CW Storage Building, Bldg. 10 (now Bldg. 276) was completed in January 1944.

The Hillfielder, 9 June 1943, published a report that on Saturday, May 29, following a personnel inspection, the Commanding Officer took the men to the field for a gas mask drill and lecture and exposed them to the smell of mustard (H) agent for their first experience with mustard.

The Hillfielder, 1 September 1943, published a two-column article on the importance of first aid for gas (CW) casualties with a list of simple rules that all individuals must know.

The Hillfielder, 8 December 1943, published an article about the authorization to build a CW equipment warehouse. The building was to be located just west of the base schools and hangars and south of the plant equipment building. The building was reported to be 15 × 132 feet in size. The Chemical Warfare Equipment Warehouse was identified on old base maps as Bldg. 10 (currently Bldg. 276). The real estate records for Bldg. 10 gives the area as

1,250 square feet with a 1:2 ratio of width to length. These numbers would give Bldg. 10 dimensions of 25 x 50 feet.

The Hillfielder, 17 May 1944, published an article describing the Base Chemical Warfare Section being moved to a three-in-one headquarters building, one block east of the clockhouse with CW offices, schoolrooms, and warehouse consolidated under one roof. Regular classes were held in the classrooms and in the field where actual tests of various gases (CW) were conducted so that students would learn to identify the CW agents. A modern gas chamber belonging to the section could use chlorine as well as tear gas and has been used by most of the trainees.

The Hillfielder, 2 August 1944, reports the OASC fire department personnel and the auxiliary military patrolmen (AMP) would begin instruction in general CW procedures. Firemen were to receive training in decontamination and the extinguishing of incendiaries and the AMPs in the use of tear gas and the detection of gas. Each man will receive four hours of instruction.

The Hillfielder, 17 May 1945, published an article on the CW instruction given the air service squadrons stationed at Hill Field. The chemical section conducted training for anti-incendiary squads, decontamination squads, gas sentinels, gas chamber exercises, and overall basic training against chemical attack for all personnel in the squadrons.

Instructions from HQ, AAF directed additional training in CW be given to all military personnel. The courses offered were Base CW courses, Decontamination Squad courses, Incendiary Squad courses, and Unit Gas Officer course (all 10 hours each); the Unit Gas NCO course (40 hours), the Decontamination Apparatus Operator courses (20 hours), the Special Guard courses for Service Command Units (12 hours), and a special course for the Auxiliary Military Police and Auxiliary Fire Department, Hill Field (4 hours per week).⁷⁷

In 1944, an Army Air Force center for CW training was activated at Barksdale Field, Louisiana.⁷⁸ In 1945 the center for CW training was moved to Buckley Field, Colorado. The instructional

⁷⁷ Ogden Air Depot Control Area Command, Ogden Air Service Command, 1 February 1943–1 July 1944.

⁷⁸ Letter, D. Kendoziora, OOALC/EMR to Montgomery Watson, Salt Lake City, Utah, 11 November 1994.

program, designed for all AAF chemical specialists, included a CW munitions and materiel course, and courses for CW technicians, decontamination-equipment operators, and CW agent handlers.

The mission of the Army Chemical Warfare Service (CWS) in the AAF was to provide for defense against CW attack; proffer recommendations on the offensive use of CW agents and munitions; and supply CW agent, munitions, and CW equipment. Specialized CW units were organized and trained--Chemical Air Operations Companies to fill and decontaminate aircraft spray tanks; chemical Depot Companies (Aviation) to operate CW ammunition depots; and Chemical Maintenance Companies (Aviation) for major repair and salvage of CW equipment. None of these type units were ever stationed at Hill AFB.

Training Procedures

Gas mask training generally involved tests in two different chambers—a tear gas chamber and chlorine chamber.⁷⁹ The trainee donned the mask prior to entering the tear gas chamber and after a period of time removed the mask and was exposed to the tear gas. The NCO in charge insured that each trainee inhaled the tear gas prior to exiting the chamber. The chlorine chamber was entered with the mask off. The trainee donned and cleared the mask, thereby gaining confidence in the protection offered by the mask. Following the gas chamber experience, standing outside in a breeze was sufficient to quickly remove the CW agent from the trainee's clothing and skin.

The location of the CW gas chamber has not been determined, nor has the location of the CW munitions magazine, nor the location of the field training area where CW agents were released in the air. Considering the location of Bldg. 10 and the necessity for a reasonably large isolated area for the open-air training, a logical area would be the site of the present Hill AFB golf course located east of the runways and northeast of Bldg. 10.

⁷⁹ Telecommunication with Sgt Maj George Murray, USACmIC (ret'd), USA Chemical Corps Museum, Ft. McClellan, Alabama.

Organizations

Throughout the history of OOAMA, two organizations have been assigned unique missions in the BW/CW USAF programs on a continuing basis--the air munitions group and the explosive ordinance disposal group. While the organizational structure seemed to be in a constant state of flux, the BW/CW missions always remained within these two organizations. The following discussion of the developing missions and functions for the air munitions group and the explosive ordinance disposal group is in a reasonable chronological order with minor deviations.

In February 1953 Air Research and Development Command (ARDC), Baltimore, Maryland, organized the 6750th Chemical Test Squadron,⁸⁰ with administrative and logistical support from the Air Depot Wing at Hill AFB, Utah. The mission of the Detachment was to support tests of Air Force BW/CW munitions, the development of which was contracted to the Army Chemical Corps. Within one year the 6750th was reassigned with a permanent change of station to DPG, Utah. This reassignment indicates that the BW/CW tests were all conducted at DPG (80 miles from Hill AFB). The fate of the 6750th could not be determined nor could any contribution made by the unit to the USAF BW/CW programs be established.

In early 1954 the mission statement for the air munitions units were expanded to include:

"conduct and supervise training and operations of appropriate organizations to insure the development and maintenance of a capability to store, handle, transport, inspect, renovate and dispose of Air Force ammunition (excluding nuclear), but including BW-CW munitions in consonance with USAF operational logistics concepts".

This mission statement remained essentially intact in the years following.

A Project Order to Pine Bluff Arsenal, Arkansas, dated 19 January 1955,⁸¹ requested the filling and final assembly of one Cluster, Bomb, 500 lb. M-33; with component bomb M-114 (water-filled); burster M29 and fuze M174 (both inert); Fin, 500 lb.; Cluster M7; and Cartridge, Ignition

⁸⁰ Organizational-Functional History of the Ogden Air Materiel Area, 1 January-30 June 1953, Installment XXV, HQ ARDC, General Orders No. 15, dated 6 February 1953.

⁸¹ Project Order No. 296-53F, dated 19 January 1955, from HQ CmlC Materiel Command to Pine Bluff Arsenal, Arkansas.

M2 (inert). The item was shipped to the Commanding Officer, AF 903 DSO, Hill AFB, Utah. The item posed no explosive or biological agent hazard. The purpose for presence of this M-33 cluster at Hill AFB could not be determined, nor could the identity of the office receiving the cluster be determined. The cluster could have been used in the EOD and/or air munitions training programs or could have been intended for a display. The records were not complete enough to develop any specific conclusions. This was not an unusual request for items related to the M-33 biological bomb cluster.

The 2700th EOD Squadron conducted proficiency tests at Wendover AFB, Utah, from July 1955 through December 1957.⁸² At 0700 to 0800 hours on the fourth day of the EOD proficiency tests, a BW bomb M-114, with agent, nose fuze M173, armed, was used in a demilitarization exercise. The dates and frequency of these tests were not specified; only the proficiency tests program and exercise description were available. The M174 was the standard fuze for the M-114, so perhaps the M173 designation was a typographical error. The description in the proficiency test implied that the M-114 was filled with agent. The useful life of the agent fill in the M-114 was such that without cold storage the shelf life would be a matter of days and with cold storage would have a shelf life of weeks. If a live agent fill was requested for the proficiency test, it would be necessary to have frequent less-than-cluster size shipments (refrigerated) from the production plant at Pine Bluff Arsenal, Arkansas, to OOAMA. No documentation exists which supports the occurrence of such frequent shipments. The fill was quite possibly water rather than BW agent. The disposition of the M-114 residual was not addressed in the proficiency test document. The demilitarization of the M-114 and subsequent EOD method of disposal would eliminate any residual artifacts that would indicate that a BW munition was or had been present.

Following the M-114 BW bomb exercise. at 0900–0930 a bomb, gas persistent, 115 lb, M70A1, inert, fuze nose, M153 dud, fired, was used in the demilitarization exercise. The M70 bomb was usually filled with mustard (H), which is described as a “gas persistent.” The documentation did not specifically identify the CW agent present as to whether the bomb was physically filled with H agent or if it was a simulant. There is no indication that any CW agent

⁸² Historical Report, 2700th EOD Squadron, Hill AFB, Utah, 1 July 1955-31 December 1957.

was released, recovered, or decontaminated and disposed. The disposition of the M70 residual was not addressed in the proficiency test document. The normal procedure was to police the area and remove any residue for proper disposal. There are no shipping records to indicate the receipt of M70 mustard-filled bombs at Hill AFB for use by the EOD.

In the first half of 1956 OOAMA⁸³ was assigned prime maintenance responsibilities. Added during this period were a large number of FSC that included class 1365 (CW agents) and class 1380 (BW agents). All items in classes 1305-1395 were included in AF Class 39-B ammunition and ammunition maintenance parts. The OOAMA prime supply responsibility also included, among other things, the 39-A (biological weapons).

As an outgrowth of OOAMA's responsibility for ammunition, plans were made in late 1956 for OOAMA's worldwide EOD responsibilities.⁸⁴ The 2949th Support Group and the 25th and 29th Ammunition Supply Squadrons were transferred from Tooele Ordnance Department to OOAMA during the period 1 July-31 December 1956. Their mission was to control and supervise unit training of AF personnel in ammunition storage and handling techniques. The emerging organization was given a long list of duties and functions. One duty was to provide custody over the AF Ammunition Display Center. In addition to the responsibilities for the AF ammunition storage, handling, maintenance, etc., the group was also responsible for on-the-job training for ammunition units to be deployed to Outside Continental United States (OCONUS) sites. The Ammunition Service Office directed the Organization and Manpower Division to study the utilization of the West Area ammunition complex (formerly Ogden Arsenal). Of the 12 functions developed, one was directed to the conduct of BW/CW storage tests. Buildings equipped with temperature-controlled storage chambers would be required for conduct of the BW/CW tests. There is no evidence that this program or the necessary facilities ever came into being.

⁸³ History of the OOAMA, 1 January-30 June 1956.

⁸⁴ History of the OOAMA, 1 July-31 December 1956.

Representatives from Hill AFB visited the Munitions Development Laboratory, Air Proving Ground Center, Eglin AFB, Florida, June 1958,⁸⁵ to consult on recommendations that in-service engineering responsibilities of items presently under development and items to be developed be transferred to AMC at the time that the Form 81 for the item was approved. It was recommended that the Air Force Ammunition Services Office at OOAMA assume in-service engineering responsibility for all items considered to be effective 1 January 1959. Included in the item list is the Bomb, Cluster, Biological, M133; the cluster fin assembly, M7; and detonating cord. The M153 tail fin fuzes for the M7 are not separately identified in the item list.

In FY1961 OOAMA was the USAF's sole worldwide manager of FSC 1300, ammunition and explosives.⁸⁶ OOAMA carried inventory management and procurement responsibilities for classes 1365, CW agents, and 1380, BW agents among many other classes. The air munitions mission included surveillance, safety, disposal and range clearance. The mission also included training of air munitions and explosive ordinance disposal organizations to insure development; and continuance of a capability to store, handle, transport, escort, inspect, renovate and dispose of AF ammunition (excluding nuclear), but including BW/CW munitions as called for in USAF and AFLC operational plans and concepts.

Over the next few years the Air Munitions Wing and the EOD underwent regular reorganizations but there was little or no change in the mission for the BW/CW program.

On 21 October 1965 AFLC designated OOAMA as the Command Program Manager for the Air Force Chemical and Biological Weapons Program.⁸⁷ OOAMA

"would integrate the actions of all AF agencies participating in this program and:
(1) represent AFLC with other government and non-government agencies;
(2) procure and provide C-B weapons; procure and provide or assure procurement and availability of peculiar dispensing and handling hardware to sustain the capabilities indicated in the PS series documents; (3) provide

⁸⁵ Memo To: Maj J. Heatherly, Ch, Programs Office, Munitions Development Laboratory, APGC, Eglin AFB, Florida.

⁸⁶ History of OOAMA, Hill AFB, Utah, FY1961, Vol. I, Text.

⁸⁷ HQ AFLC, WPAFB, OH, Letter No. 23-130, Subject: Designation of Command Program Manager for Chemical and Biological Weapons, dated 21 October 1965.

guidance and technical assistance on all safety matters pertaining to agents and weapons; (4) assure the development of a capability during acquisition phase of weapons, agents, and equipment in order to accept engineering responsibilities from AFSC; (5) assure that a command or other source of competence on all matters pertaining to BW/CW weapons and peculiar equipment is provided; (6) procedures contained in the approved OOAMA Chemical and Biological Weapons Support Plan will govern."

Specific responsibilities charged to the OOAMA's Commander were to act as AFLC program manager for the Air Force chemical and biological weapons program, including responsibility for chemical, biological technical escort.⁸⁸

On 9 November 1967 OOAMA became the inventory management point for the Shipping Container, Biological Weapons (Interim), CNU-106/E, and Shipping Container, Biological Weapons, CNU-106/E in FSC 8140.

In FY 1969 OOAMA was responsible for developing and disseminating technical data and procedures for chemical and biological decontamination.⁸⁹ Warner Robins AMA was the manager for items FSC 4230, Decontamination and Impregnating Equipment. San Antonio AMA was responsible for developing and disseminating technical data and procedures on decontamination and for radiological decontamination.

OOAMA's BW Munitions Mission

The missions assigned to OOAMA for BW weapons appear at first glance to be all encompassing. It is necessary to review the DoD BW weapons delegation of responsibilities in order to clarify the OOAMA BW mission.

The Army was assigned primary responsibility for the R&D of BW munitions which, in turn, it delegated to the Army Chemical Corps (CmIC).⁹⁰ The Air Force determined requirements and military characteristics; provided funding for end items; monitored the research and

⁸⁸ *ibid.*, pages 16-17.

⁸⁹ History of OOAMA, FY 1969, Installment 47, Vol. I, Text.

⁹⁰ History of Air Force Participation in the Biological Warfare Program (1951-1954) Chapter VII, extracted, AF organization of BW activities.

development; developed doctrine and logistical systems; and trained its personnel. The AF delegated its R&D responsibilities to ARDC and logistic and training responsibilities to AMC. The CmlC produced the agent at its production plant and purchased munition hardware from contractors. AMC stated requirements for munitions to be purchased by the CmlC for the Air Force.

CmlC facilities provided research and testing under worldwide environmental conditions; research laboratories, pilot plants, and test chamber facilities; and agent and simulant tests. The major BW production plant was the Production Development Laboratories (PDL), Pine Bluff Arsenal, Arkansas. The PDL produced agents, filled munitions, and did surveillance on BW weapons.

ARDC delegated its R&D responsibilities to WADC, WPAFB, Ohio, and testing responsibilities to the AFAC, Eglin AFB, Florida. The Armament Laboratory, WADC, was responsible for weapons system design. The AFAC conducted Phase I through IV testing, providing aircraft and facility support. Holloman Air Development Center, New Mexico, provided support in the way of instrumented test ranges. Operational suitability testing (Phase VII) was the responsibility of the APGC, Eglin Air Force Base, Florida. The APGC, for example, participated in the M-33 cluster test drops at DPG in 1951.

The AMC Programs and Requirements Division in Supply determined requirements for each item and handled most of the procurement. It was also the ammunition stock control point for the Air Force. By terms of agreement, most AF ammunition was stored and maintained by the Army. By DoD directive, the Army stored all Air Force ammunition in the ZI and shipped direct to the consumer.

An Air Force regulation dated 17 April 1953 assigned the Army CmlC the responsibility for transportation, depot storage, and maintenance of biological munitions, and the CmlC erroneously assumed that this responsibility extended to OCONUS areas. A HQ USAF operating document indicated that an air depot was to support the overseas BW capability. In 1954, AMC planned to develop that capability through the establishment of the Ogden Ammunition Training Center, with special emphasis given to those functions applicable to overseas areas. Since the only BW munitions produced for use within CONUS were for tests or

storage, they never passed through Hill AFB. However, the AF still had to have a developed maintenance capability for OCONUS deployment.

Under the AF plan the only event that would place BW munitions at OOAMA would be the requirement to ship BW munitions to OCONUS customers. By terms of the AF operating document the depot at OOAMA would support the overseas BW capability. Thus the BW munitions would be produced by PBA, shipped to OOAMA, and then further processed by OOAMA to OCONUS customers. The only BW munitions that would be shipped to OOAMA would be those standardized or type classified, which excludes all munitions in development. Shipments, depot storage, and maintenance of BW munitions for customers within CONUS would still be the responsibility of the Army.

Interservice Support Agreement

An Interservice Support Agreement (ISA) between Hill AFB and DTC, Ft. Douglas, Utah, was entered into effective 1 January 1969.⁹¹ The purpose of this agreement was to set forth the procedures and responsibilities of Hill AFB and DTC with respect to the disposal of Hill AFB CB munitions by DTC at the DPG CB Disposal Range. The munitions to be delivered to DTC personnel for disposal included, but were not limited to, the following: MC-1, TMU-28, BLU-52B, BLU-52AB, BLU-52BB, AB45Y-2 (2 agent possibility), AB45Y-1 (4 agent possibility), CBU-15, CBU-16, CBU-18, and CBU-30. The estimated monthly reimbursable cost was funded at \$100.00. Hill AFB would budget and fund for CB disposal services provided by DTC. The 11 munitions listed for disposal were chemical munitions. Since the list was not limited to those munitions specified in the ISA, biological munitions could be added to the list. There was no indication that biological munitions were ever added to the list for disposal. There is no indication that the ISA was ever exercised for the transfer of CW munitions to DPG.

USA BW Test Program Locations

The USA activities in BW test program activity from 1942-1977 have been extensively reviewed and documented by category of test.⁹² The categories are: antipersonnel, biological simulants,

⁹¹ History of OOAMA, FY 1969; Interservice Service Agreement, effective date 1 January 1969.

⁹² US Army Activities in the United States Biological Warfare Programs 1942-1977, Vol 2, Appendix IV of Annex E.

involving/not involving public domain; nonbiological simulants/air diffusion involving public domain; antipersonnel with pathogenic agents; and anticrop with pathogenic agents involving/not involving public domain. The documented tests all occurred between 1949 and 1969. As expected, a large percentage of the tests were conducted at DPG. Some of the tests were conducted at various Air Force bases, but none of the tests were conducted at Hill AFB.

History of Chemical Weapons Movement from 1946 to 1986⁹³

The USA TEU, Chemical-Biological Defense Command (CBDCOM), Aberdeen Proving Ground (APG), Maryland, has had the responsibility for the movement and remediation for all BW/CW agent and munitions, within CONUS, since 1943.

The TEU biological agent shipping records were reviewed.⁹⁴ The only available information was for the periods 8 January 1957-22 February 1958, 28 July 1958-23 June 1959, and 6 July 1954-8 October 1969. There was no record of TEU escorting a biological shipment subsequent to 8 October 1969. Of the 258 shipments documented, 145 are to Ft. Detrick, Maryland, 71 are to DPG, Utah, 13 are to PBA, Arkansas, and the remainder to miscellaneous sites. Based on available TEU records, there were no shipments of biological agents to Hill AFB, Utah, during the documented time periods.

The Army records on the movements of the munitions are incomplete. The records from 1942 to 1950 appear to be complete; from 1951 to 1954 only the historical summaries are available. TEU records for 1955 and 1956 have not been found although some records from the receiving facilities filled some of the gaps. The TEU reports for 1957, half of 1958, and a summary document for 1959 were reviewed. For 1960 through the first half of 1964 only limited information was available. The last half of 1964 through 1969 included the TEU historical records and was supplemented by the records of the receiving facility.

Shipments or movements of CW agents and munitions to and from Hill AFB are given in Table 2. The first shipment involves the air transport of nonspecified bombs from the

⁹³ Chemical Weapons Movement History Compilation, Office of the Program Executive Officer--Program Manager for Chemical Demilitarization, Bldg. E4585, Edgewood Area, APG, Maryland 21010.

⁹⁴ Report on Biological Operations 1977, draft, 24 January 1977.

Edgewood Arsenal (now CBDCOM) to Hill AFB in June of 1948. The second shipment in December of 1948 involves the air transport of bombs, filled with phosgene, from Hill to Edgewood. It can be surmised that the first shipment of nonspecified bombs was probably filled with phosgene, the second shipment involved the return of those bombs to the Army. The next shipment on 22 September 1966, is one bomb, filled with GB, delivered by truck from RMA to Hill AFB with a next-day return by truck from Hill to RMA. The purpose of either of these shipments or the intended use of these bombs is unknown. In all cases the number of bombs received were equal to the number returned.

The last shipment (Table 2) resulted from a May 1986 discovery by an AF EOD specialist.⁹⁵ A partially buried, seriously deteriorated bomb was found on a seldom-used road, near Eagle Bombing Range on the UTTR-North Range, more than a hundred miles from Hill AFB.⁹⁶ EOD

Table 2. Shipments of CW Munitions Hill AFB 1948--1986

From	To	Date	Cargo	Quantity	Transport
EA	Hill AFB	6/17-18/48	Bombs (ns)	1 A/C	A/C
Hill AFB	EA	12/16/48	Bombs (CG)	1 A/C	A/C
Hill AFB	EA	2/28/51	M78 Bombs (CK)	4 each	A/C
RMA	Hill AFB	9/22/66	Bomb (GB)	1 each	Truck
Hill AFB	RMA	9/23/66	Bomb (GB)	1 each	Truck
Hill AFB*	TEAD	5/20/86	Bomb (GB)**	1 each	Helicopter

*Eagle Bombing Range

**Later determined to be simulant filled w/inert explosive components.

specialists and the Army CBDCOM TEU were notified. On 20 May 1986 the TEU transported the bomb to Tooele Army Depot (TEAD) for storage and final disposition. The bomb was later transferred from TEAD to DPG. Tests conducted at DPG determined that the bomb was filled

⁹⁵ *ibid.*

⁹⁶ FAX, 14 December 1994, from ASACMLDA, ATTN: SFIL-NSZ, APG, MD to OO-ALC/EM, Hill AFB, Subject: Comments on Hill AFB memo reference bomb found on UTTR.

with simulant and had inert explosive components. The bomb was drained of the simulant fill and properly destroyed.⁹⁷

Environmental Restoration Management Action Plan

The Environmental Restoration Management Action Plan for Hill AFB was reviewed.⁹⁸ The areas of interest within the scope of this study includes Hill AFB, UTTR-North, UTTR-South, and Wendover Air Force Auxiliary Field.

Hill AFB. A rather intensive CW training program was conducted at Hill AFB from 1943 to 1945. The training that the officers and enlisted men received in the field, where they were exposed to low concentrations of various CW agents, would have generated a quantity of waste material that would have been disposed of, probably by burial. Considering that the CW Equipment Warehouse was located approximately 1.5 miles southwest of a dump (now Landfill 3 [LF-3], Operable Unit 1 [OU-1]) that was operated from 1940–1967 would make that landfill a candidate for any CW refuse. LF-3 was used as an industrial liquid and solid waste disposal site.⁹⁹ The remaining sites in OU-1 were not in operation during the time frame of the CW training program. LF-3 occupied approximately 5.5 acres in the northeastern portion of OU-1. There is some conjecture as to the burial of explosives or CW agents in LF-3. The CW agents that were available to the CW Officer for training were those that were in the CAIS. The mustard (H) and lewisite (L) were diluted to 5% concentration, the chloropicrin (PS) was diluted to 50%, and the CG was full strength. The PS and CG would evaporate in a very short time when released, and the H and L would either evaporate at a slow rate or hydrolyze rather quickly if in contact with water.

Water samples were collected at three different times, from 29 sites at LF3, LF-4, and the chemical disposal pits in OU-1.¹⁰⁰ Three different methods of analysis for explosive content of

⁹⁷ Conversation with personnel at US Army Program Manager for Chemical Demilitarization, Aberdeen Proving Ground, Aberdeen, Maryland, 18 March 1999.

⁹⁸ Environmental Restoration Management Action Plan for Hill Air Force Base, Utah, Environmental Management Directorate, OO-ALC/EM, Hill AFB, May 1998.

⁹⁹ Comprehensive Remedial Investigation, Report for Operable Unit 1, Vol.1, Hill AFB, Utah, December, 1995

¹⁰⁰ *ibid*, para. 8.10.1, p 8-30

the samples were used--the first two methods gave inconclusive results, but the third method (gas chromatography/mass spectrometry) was satisfactory and confirmed that no explosives were detected in the water samples. Any significant amounts of explosives probably would have been transferred to a UTTR area and disposed of there by EOD units.

Water samples were collected from the same 29 ground water and surface-water locations as used for the explosive sampling. Four different methodologies were used to detect the degradation products of the CW agents. No CW degradation products were detected in the water sampled, and it was concluded that CW agents were not disposed in OU-1.¹⁰¹

LF-3 was determined to be larger than was identified in the Comprehensive Remedial Investigation dated December 1995. A part of LF-4, adjacent to LF-3, was constructed using disposal methods similar to the landfill methods of LF-3 and, therefore, was redesignated as LF-3. LF-3, located in the northeastern portion of OU-1, is now approximately 14.1 acres. The area was originally a gravel pit from the early 1940s, and dumping began along the southern edge of the pit almost concurrent with its opening. LF-4 is located in the southeastern portion of OU-1 directly east and southeast of the LF-3.

A Summary Investigation of Operable Unit 1, Landfills 3 and 4, was conducted from February 1997 to October 1997 in two phases.¹⁰² One of the objectives of the investigation was the assessment of contaminants in soils, leachate, and groundwater below the landfill debris. Figure 1 is a map of Landfills 3 and 4, showing the disposal trenches. Sampling locations are shown in Figures 2 and 3.

¹⁰¹ *ibid*, para. 8.10.2.1, p 8-34

¹⁰² Landfills 3 and 4 Summary Report Operable Unit 1, Environmental Management Directorate, Hill AFB, Utah, April 1998

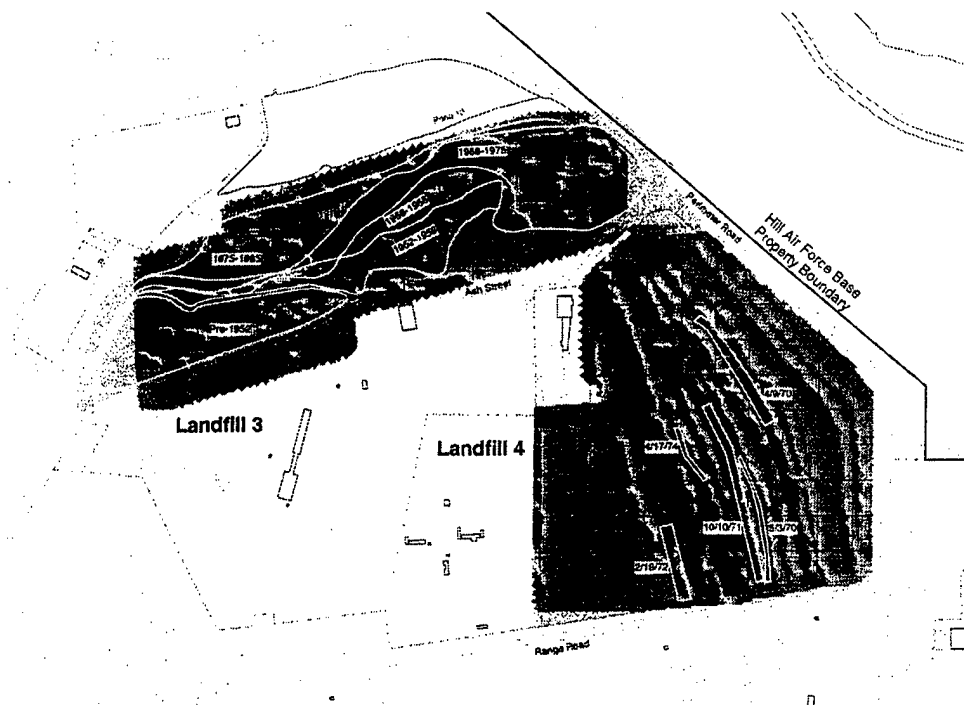


Figure 1. Map, Landfills 3 and 4, Trenches

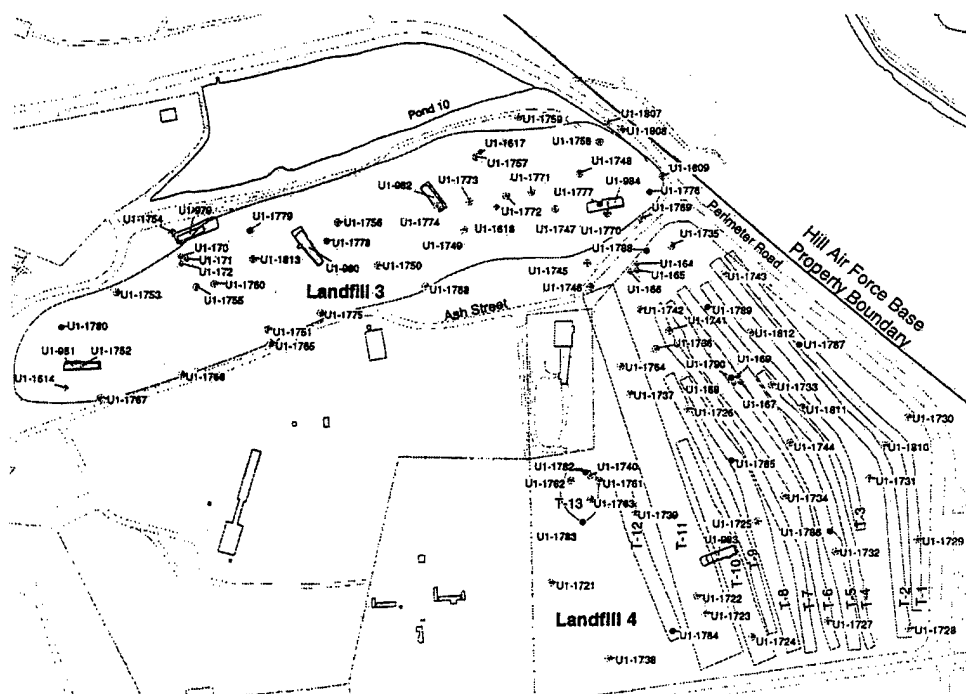


Figure 2. Map, Sampling Locations, Landfills 3 and 4, with Trenches

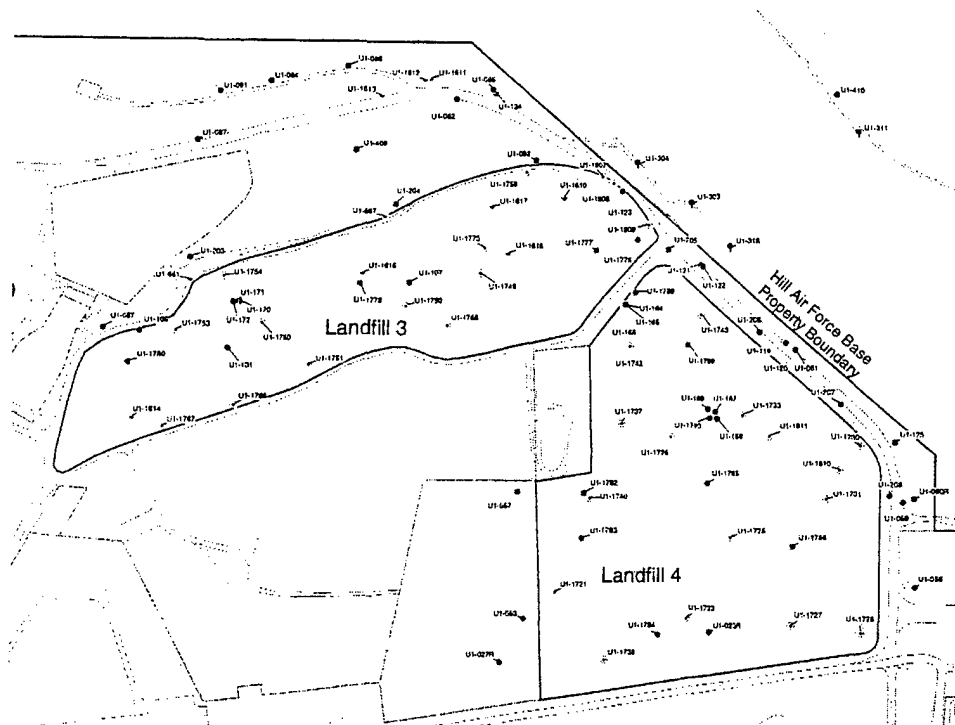


Figure 3. Sampling Locations, Landfills 3 and 4

One CW agent parameter was detected in the groundwater of the Provo Formation water-bearing zone underlying LF-3. The chemical, 1,4-oxathiane, was detected at a concentration of 4.63 µg/L in Monitoring Well U1-1617 in one of eight analyses. U1-1617 also contained high levels of VOCs, principally the 1,2-, 1,3-, and 1,4-dichlorobenzenes. The VOCs may or may not have affected the detection of the 1,4-oxathiane, a degradation product of mustard (H).

One CW agent parameter was detected in the groundwater of the Provo Formation water-bearing zone underlying LF-4. The chemical, Benzothiazole, was detected at a concentration of 14.2 µg/L in Monitoring Well U1-1790 in one of nine analyses. Benzothiazole is an impurity of mustard from the manufacturing process. There were essentially no VOCs in the water samples.

The two test sites, U1-1617 (LF-3) and U1-1790 (LF-4), are approximately 850 feet apart on a southeast to northwest orientation. The test site, U1-1617, is within that part of LF-4 that was redesignated as part of LF-3. The two test sites where CW-related chemicals were detected apparently were in use in 1966 to 1975 for LF-3 and early 1970 for LF-4. The presidential ban

on CW occurred in 1969. It is quite possible that any CW residual, such as CAIS, would have been disposed of in LF-3 and LF-4 during the period of 1969-70. If any CW munitions were at Hill AFB, it is most likely that the munitions would have either been moved to UTTR-N for destruction by the EOD units or moved to TEAD-N for storage and final disposition. The location of the disposal site for CW materiel residue from the training period of 1943-1945 is still an open issue. Only the western-most part of LF-3 was available for disposal in the 1943-1945 time frame.

UTTR-North. In UTTR-North there are 48 areas of concern (AOC) but only seven of the areas had dates of operation prior to 1970. Site 31 was an emergency fuel and ordinance drop area; site 27 tested large rocket motors; site 29 was a firing range; and sites 9, 10 and 11 were related to Open Burn/Open Detonation operations. There was no site that was identified for use with CW munitions. The more appropriate site for dropping CW bombs, filled with toxic agent, would have been at DPG. In 1986, there was a bomb found near Eagle Bombing Range that was recovered by the TEU and delivered to TEAD for disposal. The bomb, type not identified, was reported by the TEU as having a sarin (GB) fill. The bomb was transferred from TEAD to DPG. Tests conducted at DPG determined that the bomb was filled with a simulant and inert explosive components. The bomb was drained of the simulant fill and properly destroyed.¹⁰³

Wendover Air Force Auxiliary Field. An Archives Search Report for the presence of Ordnance and Explosive Waste (OEW) and Chemical Warfare Materials (CWM) at Wendover AFAF (Wendover Municipal Airport) was reviewed.

The sites specified for inspection were the Wendover Air Force Auxiliary Field, Wendover Bombing and Gunnery Range, and the Special Weapons Bombing Range Number 1. Inspection of three Wendover sites was conducted on 23 September 1993.

Chemical Warfare Materiel (CWM) Activities Wendover AFAF. The Air Force has expended CW weapons on the "active" Wendover Bombing and Gunnery range. These areas are still

¹⁰³ Conversation with personnel at US Army Program Manager for Chemical Demilitarization, Aberdeen Proving Ground, Aberdeen, Maryland, 18 Mar 99.

used for test ranges and are associated with Hill AFB. Non-CWM training continues to occur in the area immediately west of DPG on four target areas.

In a 28 February 1945 memo, the 216th AAF General Supply Officer listed authorized chemical weapons to include (10 authorized and 1½ on hand) M1 Gas ID Sets. CW training for the Wendover Army Air Base personnel was probably conducted in a manner similar to the CW training for personnel at Hill. Any residual materiel, i.e., CAIS, filters, etc., would have been disposed of, probably by burial. The base is located on the salt flats on the western edge of the Great Salt Lake Desert, and any burial site would remain visible for many years. There were no visible remains of any burial site. While it is considered unlikely that any CWM was buried in the desert, it could have been buried in the air base landfill which is still under DoD control. The base gas chamber was sold in 1957 and moved off the base. There is no indication that any CWM was found during the disassembly and removal.

Wendover Bombing and Gunnery Range. The range was a sub-post area of Wendover AFAF with facilities and equipment for training machine gunners for the bombers. The only ordinance items observed were expended .50 and .30 caliber ammunition.

Jurisdiction of the southern part of Wendover Weapons Range (R-259) (594,000 acres) was transferred to DPG for use in CW testing. DPG used the range for work on new chemical munitions and samplers on the grids checking the effectiveness of aerial tests of nerve agent or simulants. However, this area, with a potential for CW contamination, remains on active DoD-controlled bases and test ranges. CAIS have been recovered from the Wendover Bombing and Gunnery Range.¹⁰⁴

Special Weapons Bombing Range Number 1. There are two bombing targets. The eastern target has a large crater in the center. Residue of rocket motors indicated that this was used as a demolition pit around the Vietnam War period. The western target was surrounded by expended practice bombs and spotting charge containers and was heavily contaminated with

¹⁰⁴ Survey and Analysis Report Second Edition, US Army Program Manager for Chemical Demilitarization, PM for Non-Stockpile Chemical Materiel, December 1996. p. E-5.

expended .50 caliber ammunition. There was no information to indicate that the SWBR was ever used in connection with the CW program. The SWBR Number 1 is now a FUD site.

The recommendation of the Archives Search Report is that the potential for CWM contamination at Wendover Municipal Airport can be categorized as only a remote possibility.

Conclusions

- An extensive CW training course was in place at Hill Field for at least the period of 1943 through 1945. Military personnel on the base received structured and programmed training in the types of CW munitions, the types of CW agents and their effects, the use of CW agent and weapons, the use of protective clothing, how to accomplish field decontamination of clothing, shell craters, building, weapons, and aircraft, and field first aid for CW casualties. A training set of incendiary weapons and devices was included.
- The CW training was well supported with CW gas chambers for tear gas and chlorine (September 1943); a CW magazine for storage of CW munitions (September 1943); and a CW equipment storage building (January 1944).
- CAIS have been recovered from Hill Field and Wendover Bombing and Gunnery Range at Wendover. This reinforces the extent of the CW training that was ongoing at these bases.
- The 2700th EOD Squadron, assigned to Hill AFB, conducted proficiency tests at Wendover AFB at least from July 1955 through December 1957. Both BW and CW munitions were used in the demilitarization exercises. The BW bombs were most likely filled with water. The fill of the CW munitions is not known, but is believed to most likely be water filled. One shipping record was found for the shipment of an M-33 Cluster with water-filled M-114 munitions. The shipping records for CW munitions to Hill AFB (three events) show that the munitions received were also shipped back to the original source shortly after receipt.
- In the first half of 1996 OOAMA was assigned prime maintenance responsibilities, which included the BW/CW agents and weapons. One of the functions to be developed was the conduct of BW/CW storage tests in the former Ogden Arsenal. There is no evidence that this program or the necessary facilities ever came into being.

- In October 1965 OOAMA's Commander was tasked to act as AFLC program manager for the Air Force chemical and biological weapons program, including responsibility for BW/CW technical escort. By terms of agreement, most AF ammunition was stored and maintained by the Army. By DoD directive, the Army stored all Air Force ammunition in the ZI and shipped direct to the consumer. There is no indication that OOAMA ever received BW/CW munitions for storage and shipment.
- An ISA between Hill AFB and Deseret Test Center, dated 1 January 1969, provided for the disposal of Hill AFB CB munitions by DTC at the DPG CB Disposal Range. There is no indication that the ISA was ever exercised for the transfer of BW/CW munitions to DPG.
- Based on 258 available TEU records of BW agent shipments there were no shipments of BW agent/munitions to Hill AFB, Utah, during the documented time periods of 1954-1969.
- The documented tests with BW agents all occurred between 1949 and 1969. A large percentage of the tests were conducted at DPG. Some of the tests were conducted at various Air Force bases, but none of the tests were conducted at Hill AFB.
- Records confirmed shipments of CW agents and munitions to and from Hill AFB. There is no evidence of quantities of CW bombs being stored or accumulated at Hill AFB. The purposes or intended use for the bombs delivered to Hill AFB and subsequently returned are unknown.
- In 1997 a Summary Investigation of Operable Unit 1, Landfills 3 and 4 was conducted to determine the contaminants in soils, leachate, and groundwater below the landfill debris. In monitoring well U1-1617, Landfill 3, the chemical 1,4-oxathiane, a hydrolysis product from mustard (H), was detected at a concentration of 4.63 µg/L. In monitoring well U1-1790, Landfill 4, the chemical benzothiazole, an impurity of mustard (H), was detected at a concentration of 14.2 µg/L.
- These specific areas of the Operable Unit 1 were in use from 1966 to 1975. The source for these chemicals that were detected in Landfills 3 and 4 are not known.
- UTTR-N has 48 areas of concern but only 7 of the areas had dates of operation prior to 1970. To date, there has been no site that has been identified for use with CW munitions.

The source of the bomb found and removed in 1986 is not known. The more appropriate site for dropping CW bombs would have been DPG.

- In 1945 Wendover Air Force Auxiliary Field had a CW training program for the base personnel. The base gas chamber was sold in 1957 and removed from the base. There is no evidence of any CW materiel on Wendover AFAF (now Wendover Municipal Airport).
- The southern part of Wendover Weapons Range (R-259) (594,000 acres) was used by DPG to conduct tests of new CW munitions. However, this area with a potential for CW contamination, remains on active DoD-controlled bases and testing ranges.
- CAIS have been recovered from the Wendover Bombing and Gunnery Range.
- The Special Weapons Bombing Range has no information to indicate that the CW program ever used the SWBR.

Arnold AFB, Tennessee

Camp Forrest, Tennessee

In 1926 a National Guard summer camp, named Camp Peay, was established on 1,040 acres of land on the outskirts of Tullahoma, Tennessee.¹⁰⁵ The land, owned by the railroads, was donated to the State of Tennessee. About 1,500 troops came to the camp for two weeks in July and August of each year.

When the war started in Europe on 1 September 1939, the US Army was ranked about 23rd in size worldwide. A committee began to select sites in the United States where an expanded military could train for war. Camp Peay was a favored site because of the similarity of the climate and topography to that of Europe, and large plats of land could be acquired cheaply for housing and training troops. In September of 1940, Camp Peay was expanded to a tent facility for 18,000 to 20,000 troops. Ten thousand acres of land adjoining the existing facility had been placed under option, and an additional 35,000 to 40,000 acres were expected to be optioned. In October 1940 the War Department decided that Camp Peay would become a major military base. Projections called for 40,000 acres of land for the camp with 13,000 acres needed immediately for initiation of construction of the buildings and training facilities. In late 1941 into early 1942, an additional 21,000 acres were acquired. The construction eventually covered about 19,000 acres, and an additional 36,000 acres was leased for an artillery range for the 155mm howitzers. The artillery range was approximately 50 miles from the camp proper. During this same period, 4,000 acres of land were leased for use as firing ranges for light artillery, mortars, machine guns, and a rifle range. At the end of January 1941 the name of Camp Peay was changed to Camp Forrest and approximately 85,000 acres had been acquired for the camp. Troops arrived at Camp Forrest in March 1941.

In July 1941 1,200 acres were leased for the construction of an airfield to include landing strip, offices, barracks, and water tower. In November 1942 the airfield was named Northern Field. The facility was used primarily to train crews for the B-24 bomber. Airborne units, stationed at Camp Forrest, also used Northern Field for training jumps.

¹⁰⁵ REVEILLE TO TAPS, Camp Forrest, Tennessee, 1940-1946, Michael R. Bradley.

Camp Forrest was built to serve 40,000 to 50,000 soldiers at a time. More than 150,000 troops trained at Camp Forrest during the peak year of 1943. Approximately 250,000 soldiers were trained there during the war years. Training facilities were available for infantry, artillery, engineering, and signal units. An elite Ranger School and a Cooks and Bakers School operated at the camp as well.

In early 1942 an alien internment camp, with housing for about 800 civilians, was constructed on 20 acres that had originally been Camp Peay. The last of the civilian aliens were transferred to Fort Lincoln, North Dakota, in May 1943. In July 1943 the facility was designated a Prisoner of War (POW) Camp. As the war progressed the number of POWs increased to over 20,000 prisoners. Including satellite camps and other camps under administrative control of Camp Forrest, more than 68,000 prisoners were interred.

In the fall of 1944 all tactical troops at Camp Forrest had been shipped out and the induction center was also closed. In November 1944 the hospital was designated a POW General Hospital and the POWs requiring medical attention began arriving. By the end of 1945 the POW hospital had provided 5,600 major operations, 21,000 X-rays, and 120,000 physical therapy treatments. Over 15,000 Camp Forrest hospital POWs had been repatriated to Europe.

Northern Field was declared surplus in November 1945. Camp Forrest was listed as inactive in February 1946 and the POW General Hospital was closed in February 1946. On May 31, 1946, Camp Forrest was declared a deactivated base under control of the War Assets Corporation. All movable goods were sold to the public in March 1946. This was followed by the moving or destruction of the nearly 3,000 buildings on Camp Forrest and Northern Field. By mid-1947 the buildings were gone and the water lines and electrical systems were dug up and sold for scrap. The only remnants of Camp Forrest were a few chimneys, building foundations, roads, and waste disposal sites.

Camp Forrest records were lost in the fire (July 12, 1973) at the National Archives Building, St. Louis, Missouri. Five hundred pages of correspondence between the base and contractors were the only Camp Forrest records surviving the fire.

Arnold Air Force Base, Tennessee

Soon after the close of Camp Forrest, the area was selected for the site of the new Air Engineering Development Center (AEDC). In 1949 Congress authorized \$100,000,000 for construction of the AEDC. The Camp Forrest site was selected because of the abundance of available land, water, electrical power, and the security achieved by virtue of its remote location. In 1951 the center was dedicated and renamed the Arnold Engineering Development Center (AEDC).¹⁰⁶

AEDC is a test organization of the Air Force Materiel Command and is managed with a contractor workforce. The AEDC Commander's staff of military and civil service employees are responsible for the overall planning, direction, scheduling, assignment and funding associated with mission requirements. Under staff surveillance, the operation and maintenance of test facilities, real property and related equipment, and utilities are accomplished by contract. The primary mission of the center is to conduct tests and simulations in aerodynamics, propulsion, and aerospace systems.

AEDC is the most advanced and largest complex of flight simulation test facilities in the world with more than 50 aerodynamic and propulsion wind tunnels, rocket and turbine engine test cells, space environmental chambers, arc heaters, ballistic ranges and other specialized units.

Discussion

One isolated instance was found that addressed the CW training received by the trainees¹⁰⁷ at Camp Forrest. A sergeant took a group of newly assigned cooks to the gas mask course to complete a phase of their training. The group strolled up to the gas tent and mulled around until called inside. A colonel approached the sergeant and gave a lecture on the proper salute and the fact that soldiers marched—they did not stroll. The gas mask course referred to was probably a short instructional and demonstration of how to fit and don the mask. This would be followed by a pass through the gas tent filled with tear gas and removing the mask prior to exiting the tent. (The same procedure was still used in the Army basic training course as late

¹⁰⁶ Camp Forrest, Office of Public Affairs Arnold Engineering Development Center, Arnold Air Force Base, Tennessee, January 28, 1998.

¹⁰⁷ Reveille To Taps, Camp Forrest, Tennessee, Michael R. Bradley, p. 60.

as 1951 during the buildup for the Korean War.) This was probably the extent of the CW training conducted at Camp Forrest for several reasons: (1) it was referred to as the gas mask course and was just that, and (2) it was stated as completing a phase of their training. Any advanced CW training would most likely be included in the training at the next assigned post or in theater prior to entry into combat. The location of the gas tent could not be determined.

A Phase I archaeological reconnaissance survey of cultural resources within the Camp Forrest area was conducted by archaeologists from the Transportation Center at the University of Tennessee-Knoxville from July 7 to August 11, 1994.¹⁰⁸ Several field procedures were used in the survey—gridding and mapping, visual examination of the project areas, pedestrian survey and general surface collections, and excavation by shovel tests. All recovered artifacts were cleaned, identified, and cataloged.

The declaration of artifacts found from the shovel tests and general surface collections during the archaeological reconnaissance survey of the Road 10 Motor Pool site included seven chemical protective gear parts.¹⁰⁹ There was no further description of the protective gear parts. At the incinerator site one piece of mica was recovered and identified as possibly part of a gas mask (eyepiece). These findings are not unexpected since the basic training at Camp Forrest included a gas mask course.

Seventy-four sites were identified at Camp Forrest where hazardous materials may have been handled, disposed of, or present as a result of operations.¹¹⁰ The sites were categorized as potential solid waste management units (SWMUs), potential area of concern (AOCs), and other areas. The SWMUs include a bulk storage fuel farm, a camp incinerator, and two landfills; the potential AOCs include 35 motor pools, 20 gas stations, 3 large vehicle maintenance areas, and

¹⁰⁸ Phase I Archaeological Reconnaissance Survey for Cultural Resources of Selected Areas Within the Former Camp Forrest World War II Military Training Base, Arnold Air Station, Coffee and Franklin Counties, Tennessee, prepared by Transportation Center, The University of Tennessee, Knoxville, Tennessee, for Hazardous Waste Remedial Actions Program Division, Environmental Management and Enrichment Facilities, Lockheed Martin Energy Systems, Inc., Oak Ridge, Tennessee., July 1995.

¹⁰⁹ Ibid., p. 69.

¹¹⁰ Final Draft, Expanded Preliminary Assessment Camp Forrest Site SS-19, Vol. 1, CDM Federal Programs Corporation, Oak Ridge, Tennessee, May 1994.

5 shop/warehouse foundations. The other areas include 3 potential landfill areas, 2 bermed depressions, 1 potential fuel distribution area, and 1 former coal pile.

Aside from the landfill areas none of the remaining sites have the potential for burial of CW waste. Assuming that the CW training course was limited to the gas mask course and tear gas tent, any burial of CW materiel would be limited to the tear gas agents. The standard tear gas for that period was more likely chloroacetophenone (CN) based--sometimes the CN was mixed with chloropicrin (PS) and chloroform and designated CNS, or if mixed with chloroform only it was designated CNC, or if mixed with benzene and carbon tetrachloride it was designated CNB. An alternate to CN was bromobenzylcyanide (BBC).

A review of the organizational charts for the AEDC did not find any Chemical Officer assignments to the staff at AEDC. There is no indication that any CW training exercises were ever conducted at AEDC.

Conclusions

- The CW training at Camp Forrest was consistent with the basic training course used by the Army at the time. There is a high probability that the only CW used at Camp Forrest was tear gas (e.g. chloroacetophenone (CN)). If so, any buried residual would pose no hazard to personnel, particularly after 50-plus years.
- There was no documentation found that indicates that any CW training exercises were ever conducted at Arnold Engineering Development Center.
- No documentation was found that would indicate any level of participation in the BW/CW program by Arnold Engineering Development Center.
- No documentation was found that would indicate any Chemical Officers were ever assigned to Arnold Engineering Development Center.

Kirtland AFB, New Mexico

Background

Kirtland AFB is located on a roughly 82 square mile area immediately southeast of the city of Albuquerque, New Mexico. The base is bordered on the north and west by the city of Albuquerque, on the south by the Isleta Indian Reservation, and on the east by the Cibola National Forest.¹¹¹

In 1938, the City of Albuquerque began planning a new municipal airport.¹¹² The Army leased 2,000 acres of land from the City of Albuquerque, adjacent to the municipal airport, for construction of an air base. Construction on the Albuquerque Army Air Base was completed by August 1941. The base was designed to house and supply quarters and workspace for 225 officers and 1970 enlisted men comprising the 19th Bombardment Group (BG) and its attached Squadron, Quartermaster, Signal, Ordnance, Medical, Chemical Warfare Service, Chapel, and Finance Units. The existing 5,000-foot, north-south runway was extended to 10,000 feet in anticipation of the B-17 heavy bombers of 19th BG. By late March 1941, the Quartermaster units had arrived to provide supply and transportation and were followed by detachments of the Medical and Finance Departments and the 3d Chemical Company. The 19th BG transferred to Albuquerque to train for reconnaissance and bombing with the B-17 aircraft prior to deployment overseas. On 27 September 1941 the 19th BG and elements of Ordnance, Materiel, Quartermaster, and Chemical Warfare Service departed Albuquerque Army Air Base for San Francisco Port of Embarkation, California, for a permanent change of station. The bombardier school at Barksdale Field, Louisiana, was transferred to Albuquerque in October 1941. By the end of 1942 contracts for bombing targets on the ranges covered 2,450 square miles of ranch land and Indian reservations.

In February 1942 Albuquerque Army Air Base was named Kirtland Field. From mid-1942 on, new units continued to arrive at Kirtland Field, including a Chemical Warfare Company. In May of 1942 the Army Air Force acquired Oxnard Field, a private airfield located east of Kirtland

¹¹¹ Installation Restoration Program, Kirtland AFB, Albuquerque, New Mexico, December 1997, p. 1-1.

¹¹² Alberts, D. E. and A. E. Putnam. A History of Kirtland AFB, 1928-1982. Kirtland AFB, New Mexico: 1606th ABW.

Field on 1,100 acres of land. Construction began on Oxnard Field for the Albuquerque Air Depot Training Station (for aircraft mechanics); this area later was to become known as Sandia Base. By October 1943 four Air Base Groups had been trained at the station. As the last trained contingent departed, the Training Station became the Albuquerque Army Air Field. In mid-1944 the field became the Army Air Force Convalescent Center until April 1945 when it was closed and again became an Army Air Field. The airfield received over 2,000 surplus military aircraft as World War II came to an end--in the fall of 1946 the remaining aircraft were sold essentially for scrap. A part of Sandia Base, including the runways, was transferred to the Manhattan Engineer district for use with the atomic programs.

From February 1945 until the end of World War II, combat crew training for the B-29 Superfortress was conducted at Kirtland Field. In the 1944-45 timeframe the runways at Kirtland Field had been extended and bomb-loading pits constructed to support aircraft carrying weapons for the Los Alamos programs. Units of Los Alamos Laboratory during September 1945 moved to the Albuquerque Army Air Field, formerly the Albuquerque Air Depot Training Station, to manage the development of weapon assemblies. The field was redesignated the Armed Forces Special Weapons Project (which later became the AFSWC), then the Air Force Weapons Laboratory (AFWL), and is currently designated as the Phillips Laboratory).

A letter from HQ Army Air Force, dated 8 August 1947, to the Chairman, AAF Tactical and Technical Liaison Committee, Kirtland Army Air Field, New Mexico, approved the charter for the AAF Tactical and Technical Liaison Committee with a member of the committee to be attached to Kirtland Field for administration and services. The committee was to provide necessary tactical and technical liaison with the Armed Forces Special Warfare Program at Sandia Base. The committee also was to direct contact between Army Air Forces and the Sandia-Los Alamos activities of the Atomic Energy Commission. On 18 July 1949 HQ USAF renamed the AF Tactical and Technical Liaison Committee as the USAF Field Office for Atomic Energy with no change in function. The Sandia Branch of the Los Alamos Scientific Laboratory was established in 1949 and later became the Sandia National Laboratory (SNL). SNL was and is involved in the development and testing of special weapons and in the research and development of energy source systems.

In 1947 Kirtland Field was renamed Kirtland AFB. Also in 1947, the construction of a weapons storage area began in the foothills of a subrange of the Manzano Mountains near the northeastern border of Sandia Base. This storage area became known as the Manzano Base. Manzano Base reported directly to the Armed Forces Special Weapons Project. In 1971 it became the Manzano area of Sandia Base.

In the 1960s Kirtland AFB and Sandia Base were primarily known as development and testing facilities. In 1966, the airfield, taxiways, and other properties were sold to the City of Albuquerque to become the Albuquerque International Airport. Kirtland AFB became a tenant to the airport and supplied all emergency services. In July 1971 Manzano and Sandia Bases merged with Kirtland AFB and became the eastern side of Kirtland AFB; the Air Force Weapon Laboratory assumed management responsibilities. In the 1970s, Kirtland AFB evolved essentially into a research and development organization that hosted other military organizations. The Air Force Systems Command operated the base. In 1976 the Military Airlift Command (MAC) assumed control of Kirtland AFB and activated the 1606 ABW as host base wing at Kirtland AFB.

In 1982 the Air Force Space Technology Center was activated at Kirtland AFB. The Phillips Laboratory assumed the Space Technology Center and Weapons Laboratory missions in 1990.

On 1 January 1993 Kirtland AFB was reassigned from the Air Mobility Command (AMC) (formerly MAC) to the AFMC headquartered at Wright-Patterson AFB, Ohio. The 377 ABW was activated as the new host base wing.

Discussion

Chemical Warfare Training

A series of pictures is contained in a 1943 article of personnel wearing gas masks while performing their normal duties. The caption reads "Every Tuesday everyone wears a gas mask regardless of duty."¹¹³

¹¹³ History of the Air Depot: Training Station, Albuquerque, New Mexico, 1943.

Ground training was organized during the latter part of June 1946 and began operation on 24 June 1946. Training was divided into 11 branches, of which CW was one of the 11 branches.¹¹⁴ No CW class was scheduled for the month of September, but was to be held the first week in October.¹¹⁵

In October and again in November 1946, a request for a Chemical Warfare Officer for Kirtland AAF was disapproved.¹¹⁶

On 1 May 1955 the 4901 ABW was designated as the 4900th Air Base Group (ABG). The RW Defense Unit, 4900th ABG, Kirtland AFB, traveled to Davis-Monthan AFB, Arizona, 22-25 May 1955, to give CW, BW, and RW training to 120 members of the 34th Air Division stationed at Davis-Monthan AFB.¹¹⁷ The same group of instructors presented CW, BW, and RW training to 137 officers and airmen of the Continental Divide Air Force Station between 1-3 June 1955. The students received eight hours each on CW, BW, and RW defense training.¹¹⁸ Next the instructors presented the CW, BW, and RW training to 96 officers and airmen at Tierra Amarilla Air Force Station, New Mexico between 7-9 June 1955. The students received six hours each on CW, BW, and RW defense training.¹¹⁹ The CW, BW, and RW training presentation was given to 126 officers and airmen of Moriarty AF Station, New Mexico, on 14-15 June 1955. The students received seven hours each on CW, BW, and RW defense training.¹²⁰ From 20-24 June 1955, personnel of the RW Defense Unit presented 32 hours of CW, BW, and RW defense training to 7 officers and 11 NCO's from Edwards AFB, California, and 1 officer from Kirtland AFB.¹²¹ From 27-30 June 1955, the personnel of the RW Defense Unit presented 32 hours of CW, BW, and RW defense training to 471 officers and airmen of the 34th Air Division,

¹¹⁴ History of Kirtland Army Air Field (15th Air Force) for June 1946, Ground Training Schedule, 24 June to 28 June 1946, p 13.

¹¹⁵ History of Kirtland Army Air Field (15th Air Force) for September 1946, Ground Training Schedule, p. 8.

¹¹⁶ History of Kirtland Army Air Field (15th Air Force) for October 1946 and November 1946.

¹¹⁷ AFSWC Monthly Historical Report, 6 June 1955.

¹¹⁸ AFSWC Monthly Historical Report, 1 July 1955.

¹¹⁹ *ibid.*

¹²⁰ *ibid.*

¹²¹ *ibid.*

Kirtland AFB, and 3 airmen of the 4900th USAF Infirmary, Kirtland AFB. The students received 10 hours each on CW, BW, and RW defense training.¹²²

A Unit NCO's Monitors Course for defense against CW, BW, and RW attacks was held the week of 15-19 August 1955. Eleven NCO's of the 4900th ABG attended and completed the course successfully. A Unit Passive Defense Officers Course for CW, BW, and RW defense was held the week of 22-26 August 1955. Eight officers of the 4900th ABG successfully completed the course.¹²³ Two officers and six airmen from the 34th Air Division successfully completed a Passive Defense Monitors Course including Atomic, Chemical, and Biological Warfare Defense Training during 6-12 September 1955.¹²⁴ Personnel of the RW Defense Unit, 4900th ABG conducted CW, BW, and RW training for 97 officers and airmen of the Tierra Amarilla Air Force Station on 4-5 October 1955.¹²⁵ A make-up class on CW, BW, and RW defense was given to 14 airmen from the HQ Squadron Section, 4900th ABG on 23 November 1955.¹²⁶ On 8 February 1956 personnel of the RW Defense Unit, 4900th ABG lectured 171 airmen of the 34th Air Division on decontamination. On 13-17 February 1956 the RW Defense Unit, 4900th ABG lectured 12 airmen attached to the 34th Air Division on CW, BW, and RW defense, and on 29 February 1956 briefed 2 men from the Federal Defense Service on CW, BW, and RW defense.¹²⁷

On 4 May 1956 the HQ Squadron, 4900th ABG was fitted with gas masks, type M9A1, and the sizes were reported to the Squadron Supply Officer. On 14-18 May 1956 12 personnel from the Air Base Group Squadrons attended a CBR Instructor's course for 32 hours of instruction and 2.5 hours of testing.

¹²² *ibid.*

¹²³ AFSWC Monthly Historical Report, 12 September 1955.

¹²⁴ AFSWC Monthly Historical Report, 6 October 1955.

¹²⁵ AFSWC Monthly Historical Report, 3 November 1955.

¹²⁶ AFSWC Monthly Historical Report, 5 December 1955.

¹²⁷ AFSWC Monthly Historical Report, 6 March 1956.

On 25 May 1956 the Ground Safety Officer notified the Officer in Charge (OIC), RW Defense Unit, 4900th ABG, of a leaking chlorine gas cylinder. The OIC had the tank dispersed and returned empty.¹²⁸

On 9 August 1956 a NCO gave a four-hour lecture on chemical warfare to the Passive Defense Unit personnel from the RW Defense Unit, 4900th ABG.¹²⁹

On 29 August 1956 personnel from the RW Defense Unit, 4900th ABG, disposed of 22 vials of "poison gas" by burning.¹³⁰ The vials of "poison gas" would most likely have been obtained from CAIS widely used in training exercises. Kirtland Air Force Base has been listed as a location that has been associated with CAIS, and some CAIS components may have already been recovered from the site.¹³¹

On 29 October through 6 November 1956 personnel of the RW Defense Unit, 4900th ABG presented a 52-hour training program on CW, BW, and RW defense to four officers and six NCO's.¹³²

In September 1958 a limited responsibility for decontamination of CW contamination was delegated to the RW Defense Unit, 4900th ABG.¹³³

In an analysis of existing facilities in March 1959, the Chemical Corps storage was found to be housed in a base supply storage area. The storage was considered adequate for present and future requirements, and no additional area was required for accomplishment of the mission. Medical and chemical units were noted to have no open storage area assigned to them.¹³⁴ Ten

¹²⁸ AFSWC Monthly Historical Report, 7 June 1956.

¹²⁹ AFSWC Monthly Historical Report, August 1956.

¹³⁰ AFSWC Monthly Historical Report, August 1956.

¹³¹ Survey and Analysis Report, 2nd Edition, USA Program Manager for Chemical Demilitarization, Appendix E, December 1996, p. E-5.

¹³² AFSWC Monthly Historical Report, 7 November 1956.

¹³³ AFSWC Monthly Historical Report, 10 October 1958.

¹³⁴ Part 1, Master Plan, Sandia Base, Albuquerque, New Mexico, 15 March 1959.

years later the CBR training facilities and team meeting locale occupied the former arms room in Bldg 202D with a floor area of 1160 square feet. The Chemical Corps storage was still considered adequate for present and future requirements, and no additional area was required.¹³⁵

A training exercise stressing the reliability of the gas mask when worn in the presence of CW gas was conducted with the personnel of the RW Defense Unit, 4900th ABG on 16 July 1959.¹³⁶ These types of tests were often conducted in a tear gas chamber and in a chlorine chamber if available. The tear gas chamber was entered with the mask on, and after a short period the mask was removed before exiting the chamber. The chlorine chamber was usually entered with the mask off and donned after a short exposure to the chlorine gas. This procedure provided the opportunity for the trainee to don the mask in a gas environment and to clear the mask while in a gas environment. The ability to don and clear the mask in a gas environment is an important skill. No description of a gas chamber, tear gas or chlorine, was found. The archived records relate that a great deal of training was done with the gas masks—the details of the training are not known. It can be reliably assumed that the gas mask training conducted at Kirtland AFB did not significantly differ from the training conducted at other air bases and most likely would utilize a gas chamber.

Chemical, Biological, and Radiological Warfare Testing

A memo for record, dated 9 May 1950, from the Office of the Director of Armament, USAF, addressed the role of the Special Weapons Command, USAF, in the chemical, biological, and radiological warfare program of research and development of munitions and munitions systems.¹³⁷ The responsibility for the developmental testing of all the CBR munitions was placed with the Special Weapons Command. The Air Force Test Unit at the Chemical Corps, Edgewood Arsenal, was transferred to the Special Weapons Command. By letter, dated 2 June 1950, the Commanding General, Special Weapons Command, Kirtland AFB, informed the Chief, Chemical Corps, Department of Army, of the transfer of responsibility for the

¹³⁵ Master Plan Analysis (Existing Facilities), Sandia Base, Albuquerque, New Mexico, Office of the Base Engineer, 1 February 1969.

¹³⁶ AFSWC Monthly Historical Report, 10 August 1959.

¹³⁷ MFR, subject: CEBAR, Director of Armament, 9 May 1950.

developmental testing of the CW, BW, and RW munitions and munitions systems developed by the Chemical Corps.¹³⁸ A detailed breakdown of the projected Research and Development within the Chemical Corps that required development testing was requested.

The Air Force Field Office, Fort Detrick, Maryland, forwarded a schedule for tests of BW munitions requiring aircraft at DPG, to the Special Weapons Command (SWC). Between 15 June and 25 August 1950 a series of 19 tests had been scheduled, requiring B-26 and B-50 aircraft, plus four ferry flights requiring B-29 or B-50 aircraft. The ferry flights would be loaded at the Army Chemical Center, Maryland, and ferried nonstop to DPG.¹³⁹

The SWC was assigned responsibility for development tests of CW, BW, and RW developed by the Army Chemical Corps. All testing programmed for the Chemical Test Squadron, Army Chemical Center, through the summer of 1950 continued as planned. The SWC assumed responsibilities for high altitude test drops at DPG commencing 7 July 1950 and would formulate plans for assuming the entire airborne test program.¹⁴⁰

RW bomb tests at DPG were scheduled for 3-5 August 1950. Static tests of RW generators were scheduled for September. Three E-96 BW clusters were released from 35,000 feet at DPG. The bombs, filled with oil, were dropped for ballistic data and target coverage. A B-29 departed Kirtland on 13 July 1950 for the Army Chemical Center to transport three BW units to DPG--the units were inert fill. The unit to be picked up on 25 July 1950 was planned to have live agent.¹⁴¹ The SWC completed the 1950 schedule for high altitude release of the BW cluster bombs on assigned targets at DPG. Between 12-26 July 1950 there were 13 individual cluster drops and one 2-cluster drop at varying altitudes.¹⁴² In August 1950 there were seven BW ferry flights for duration of 36.5 hours. In September 1950 there were three BW and RW flights for

¹³⁸ Letter, CG, Special Weapons Command, Kirtland AFB to Chief, Chemical Corps, USA, subject: Development Testing of CEBAR Munitions and Munitions Systems, dated 2 June 1950.

¹³⁹ Letter, Subject: Development Testing for Biological Warfare Program, 29 June 1950.

¹⁴⁰ Special Weapons Command Progress Report, DCS/R&D, 16-30 June 1950.

¹⁴¹ Special Weapons Command Progress Report, DCS/R&D, 1-15 July 1950.

¹⁴² Special Weapons Command Progress Report, DCS/R&D, 16-31 July 1950.

duration of 17.3 hours. Four RW bombs were ferried and released at DPG; one BW bomb cluster was ferried to DPG.¹⁴³

By July of 1950, the 4925th Special Weapons Group experienced a 250% increase in the workload of the organization for the scheduled drops for the Atomic Energy Commission for FY51. The commitment to the Army Chemical Center for CW, BW, and RW scheduled drops could not be met with any regularity. Two additional B-50D aircraft were requested as soon as possible as well as the replacement of four B-29s by B-50Ds in the near future.¹⁴⁴

A special Wendover Air Base joint field test by ACC and SWG was conducted from 15-28 February 1950.¹⁴⁵ The SWG support for the Army Chemical Center's RW program continued at a reasonable pace until mid-September 1953 when SWG was informed by the Army Chemical Center that all RW testing was suspended. Cancellation of the current projects in support of the Army Chemical Corps was forwarded to the 4925th for action.¹⁴⁶

By letter, dated 18 January 1952, from the Office of the Vice Chief of Staff, USAF, to the Commanding General, Special Weapons Command, the Special Weapons Command was transferred to the ARDC to form an atomic development center. The Special Weapons Command status as an operating agency was terminated.¹⁴⁷ The Special Weapons Command was redesignated as the AFSWC.

Wright Air Development Center of ARDC requested AFSWC support for 25 drops of the Matador fin-stabilized warhead containing CW bombs with simulant fill to determine dispersion of the bombs over a target area. The warhead was loaded in the forward bomb bay of a B-36.

¹⁴³ Special Weapons Command Semi-Monthly Consolidated Report, 15-30 September 1950.

¹⁴⁴ Letter, subject: Request for Additional B-50 Aircraft, from: CO, 4925th Special Weapons Group, to: CG, Special Weapons Command, Kirtland AFB, New Mexico, dated: 20 July 1950.

¹⁴⁵ Special Weapons Command Semi-Monthly Consolidated Report, February-December 1950.

¹⁴⁶ AFSWC Semi-Monthly Report for Period Ending 15 September 1953.

¹⁴⁷ Letter, 18 January 1952, Dept. of the AF, Office of the Vice Chief of Staff, USAF, to: CG, Special Weapons Command, Kirtland AFB, New Mexico, subject: Transfer of Special Weapons to the Air Research and Development Command.

During other drop tests at Edwards AFB, the warhead was dropped at the desired altitude and the aircraft then proceeded on to the sponsored drop at higher altitude.¹⁴⁸

On 20 April 1954, ARDC advised that for the weeks of 15 April–12 May 1954 the test program for BW contamination missions would originate from Kirtland AFB. Two four-hour flights on two aircraft were required.¹⁴⁹ The BW agent contamination was a simulant. This test program was conducted under Test Project 54-89 BW-CW Vulnerability Assessment (WADC, WPAFB) and Project 5139, Test No. 55-44 Support to AF Armament Center in BW/CW Drop Program.¹⁵⁰ The period of support was March to May 1955.¹⁵¹

Personnel from the Group Operations Office, 4900th ABG, represented Kirtland Air Force Base at the 18th Meeting of the BW and CW Vulnerability Advisory Committee at Wright Air Development Center, WPAFB, Ohio, in February 1956.¹⁵²

The Air Force developed a family of guided missiles following World War II. The AF programmed BW, CW, or high explosive warheads for installation in certain models of the missiles in addition to nuclear warheads.¹⁵³ While the program was managed from WADC, WPAFB, the AFSWC participated in the test and evaluation program.

In April 1959 AFSWC planned a future series of tests for the Army Chemical Center in conjunction with work underway at DPG.¹⁵⁴ No test and evaluation entries were found in the archives after April 1959 until October 1968 when the AFSWC provided support to the ADTC, Eglin AFB for flight tests with the TMU series of spray tanks.

¹⁴⁸ Weekly Activity Report and SWOT Staff Project Report for Period Ending 20 January 1954.

¹⁴⁹ DF, Ch, Requirements Br, to Ch, T&E, DCS/Ops, 12 May 54, Subj: Weekly Activity Report.

¹⁵⁰ Staff Officers Summaries, AFSC, September 1954.

¹⁵¹ Staff Officers Summaries, AFSWC, May 1955.

¹⁵² Air Force Special Weapons Center, Operations/Training History Reports, 1955-69.

¹⁵³ History of the AFSC, 1 January-30 June 1959.

¹⁵⁴ AFSWC, Briefing and Activities, April 1959.

AFSWC provided support to the ADTC through F-4 flight tests of the TMU-38/A spray tank. The TMU-38/A is used to deliver nonlethal agents with high-speed aircraft at a low altitude, e.g., 400 KIAS to 525 KCAS at 100 to 500 feet AGL. Test objectives were: (1) determine the compatibility of the TMU-38/A on the outboard stations of the F-4 aircraft; (2) evaluate the functional reliability of the TMU-38/A tank and the cloud travel and ground coverage obtained when dispensed from the F-4 aircraft; and (3) obtain information applicable to design improvement on the final configuration. Eight missions were planned to use the White Sands Missile Range at a rate of one per week for September and October 1968.¹⁵⁵ A final AFSWC drop test of this project in support of ADTC was conducted at AFSWC Number 1 target on 4 November 1968. The TMU-38/A tanks, on the outboard stations of an F-4D, contained 360 pounds each of talcum. The talcum was dispensed from 300 feet AGL at 400 KCAS. The test program was curtailed because of lack of adequate detailed meteorological data in the target area. The program was continued at the instrumented grid at Eglin. In total, nine successful drop tests were conducted by AFSWC.¹⁵⁶

The Chemical and Biological Warfare program was cancelled by presidential proclamation in 1969.

Conclusions

- From 1943 to 1969 Kirtland AFB maintained extensive classroom training in CW, BW, and RW defense. The training exercises stressed proficiency with the gas mask and indicated gas chamber exercises were done on a regular basis.
- Based on the gas mask exercises and the destruction of numerous vials of "poison gas," it is very likely that CAIS were used at Kirtland AFB. There are reports that indicate that CAIS may be or have been found at Kirtland. Based on this evidence there is a significant probability that CAIS may still be present at Kirtland AFB.
- The SWC provided a significant amount of support to the Chemical, Biological, and Radiological Warfare testing program. The support provided was principally the provision of

¹⁵⁵ AFSWC Monthly Activities Briefs, Nbr. 8, October 1968.

¹⁵⁶ AFSWC Monthly Activities Briefs, Nbr. 9, November/December 1968.

aircraft for ferrying CBR weapons to various test sites and the provision of aircraft for the delivery of the CBR weapons on target grids during the test trials. The majority of the drops were with simulant-filled weapons with a minimal number of drops where the weapons were filled with agent. There is no evidence that any agent-filled weapons were ever present at Kirtland AFB.

Robins AFB, Georgia

Background

Robins AFB is located in the northeastern section of Houston County, Georgia, approximately 18 miles south of the city of Macon and immediately adjacent to and east of the town of Warner Robins (formerly Wellston, Georgia). Robins AFB began on 16 June 1941 with the announcement by Congressman Carl Vinson, Georgia, of plans to establish a maintenance and supply depot at Wellston, Georgia. The Wellston location was chosen over competing sites due to the flatness of the terrain which required little grading and excavation to build the base and runways; the availability of an adequate water supply; the close access to a railroad, and the advocacy of local officials and politicians. The City of Macon and Bibb County donated the original tract of 3,000 acres of land. Subsequent acquisitions by the Federal Government increased the size of the installation to its present 8,855 acres.

Present land areas adjacent to the base are primarily commercial and residential, except to the east where approximately 1,200 acres of wetlands form an unimproved river swamp system. This system provides important functions for the sustenance of aquatic life, as well as plant and animal life, and water quality in the Ocmulgee River.

Base Construction

The War Department funded construction of the Robins Air Depot during the years immediately preceding World War II. The depot was built in accordance with standard plans of the ASC, headquartered in Dayton, Ohio, and planned as one of 11 ASC Control Depots in the country. On 1 September 1941 the US Engineers began construction of what would later become the Warner Robins Air Logistic Center and Robins Field.

The original depot project was completed on 31 August 1942. The project included the construction of three runways, each 5,000 feet long and 150 feet wide, and an industrial area. The runways were extendable to 7,500 feet. The industrial area included Headquarters, Operations (operations, flight test, and transport squadron hangar), Maintenance Hangars, two Depot Supply Buildings, and buildings for engine test, engine storage, engine repair, equipment repair, radio repair, armament, and signal storage. Also included were a gasoline storage

system; numerous warehouses; utilities to maintain the depot; a sewage treatment plant; and Officers' and NCO's quarters.

The cantonment area construction began on 4 May 1942 and was completed on 31 August 1942. This area consisted mostly of buildings of temporary wooden construction and the Regional Station Hospital.

A third construction project began on 1 August 1942 and was completed on 10 April 1943. Dormitories for civilian workers, 100 hardstands with taxiways for parking aircraft, and rifle and pistol ranges were completed. Additional facilities were also completed in the industrial area that included buildings for engineering maintenance, motor maintenance, engine preparation, and finance as well as a Chemical Warfare Warehouse.

The last major construction was started on 5 February 1943 and completed on 31 October 1943 consisting of 16 new buildings or additions at a cost of \$4 million. On 1 October 1942 the Robins Field Facility began official operations.

Operations

On 9 November 1941 a colonel arrived in Macon, Georgia, to assume command of the Air Depot at Wellston (the future Robins Depot). Since facilities were not available at Wellston at that time, the Depot headquarters was established in a tent at the Herbert Smart Airport (Macon's Municipal Landing Field). Herbert Smart was activated as a sub-depot of the Southeast Air Depot. On December 6, 1941, the 5th Air Depot Group arrived at Herbert Smart Airport for training, thus beginning the Depot's training function. On 9 May 1942 the Post Headquarters Building at Robins Field was occupied.

On 1 September 1942 Wellston Air Depot was assigned five sub-depots and a sixth sub-depot two weeks later. Eighteen air depot detachments and 17 additional sub-depots were transferred to the Wellston Air Depot effective 29 September 1942. As a control depot under the 3rd Air Service Area Command, Wellston exercised control over several bases and units in five states. This activity was ongoing prior to the completion of the depot (known later as Robins Field).

On 23 January 1942 the post was officially named Robins Field and on 14 March 1942 the depot was officially named Wellston Air Depot.¹⁵⁷ On 1 September 1942 the village of Wellston changed its name to Warner Robins and on 14 October 1942 the Depot was redesignated Warner Robins Army Air Depot.

On 1 February 1943, the four Air Service Area Commands were abolished, and 11 Control Area Commands were established (including Robins). On 19 February 1943, by orders from HQ, ASC, area commanders for the Control Area Commands were relieved of responsibility for their local housekeeping functions necessary for operating the base. Certain WRASC officers assumed dual roles between the depot and the base. For example, the Chemical Warfare and Ordnance functions were performed by the WRASC officers in addition to their other functions.¹⁵⁸

The base was officially activated on 1 March 1942 and declared a permanent military installation in 1952. Although the original intent was to establish a maintenance and supply depot, the installation also became a training center.

"During the war years the training function was a very important part of the mission of Warner Robins. As aircraft overseas had to be kept flying both officers and enlisted men had to be trained to perform the functions of supply and maintenance overseas. At the height of the war Warner Robins was often called upon to ship aircraft parts to combat theaters."¹⁵⁹

On 6 December 1943 the AAF Medical Service Training School at Robins Field was established as one of three specialized medical training schools. After World War II, Robins ceased to be a training center but continued its repair and supply missions. To support these missions, quantities of petroleum, oils, lubricants, solvents, and protective coatings have been used with resultant wastes generated.

¹⁵⁷ On 16 February 1948 Robins Field was redesignated Robins Air Force Base (RAFB).

¹⁵⁸ Grindstaff, Charles W. War Baby of the South, 1940-1945. Robins AFB, Georgia: Office of History, Warner Robins Air Logistics Center, September 1988, p. 57.

¹⁵⁹ *ibid.*, p. iii.

During the war years the primary tenant of the base was the Warner Robins Air Technical Service Command (WRATSC), which had the mission to train air depot groups for overseas deployment, to train civilian employees in the repair and maintenance of Army Air Corp materiel, and to gather and store supplies. The Command overhauled and modified nearly 2,000 aircraft and more than 21,000 aircraft engines and handled an estimated 55,180 carloads of supplies and equipment during World War II. WRATSC trained more than 50,000 technical and supply workers for use at the base and at operating locations doing similar functions.¹⁶⁰ Immediately after the conclusion of World War II, the requirement for depot facility was questioned and the base was almost closed. While the base participated in several "mothballing" programs, the number of workers declined.

A second growth spurt began in 1949 when the Fourteenth Air Force Headquarters moved to Robins where it remained until deactivated in 1960. Other factors contributing to the expansion were the Korean Conflict in 1950 and the decentralization of prime responsibility by the Air Materiel Command to its Air Materiel Areas.

"During the Korean War, Robins workers, reduced in number by postwar cuts to 3,900, swiftly and heroically retooled and fitted hundreds of mothballed B-29s."¹⁶¹ By December 1957, Robins tenant units included (among others): Warner Robins Air Materiel Area, 4th Communications Construction Squadron, Det 10 of the 2700th EOD Squadron, and 7th Logistical Support Squadron of the Air Materiel Command; Headquarters, Fourteenth Air Force of the Continental Air Command; 1803d AACS Group, 1926th AACS Squadron, and 1852d AACS Flight of the Military Air Transport Service; 729th AC&W Squadron and 427th Air Refueling Squadron of the Tactical Air Command; and the Sixth District Office of the OSI, Inspector General (USAF).¹⁶²

A large construction program commenced in 1958 to prepare facilities for the 19th Bombardment Wing as a tenant organization. In February 1961, the new C-141 Starlifter jet transport became the responsibility of Robins AFB. With the escalation of hostilities in Vietnam in 1965, jobs given to the base increased dramatically. During this era, the Air Force Air

¹⁶⁰ *ibid.*, p. 69.

¹⁶¹ 1998-1999 Base Guide, Robins AFB, Escondido, California: Hart Publishers, Inc., 1998.

Materiel Command was reorganized into the Air Force Logistics Command with five Air Logistics Centers--the centers providing logistic support to the entire Air Force.¹⁶³ Robins was designated as the Warner Robins Air Logistic Center (WR-ALC). In the early 1980s, depot maintenance of the F-15 Eagle air superiority fighter became a responsibility of the base.

Currently, Robins is home to 40 separate organizations and employs approximately 12,000 civilian employees and 5,000 military members. The principle tenant is the Warner Robins Air Logistics Center which has management and engineering responsibility for the repair, modification, and overhaul of the C-141 Starlifter, the C-5 Galaxy, and the C-130 Hercules cargo and transport aircraft, as well as the F-15 Eagle fighter aircraft. The Center is also responsible for several other weapons systems and components. Another major tenant, Headquarters, Air Force Reserve Command, administers and supervises the activities of the Reserve program throughout the United States. This organization is a direct descendant to the Headquarters, Fourteenth Air Force. Also located on Robins (as of 1998) are the 19th Air Refueling Group, the 5th Combat Communications Group, the 367th Recruiting Group, 116th Bomb Wing of the Georgia Air National Guard, the 93rd Air Control Wing, and Det 105 of the AFOSI to name a few.¹⁶⁴

Discussion

The Herbert Smart airport was a provisional camp used only until the depot at Robins Field was available. After the units at Herbert Smart Airport moved to Robins Field, there was little activity at Herbert Smart Airport until it was redesignated a Chemical Warfare Replacement Training Center in October 1942. At this time Herbert Smart received about 25 chemical companies with nearly 3,000 enlisted men.¹⁶⁵ Between November 1941 to May 1944, fifty chemical companies trained at Herbert Smart Airport and Robins Field prior to overseas deployment. The type and extent of CW training that these personnel received is not known.

¹⁶² History of Warner Robins Air Materiel Area, CY 1957, 1 July–31 December 1957.

¹⁶³ Office of History, WR-ALC. A Chronology of The Role of Warner Robins Air Logistic Center and Robins AFB, Georgia, in World History, 1935-1995. Robins AFB, Georgia, 1996, p. 279.

¹⁶⁴ 1998-1999 Base Guide, Robins AFB. Escondido, California: Hart Publishers, Inc., 1998.

¹⁶⁵ *ibid.*, p. 40.

Their training program may have followed the CWS primary training program, which consisted of acquainting basic recruits with toxic agents and how to counteract them.¹⁶⁶ In 1940-1941 the troops were given 4-10 hours in basic protection against gas attack. This program of training stressed the ability to mask quickly, the ability to perform duties with the mask on, and the ability to identify common CW agents and how to defend against them. The approach to training AAF included anti-gas protection of air bases. In 1940, six hours of instruction in defense against a chemical attack was provided for all AF inductees.¹⁶⁷

“After recruit instruction in use of the gas mask, training followed three well-defined phases--specialist training of unit gas officers, NCO's, and finally, application of basic unit training in field problems involving gas situations.”¹⁶⁸

In 1943 additional facilities, including a Chemical Warfare Warehouse, were erected in the industrial complex at Robins Field. The Chemical Warfare Warehouse was assigned building number 1197. There is no further information on Bldg. 1197, i.e., description of materiel stored, duration of use, or disposition of any materiel distributed.

Three different CW “gas” chambers were located at RAFB at different periods. The earliest chamber was located on government property (across the highway along the boundaries of RAFB and the city of Warner Robins). There is some indication that this chamber was located in the unoccupied government housing that had been constructed on that location. The chamber was dismantled and removed at an unknown date. A new chamber, a trailer, was situated within the boundaries of RAFB. The location of this CW “gas” chamber is not known. This chamber was also dismantled and removed, again at an unknown date. Based on the location of these two chambers and the general type of construction, it is reasonable to assume that they were tear gas chambers. The Disaster Preparedness Office (DPO) currently (1999) has a new “gas” chamber in which they use CS (tear gas) for training purposes. Previously the DPO had used banana oil but it was not considered satisfactory and CS was selected for use in training.

¹⁶⁶ Office of the Chief of Military History: United States Army in WW II, The Technical Services, The Chemical Warfare Service: Organizing for War. Department of Army, Washington, DC., 1959, p. 187.

¹⁶⁷ *ibid.*, pp. 220-222.

¹⁶⁸ *ibid.*, p. 192.

In 1948 the Technical Services Staff included a Chemical Officer.¹⁶⁹ The Military Intelligence Section prepared and delivered 14 lectures to military personnel on intelligence subject matter. "Type of subjects given were: ...Chemical and Biological Warfare;" ¹⁷⁰ A Chemical Warfare School was started at the base on 10 May 1948 with 21 officers and non-commissioned officers in attendance. The CW School, in compliance with AF Regulation 50-25 and AMC Regulations 50-7 and 50-7A, trained unit gas officers and non-commissioned officers. The Air Chemical Officer for the base was selected to instruct the course. The course included 52 hours of classroom and demonstration periods. Mid-term and final examinations were given to test the proficiency of the students. Graduates of the course were to present a 10-hour refresher course to members of their individual organizations.¹⁷¹ The Military Training Section conducted an orientation program on 28 July 1948 which included a lecture to officers on BW. The Chemical Officer of the Technical Services Staff conducted training. The training was a weekly briefing given to both officers and enlisted personnel.¹⁷²

The two-volume History of the Warner Robins AMA, CY 1950, did not list any Chemical Officer on the Technical Services Staff, and Appendix 6, Military Training Courses, did not list any CW, BW, or RW training. The volume covering the last half of CY50 did report that the Fourteenth AF staged a chemical warfare demonstration that was attended by all units of Robins AFB. The History of the Fourteenth AF for the last half of CY50 inexplicably failed to report anything at all about the CW demonstration.

A project was initiated 15 October 1951 to transfer Army-purchased quartermaster, ordnance, civil engineering, and CWS items to AF property classes. Approximately 1,400 items, amounting to 220 tons, were subject to transfer.¹⁷³ No breakout of the property classes is available.

¹⁶⁹ History of Warner Robins Air Materiel Area, CY 48, 1 January 1948–30 June 1948, p. 3.

¹⁷⁰ *ibid.*, p. 129-130.

¹⁷¹ *ibid.*, p. 173.

¹⁷² History of Warner Robins Air Materiel Area, CY 48, 1 July 1948–31 December 1948, p. 193.

¹⁷³ History of Warner Robins Air Materiel Area, CY 51, 1 July 1951–31 December 1951, p. 75.

The Military Training Section conducted a 22-hour course in radiological monitoring and surveying in the first half of CY52. This course instructed key personnel in preventative measures to be taken in the event of an atomic attack. One officer, 47 airmen, and 2 civilians completed the course.¹⁷⁴

In the first half of CY56 the FSC Class 1060, Biological Weapons, was assigned to Ogden Air Materiel Area, Hill AFB, Utah. The rest of the FSC Class 10, Weapons, was assigned to WRAMA. No other mention of CW or BW was found in the official histories through 1972.

On 28 April 1998 a munition dumpsite was discovered outside of the southeast boundary of the base. Included in the dump were 1940's vintage M1 land mines, expended M9 rifle grenade, M6 series anti-tank mines, M2 and M3 series antipersonnel mines, an unidentified adapter/booster, an item that appeared to be a barrel lid, and finally, a canister made of light rolled steel, 19 cm (7.48 in.) in length and 7.5 cm (2.95 in.) in diameter. No identifiable markings on the canister were discernable; however, the EOD OIC ventured that while the device was unidentified, it may have been a WW II era chemical training/detector kit canister. Tests on the recovered items with M8 paper for CW contamination were negative.¹⁷⁵ This would be expected if the items date from WW II, a period of over 50 years ago. Because of the very wet environment, any exposure of the CW agents would generally result in fairly rapid hydrolysis of any residual agent. The items were destroyed by explosive disposal on 30 April 1998.

The assertion that the canister found may be a WW II era chemical training/detector kit canister is questionable because of (1) the small length to diameter ratio of 2.5:1, (2) the short canister length of 7.48 inches, and (3) the small canister diameter of 2.95 inches. For example, the K9-41 CAIS has a length of 38 inches, a diameter of 6.625 inches (length to diameter ratio of

¹⁷⁴ History of Warner Robins Air Materiel Area, CY 52, 1 July 1952–31 December 1952, p. 113.

¹⁷⁵ 347th CES/CED, Moody AFB, Georgia, AF Form 3579 (EOD Report), 12 May 1998.

5.74),¹⁷⁶ and a wall thickness of 0.145 inches (the wall thickness of the found canister was not reported).

The Environmental Management Directorate, Compliance and Restoration Division is performing corrective action at 76 SWMUs. Thirty of these SWMUs have been closed. Three more are awaiting approval for closure by the Georgia Environmental Protection Division. To date, remediation of the landfills has not indicated that any CW materiel, i.e., specifically CAIS, was buried. However, Robins Field has been cited as examples of locations where CAIS were recovered.¹⁷⁷ No tests were conducted for the presence of CW agents or their hydrolysis products in these landfills. Unless some physical evidence of CW materiel is uncovered or evidence in the historical documentation suggests that CW materials were present on the base, the Environmental Management Directorate does not plan to do extensive testing for the hydrolysis compounds.

Interviews were conducted with several people at Robins AFB:

Mr. William Downs, WRALC/EMQ:

- CW training was conducted in the early 80's. A weak concentration of tear gas was used. Simulated attacks used smoke. Dilute ammonia was used to test mask seal.
- The only type of decontamination equipment stored and maintained at WR-AMA was showers and equipment decontamination apparatus.
- Testing of ground water for the presence of CW agents or their hydrolysis byproducts was not done. Tests for Agent Orange and dioxin were done several times but results have always been negative. The reason for Agent Orange being on base was because WR-AMA was a depot level facility.

¹⁷⁶ Telephone conversation, Mr. Collins and Mr. Heyman from the Office of the US Army Program Manager for Non-Stockpile Chemical Materiel, Aberdeen Proving Ground, Aberdeen, Maryland, 18 March 1999.

¹⁷⁷ Survey and Analysis Report, Second Edition, Project Manager for Non-Stockpile Chemical Materiel, Appendix E, p. E-4, December 1996.

Mr. Shawn Politino, WRALC/EMQ:

- Mr. Politino discussed the discovery of the munitions dump site (see preceding explanation).

Ms. P.A.M. Smock, WRALC/CE (Disaster Preparedness Office).

- The current gas mask facility was built in the 1980's. The previous facility was a trailer; prior to that a building in an area not on Robins was used. Both previous facilities have been demolished. The earliest building was on land that is no longer federal property.
- She had no knowledge of CAIS sets.
- Current BW/CW training consists of 6 to 6.5 hours initially with a 3 to 3.5 hours refresher. The training includes: history of CW, types of agents, individual protective equipment, warning, unexploded ordinance, decontamination procedures, and contamination control. Training is primarily done by lecture, following AFI 32-4001 and the lesson plans furnished through AF Index 11. Some demonstrations are conducted, e.g., how to don the individual protective equipment.
- Students are troops subject to deployment to a threat area as well as just-in-time training for local units processing for deployment.

Mr. Bob Ellis, WRALC/EMQ:

- The fence marking the base boundaries was erected in 1968.
- The base gas mask training facility was built approximately 10-12 years ago.

Conclusions

- No evidence was discovered to confirm that any CW or BW munitions were ever on Robins Air Force Base.
- Significant evidence was found documenting that extensive training of chemical units occurred at Robins AFB. The type of training received by the chemical units is speculative but probably followed the course structure outlined by the CWS.

- CW training included use of gas chambers at Warner Robins. No detailed information about these chambers was found.
- In October 1951 all CWS items stored in the Chemical Warfare Warehouse, Bldg 1197, built in 1943, were transferred to AF property classes. The purpose of the warehouse and its contents is unknown.
- No evidence exists of any CW training between 1952 and 1970.
- CAIS may have been used at Robins Air Force Base as part of the CW training programs.

Brooks AFB Texas

Background

General

The San Antonio Chamber of Commerce leased 873 acres of land in October 1917 that became the south section of Brooks Field. The government purchased this land in December and broke ground for the new airfield on 8 December 1917. It was first named Kelly Field #5 until 4 February 1918 when it was renamed Brooks Field. Construction was completed in a matter of months, and the first flight from Brooks Field occurred on 28 March 1918. The land that became the northern section of Brooks Field was purchased just prior to WW II. The field was redesignated Brooks AFB on 24 June 1948.

Pilot Training

Brooks Field was one of 27 flying fields used for pilot training in WW I. The demand for fliers decreased significantly at the end of the war, and pilot training at Brooks Field was gradually phased out in the early months of 1919. The flying school closed in May of that year.

Shortly after the closure of the flying school, Brooks became the home for the balloon and airship school. A series of fatal accidents with the hydrogen-filled airships led to a shutdown of the training and a transfer of the airships in June 1922.

The Air Service's primary flying school moved to Brooks Field in June 1922. Primary flying training was conducted at Brooks until 1931 when the function was transferred to the newly opened Randolph Field. Following the loss of the primary training school, Brooks became the center of tactical observation aviation. By 1931 a number of observation squadrons and a medical detachment transferred to Brooks. By the late 1930's, only one observation squadron remained at Brooks.

With realization of the imminence of US involvement in WW II, plans were made to establish an advanced program of flight instruction at Brooks in September 1939. In early 1941 the War Department designated Brooks as the home of the Army Air Forces Advanced Flying School (Observation). The advanced flight training program was a success while the observation training was not. Brooks' mission evolved into provision of flight instruction for the Air Corps

advanced flying school. In August 1943, the flying school, renamed the Army Air Forces Pilot School (Advanced 2-Engine), mission was to prepare pilots for B-25s.

Pilot training concluded with the end of WW II, but in late 1951 a reserve-training center was established as a troop carrier unit. The new mission was pilot training (single engine). At the end of 1954, the single engine pilot training program was replaced by a Troop Carrier Wing. In 1956, the Wing was moved to Kelly AFB. All flying activity at Brooks ceased after 20 June 1960.¹⁷⁸

Aviation Medicine

In 1926, the School of Aviation Medicine was moved from Mitchell Field, New York, to Brooks Field. Randolph Field was completed in 1931 and the School of Aviation Medicine was relocated there. In May 1942, a proposal for a School of Air Evacuation was developed to train nurses in the new nursing specialty of air evacuation of casualties. In 1945, the School of Air Evacuation at Brooks merged with the School of Aviation Medicine at Randolph.

In the desire to consolidate aeromedical research, the Air Force chose Brooks as the location for its new aeromedical center. Land was readily available at Brooks and was relatively close to Randolph, which would make the move easier and less expensive. The new aeromedical center, the Aerospace Medical Center, was dedicated in November 1959 by Senate Majority Leader Lyndon B. Johnson. The Center was renamed the USAF School of Aerospace Medicine in 1962.

"With the emergence of the Aerospace Medical Division in 1961, the USAF School of Aerospace Medicine together with other organizations combined aerospace medical research, education, and clinical treatment under one center designed to study flight and its effects on the individual, as well as the various systems which support the crew member while in flight."¹⁷⁹

¹⁷⁸ Mueller, Robert. Air Force Bases, Volume I, Active Air Force Bases Within the United States of America on 17 September 1982. Washington DC: Office of Air Force History, United States Air Force, 1989, p. 53.

¹⁷⁹ A History of Military Aviation in San Antonio, September 1996, Air Force Historians, SA-ALC, HSC, AETC, and SA-ACC, p. 60. Note: Much of the information in this section was extracted from this publication.

Discussion

Air Evacuation

The training of nurses in the military included chemical warfare and physical training.¹⁸⁰ The CW training was split: a three-hour period with a one-hour period the following day. The one-hour training session could have been a lecture or a gas mask drill--either a tear gas chamber or an open-air exercise with smoke and tear gas. A news article displayed a picture of three nurse trainees moving through a gas field wearing gas masks at Bowman Field, Indiana, as part of their training where realism was stressed. Gas chambers were available at Kelly, if there were none at Brooks. A facility for open-air gas drills was available at Camp Bullis, 25 miles northwest of Brooks, which was often used by the Air Force. There is no evidence that a gas chamber or open-air type of facility was available at Brooks.

Reserve Training

The 2577th Air Force Reserve Training Center included training with small arms and chemical warfare.

"In view of the anticipated participation during the early periods and somewhat restricted facilities, the training programs were limited to lectures and discussions of a general military nature."¹⁸¹

The training schedule for Sunday, 18 November 51, included a lecture from 1400-1500 hours in Hangar 16 on Chemical Warfare.¹⁸² In the History, dated 1 January-31 March 1952, the training program included small arms and chemical training. In the 1 April-30 June 1952 History, the training program still listed small arms and chemical training, but no CW training was listed in the mission statement. In the History dated 1 July-31 December 1953, no mention of chemical training was made.

¹⁸⁰ Report for Squadrons, Unit Historical Data, Station Hospital, Brooks Field, Texas., Sq. E, 2510th AAF Base Unit, 1 November 1944-1 March 1945.

¹⁸¹ History, AF Reserve Training, 2577 AF Reserve Training Center, 1 October-31 December 1951, p. 7.

¹⁸² History, AF Reserve Training, 2577 AF Reserve Training Center, 1 October-31 December 51.

Aerospace Medical Division

The program formulating the direction of the School of Aviation Medicine (renamed the USAF School of Aerospace Medicine (USAFSAM) in 1961 and part of the Aerospace Medical Division) included the following statement:

"In the area of chemical warfare no extensive program of research and development is contemplated. However, it is felt that there should be restrictions on the use of facilities for studying the fundamental cell and molecular mechanisms, which will contribute to defense against chemical weapons. In other words, whenever it is felt that a specific piece of fundamental research might contribute to a better understanding of the action of the highly specific 'nerve gases,' possibly leading to improved preventative measures, such research should be encouraged at any institute where it might be undertaken.¹⁸³ The importance of bacteriological warfare for the future is difficult to assess. It seems advisable to the Air Force to maintain an interest in this subject and to remain well informed on the results of research and study being conducted by other groups having primary responsibility in this area."¹⁸⁴

The mission of the Aerospace Medical Division was provided in AFSC Reg No. 23-39 to include: "Conduct programs to investigate biological and chemical warfare with respect to physical defensive systems and the medical defensive aspects of this area."¹⁸⁵

Project 7754, Aerospace Medical Problems in Chemical and Biological Operations, was conducted by USAFSAM and first mention was found in the 1965 Aerospace Medical Division history. The project had three major areas: (1) medical evaluation of BW/CW operations; (2) investigation, evaluation, and formulation of BW medical defense techniques; and (3) investigation, evaluation, and formulation of CW techniques. The most significant progress for CY65 was in-house and contractual studies directed at satisfying requirements for rapid identification of microbial agents in BW operations.¹⁸⁶ The results of the project were intended

¹⁸³ Aeromedical Center Program, Air University School of Aviation Medicine, Brooks, AFB, Texas, part C of part II, p 3., 1 July 59

¹⁸⁴ *ibid*, p 5.

¹⁸⁵ AFSC Regulation No. 23-29, Organization and Mission-Field, Aerospace Medical Division, 24 December 1964.

¹⁸⁶ History of the AMD, 1 January–31 December 1965, p 108.

to enable the USAF Medical Service to be prepared to provide medical support in BW/CW operations.

By FY67, the objective of the research efforts for Project 7754 was to collect data from research programs and foreign technology reports.¹⁸⁷ The data were evaluated with respect to BW/CW medical defense requirements and existing scientific knowledge capabilities. Technical guidance and recommendations were offered to improve medical defense in BW/CW operations.¹⁸⁸ Project 7754 also included work on the identification of bacterial and viral agents, which had two significant achievements: the development of a bio-impinger and the successful feasibility demonstration of a field unit of the bacterial automated identification technique (BAIT) system. During FY69 Project 7754 was severely limited in funding and most efforts were terminated. In FY70, most Project 7754 efforts were limited to open literature searches and reviews of available technical information.¹⁸⁹ In the following years Project 7754 was zero funded for FY70 and FY71. By FY73, there was no mention of BW/CW in the program for Aerospace Medical Division.

Chemical and biological agents were sometimes obtained in laboratory quantities for use in tests. The agent residues were disposed of according to rigid protocols established for proper and safe disposal. Any BW agents were easily disposed of by sterilization in the laboratory autoclaves. The CW agents were disposed of by transferring the items to the US Army Technical Escort Units who in turn transferred them to a proper disposal site maintained by the US Army.

Landfills

There are six landfills on Brooks AFB; the following is a general description:

- Landfill No. 1: Operated from the 1930's and closed in 1942. The 1.3-acre site is currently a golf course. Remedial investigations in 1987-1989 found no volatile

¹⁸⁷ Project 7754 was the only project in the Division's research and development program authorized under the chemical/biological and conventional weapons program element.

¹⁸⁸ History of the Aerospace Medical Division, FY67, 1 July 1966–30 June 1967.

¹⁸⁹ History of the Aerospace Medical Division, FY70, 1 July 1969–30 June 1970.

organics and no organic contamination with one exception--polynuclear aromatic hydrocarbons from one monitoring-well location. It was concluded that landfill gas was not a problem. No ventilation or gas collection systems exist.

- Landfill No. 2: Operated from 1943 to the late 1940's. The 3.9 acres are currently a golf course and housing area. Remedial investigations in 1987-1989 found no leachate, standing liquids, or landfill gas. No ventilation or gas collection systems exist.
- Landfill No. 3: Operated from the late 1940's to 1953. The 1.9 acres are currently a golf course. Remedial investigations in 1987-1989 found no leachate, free liquids, or landfill gas. No ventilation or gas collection systems exist.
- Landfill No. 4: Operated from 1953 to 1962. The 2.6 acres are currently a golf course and housing area. Remedial investigations in 1987-1989 found no leachate, free liquids, or landfill gas. It was concluded that landfill gas was not a problem.
- Landfill No. 5: Operated from 1962 to 1970. The 7 acres are currently unused. Remedial investigations in 1987-1989 reports refuse 8-22 feet below ground surface. Test borings showed only minor levels of a volatile organic, trichloroethylene, in one soil boring. No volatile organic compounds (VOCs) or SVOCs were detected in any groundwater samples. It was concluded that landfill gas was not a problem.
- Landfill No. 6: Operated from 1971 to 1985. The 15 acres are currently used as nature trails. Remedial investigations in 1987-1989 reports landfill refuse. Above background OVA readings indicates that landfill gas may be present. Petroleum hydrocarbons were detected in two test pits. No ventilation or gas collection systems exist.
- Tests for the detection of CW agents or their byproducts were not conducted on any of the landfills.

Conclusions

- Flight nurses were given four hours of training in chemical warfare. There is indication that the nurses may have had gas mask training--either gas chamber or open-air smoke and tear gas. There is no indication of any advanced training, e.g., field identification of chemical agents that would have required use of Chemical Agent Identification Sets.

- The Air Force Reserve Training Center units received one hour of training in chemical warfare. The training consisted of lectures.
- The BW/CW research programs under the umbrella of the USAF School of Aerospace Medicine at Brooks included laboratory studies, literature searches, and reviews of available technical information. There is no evidence that BW/CW weapons or Chemical Agent Identification Sets were ever in possession of the laboratories.
- No tests were conducted for the presence of CW agent residues and byproducts in the landfills. However, there is no evidence that CW agents used in training at Brooks AFB would be anything more than tear gas.
- There is a very low probability of the presence of Chemical Agent Identification Sets at Brooks AFB.

Kelly AFB, Texas

Background

Kelly AFB, founded in 1917, is the oldest, continuously active airfield in the USAF. During WW I, Kelly Field was a reception and testing center for recruits and a training center for pilots and mechanics. The base consisted of a 700-acre tract of land south of San Antonio and adjacent to the Missouri-Pacific railroad. When that site proved too small, adjoining land to the north was leased; this area became known as Kelly No. 2. The southern site (Kelly No. 1) became a reception center for the recruits as well as the home for the Aviation General Supply Depot, which moved from downtown San Antonio. Kelly No. 2 was the home of most of the flying activities.

Kelly remained open after the end of WW I. The Aviation Repair Depot in Dallas was combined with the Aviation General Supply Depot; the new organization was known as the San Antonio Intermediate Air Depot. The Advanced Flying School moved to Kelly No. 2 in 1922 and trained pilots in the skills of pursuit, bombardment, attack, and observation. Every Army aviator finished his flight training during the 1920's, 30's, and early 40's at Kelly Field.

In 1925, the two Kelly Fields were officially separated. Kelly No. 1 was renamed Duncan Field and Kelly No. 2 became Kelly Field. Each field retained their assigned functions. By 1938, the San Antonio Air Depot (the former San Antonio Intermediate Air Depot) was the largest of the five major repair depots of the US Army Air Force. In 1943, Duncan Field and Kelly Field were reunited as Kelly Field. The mission of the field changed: the flight training mission moved elsewhere and the primary mission became that of maintenance, supply, field servicing of aircraft (B-17, B-25, B-29, C-47, and P-51), and overhaul of bombsights, engines and electrical equipment. The new organization was named the San Antonio Air Service Command.

Due to the requirement for more storage space, Kelly annexed the Normoyle Ordnance Depot, which is known today as East Kelly. Thousands of soldiers were discharged at the out-processing center established there at the conclusion of WW II.

Following WW II, the field downsized, but still retained its maintenance and supply functions. T-6, P-51, and B-29 aircraft were delivered to Kelly for disposal and storage. In 1946, San

Antonio Air Technical Services Command was renamed the SAAMA¹⁹⁰ and Kelly Field was renamed Kelly Air Force Base in 1948. The mission of Kelly has remained much the same since the end of WW II; the types of aircraft and engines have changed, but Kelly has remained a maintenance and supply base. Some of the aircraft managed and maintained included the B-36, B-47, B-58, and B-2 bombers; the F-102 and F-106 fighters; and the C-5 cargo planes. Various engines have been maintained at Kelly as well.

In June 1995, the Defense Base Closure and Realignment Commission (BRAC) announced that SA-ALC was included on the closure list of DoD facilities. The base is slated to close on 13 July 2001. SA-ALC functions have been transferred to other facilities and the process of turning the base over to civilian control is well underway.¹⁹¹

Discussion

BW/CW Activities

The 3rd and 5th Air Depot Groups were activated at Duncan Field on 1 May 1941. Troops were given on-the-job training (OJT), amplifying their previous training, for work in depots. "Courses in technical supply and engineering and maintenance were given. Incidental training, such as camouflage, chemical warfare, etc., was given along with the technical training." Several Air Depot Groups were trained; the troops were transferred overseas. A phased training program was developed and found to provide the best results: first phase, basic military training; second phase, OJT technical training; and finally, training with the group functioning as a unit under simulated field conditions.¹⁹²

The Military Training Section (MTS), subordinate to Personnel and Training Division, was comprised of the Military Training Commitments and Requirements, Training Aids, and Chemical Branches. The Chemical Branch was inactivated 1 January 1946 when the Chemical Officer was released from duty and the personnel strength was reduced to zero. The Branch

¹⁹⁰ In 1974, all Air Materiel Areas were renamed Air Logistics Centers by the Air Force Logistics Command.

¹⁹¹ This section extracted from: *A Brief History of Kelly Air Force Base*, KAFB Pamphlet 84-1, April 1998, Office of History, SA-ALC, KAFB Texas, and *A History of Military Aviation in San Antonio*, September 1996, Air Force Historians, SA-ALC, HSC, AETC, and SA-ACC.

¹⁹² History of San Antonio Air Service Command, 1 February 1943, pp. 88-93

continued on inactive status under the MTS until 18 June 1946 when it was transferred to the Deputy for Supply (T-4) and was designated as the Air Chemical Office.

The General Supply Section, Supply Division, consolidated the General Supply Branch, Sales Commissary Branch, and Publications Distribution Branch. Supply functions for Ordnance (Ammunition and Armament), Chemical, and Corps of Engineers (CE) were integrated into the General Supply Section. This action involved movement of records for 300 items of ordnance property, 550 items of CE property, and 216 items of Chemical property.¹⁹³

The Air Chemical Office, staffed by a Lieutenant Colonel and assisted by a civilian stenographer, was under the Deputy for Supply in accordance with AMC Reg 21-410 (20 June 1946). The Chemical Office continued to be "responsible for coordinating, planning, developing, and testing chemical warfare materiel related to projects for which Air Materiel Command was responsible and for disseminating technical information and instructions pertaining to chemical warfare matters..." Under supervision of the Staff Chemical Officer, one officer and four enlisted men of the 4505th AAF Base Unit conducted training for unit gas officers and unit gas NCOs, who in turn trained members of their respective units. On 1 July 1947 the Air Chemical Office and its functions were placed under the Deputy of Supply. Because of command reorganizations in July and August, the chemical activities were reinstated under Military Training with the same staff personnel.¹⁹⁴

The Staff Chemical Officer had various responsibilities. He acted in an advisory capacity to the Commanding General, SAAMA, on chemical activities. Also, he was engaged in the coordination of activities relative to chemical training; prepared technical material in lay terms for teaching atomic offensive measures; researched and segregated material for Radiological Defense presentations; and coordinated with Military Training Branch in conducting biological warfare training for all SAAMA officers.¹⁹⁵ Personnel from exempted stations were sent to the chemical training courses conducted by Military Training.

¹⁹³ SAASC, Kelly Field, Texas, September 1945 – 30 June 1946, pp. 9, 13, 43, 145, 173.

¹⁹⁴ History of SAAMA, Kelly Field, Texas, July 1947–December 1947, p. 151.

¹⁹⁵ History of SAAMA, Kelly Field, Texas, 1 January 1948–30 June 1948, p. 68.

In June 1948, 599 ROTC students reported to Kelly Air Force Base and entered in OJT and classroom training in specialized subjects. In addition to the specialized subject matter, all personnel were scheduled to receive training in chemical warfare. The training was completed on 14 July 1948.¹⁹⁶

In July 1948, the Air Chemical Officer was moved from Kelly proper to East Kelly to facilitate close coordination with the Military Training Branch which had also been moved to East Kelly. The chemical training included:

- Three hours CW instruction in field identification of chemical agents, gas chamber exercises, and gas mask drill for 624 ROTC students in July.
- Three-week course for four Unit Gas Officers and 20 Unit Gas NCO's from SAAMA military organizations, and Holloman and Kirtland Air Force Bases.
- Three hours Radiological Defense Training for 2,650 SAAMA military personnel.¹⁹⁷

The Ammunition School was consolidated with the Chemical School because of a decreased workload after an Air Ammunition Squadron was sent to Camp Stanley for training. The Chemical Warfare School had four instructors and/or administrative personnel furnished by the 2900th Depot Training Squadron.¹⁹⁸ The primary mission of the 2900th was to provide training personnel (instructors, etc.) to the Military Training Section of SAAMA.

The 29th Air Depot Wing was activated on 1 July 1949. Four more Wings were to be activated at three-month intervals during FY50. "Kelly was designated the AMC Depot Training Center for training these Air Depot Wings. Personnel assigned to the Air Depots were to be given depot level (4th echelon) individual training..."¹⁹⁹ There was no mention of chemical warfare training. On 15 August 1949, a Captain was announced as Acting Area Chemical Officer, a

¹⁹⁶ *ibid*, p 147.

¹⁹⁷ History of SAAMA, Kelly Field, Texas, 1 July 1948–31 December 1948, p. 172.

¹⁹⁸ History of SAAMA, Kelly Field, Texas, 1 January 1949–30 June 1949, pp. 195-6.

¹⁹⁹ History of SAAMA, Kelly Field, Texas, 1 July 1949–31 December 1949, p. 141.

responsibility that was in addition to his other duties. The Lieutenant Colonel was relieved to attend a course at Maxwell AFB.

The Air Depot Training program was brought to a close at Kelly in May 1950. Only two of the four wings scheduled for training had been trained. Two groups of the third wing scheduled for training were activated in February and deactivated in April. The two wings that had been trained were transferred to other bases. The 2900th Depot Training Squadron was discontinued on 1 June 1950. However, the training program was revived in August 1950 approximately one month after the military action began in Korea. The 2899th Depot Training Squadron was designated to accomplish air depot wing training and was organized at Kelly AFB on 3 August 1950. Personnel were assigned beginning September 1950.²⁰⁰

In 1951 a Real Property Record shows that Building 43, Chemical Warfare Office (200 ft x 200 ft) was renamed Admin/Supply Building. Building 43 was located on a San Antonio Air Depot Map, dated 20 February 1943, as the Chemical Warfare Service and Corps of Engineers Warehouse.

During the January-June 1951 period the 2899th Depot Training Group included an office for Chemical, Radiological Defense and Munitions Training. A Captain was listed as the OIC, with a Sergeant as the NCO in charge (NCOIC). Effective 2 April 1951, the functions of the Military Training Section were put under the command of the Chief, Military Training Branch, and all functions absorbed by the 2899th Depot Training Group.²⁰¹ During the latter part of June 1951, all military training activities were withdrawn from the 2899th Depot Training Group and placed under control of the Military Training Branch. A Chemical and Munitions Training school, staffed by a Captain, OIC, and a Master Sergeant, NCOIC, was among the military training schools in East Kelly.²⁰² In the first half of 1952, the Chemical and Munitions Training was consolidated with Air Police Training into the Air Police--Chemical Training Unit under one OIC. Personnel of the Air Police--Chemical Training Unit supervised the weapons firing of 4,584 officers and airmen at the Camp Bullis and Kelly firing ranges. In February 1952, the Unit Gas

²⁰⁰ History of SAAMA, Kelly Field, Texas, 1 July 1950–31 December 1950, pp. 206-9.

²⁰¹ History of SAAMA, Kelly Field, Texas, 1 January 1951–30 June 1951, p. 142.

Officer and Unit Gas Noncommissioned Officer Course was conducted for personnel of the 75th Air Depot Wing.

Collateral Training, comprised of 44 hours of instruction in basic military subjects and 24 hours of bivouac, began in January 1952, for personnel of the 610th Communications Construction Squadron and the 75th Air Depot Wing. Approximately 4,000 personnel completed the Collateral Training under supervision of the Troop Training Unit. Bivouac training began on 17 March. Each group was transported by truck to Camp Bullis (about 26 miles from Kelly). The first phase of the bivouac was firing on the firing ranges. The second phase was the transport of the trainees to a point six miles from the bivouac area for a road march back to the bivouac area. On the return march, the trainees were challenged with a surprise chemical attack of smoke and tear gas.²⁰³

The Air Police-Chemical Training Unit supervised the training of approximately 3,000 officers and airmen on the firing ranges at Kelly, Lackland, and Camp Bullis. Gas chamber exercises were conducted for 1,345 airmen of the 75th Depot Wing. Due to a limited number of gas masks, the trainees were processed in groups of 25.²⁰⁴ In October, Radiological Defense lectures were given to 334 civilian employees. The Air Police-Chemical Training, Military Training Branch, was staffed with three airmen.²⁰⁵ Organizational changes in 1953 resulted in the discontinuance of the Air Police-Chemical Training Unit and transfer of the remaining functions to the Troop Training Unit.²⁰⁶ There is no indication of any continuation of the chemical warfare training on the organizational charts.²⁰⁷

AMC Organization Directive (AMCOD) 21-4, 29 July 1952, para 3.a. (20), *Special Mission*, stated that SAMMA would "act as stock control point in the western zone for Army-purchased

²⁰² History of SAAMA, Kelly Field, Texas, 1 July 1951–31 December 1951, App. 1.

²⁰³ History of SAAMA, Kelly Field, Texas, 1 January 1952–30 June 1952, p. 174.

²⁰⁴ History of SAAMA, Kelly Field, Texas, 1 July 1952–31 December 1952, p. 209.

²⁰⁵ *ibid*, App. 1-A.

²⁰⁶ History of SAAMA, Kelly Field, Texas, 1 January 1953–30 June 1953, p. 243.

²⁰⁷ *ibid*, Appendix 1, p 3, and Appendix No. 47.

QM materials--handling and special purpose vehicle parts and Ordnance Corps items excluding weapons, Engineer spare parts, Transportation, and Chemical Corps."²⁰⁸

In 1954, SAAMA, Kelly AFB, was one of eight air materiel areas (AMA's) under AMC. SAAMA's mission was to provide worldwide support to USAF with respect to supply and services, maintenance engineering procurement, and to organize and conduct unit and individual military training in all fields of AMC activity. The Programs Division interpreted, published, and distributed programming data to all activities and organizations at SAAMA responsible for preparing FY55 Financial Plans and FY56 Budget Estimates. Major Budget Projects assigned SAAMA, with respect to Radiological, Biological, and Chemical matters, in which financial plans and budget estimates were prepared, were as follows:^{209, 210}

Budget Project	Title	Original B/A \$1,000.0	October. Revision \$1,000.0
272	Radiological, Biological, and Chemical Equipment	0	0
421	Organizational Base and Maintenance Equipment (Radiological, Biological, and Chemical Equipment)	33.1	57.6
422	Organizational Base and Maintenance Supplies (Radiological, Biological, and Chemical Equipment)	600.0	1,000

In the first half of CY55, mission, organizational, and jurisdictional changes were noted. The general responsibilities of HQ, SAAMA were to provide USAF logistical support, worldwide, for assigned property classes, manage weapon systems, and accomplish weapon system responsibilities. In the area of Special Weapons, SAAMA was to provide AF-wide logistical support and technical and quality control assistance for atomic weapons, atomic components, atomic weapons publications, and support equipment. SAAMA was designated as the Lead AMA, or the AMC focal point, on all supply and maintenance matters for all configurations of

²⁰⁸ History of SAAMA, 1 July 1952–31 December 1952, Appendix 69.

²⁰⁹ History of SAAMA, Kelly AFB, Texas, 1 January 1954–30 June 1954, pp. 195-196.

²¹⁰ History of SAAMA, Kelly AFB, Texas, 1 July 1954–31 December 1954, p. 268.

B-36, B-58, and F-102 weapon systems, and for the C-45, C-131, L-23, T-29, T-34, and XC-99 supporting systems.

A number of problems occurred relative to the decontamination of radioactive contaminated B-36s and, more specifically, the contaminated engines. SAAMA conducted Radiological Monitor Instructor's course for personnel from each Air Force Depot and Air Materiel Area. The trainees would act as instructors at their respective bases. To obtain experience, SAAMA personnel participated in decontamination of radioactive-contaminated aircraft at Indian Springs AFB, Nevada, in February 1955, and observed nuclear tests in February 1955 and biological warfare tests at Eglin AFB, Florida, in April 1955.²¹¹

In the first half of CY56, the phase-out of the B-36 began. By 30 June 1956, 29 B-36's had been received and placed in storage at Davis-Monthan AFB. Replacement aircraft included the B-47, B-52, and B-58. SAAMA's special weapons mission involved providing logistic support and technical assistance to: (1) war reserve nuclear weapons, (2) nuclear training weapons, (3) ground handling, loading, and testing equipment for nuclear weapons, (4) special support equipment owned by the AEC, (5) nuclear weapons publications, and (6) common AF property class peculiar to the Special Weapons Program.²¹² In the last half of CY56, SAAMA became the lead AMA for the F-102A and B-58, with prime responsibility for the J-57 series engines for the F-102A. SAAMA was the parent depot for support of AF training and DoD war reserve nuclear weapons. SAAMA was to insure that organizations with nuclear weapon capability were equipped with training weapons and necessary ground handling and test equipment. SAAMA was responsible for assuring that AEC-owned equipment installed in missile carriers was available for all missiles that SAAMA had prime responsibility. SAAMA as the Nuclear Ordnance Commodity Manager, had responsibility for storage and distribution of nuclear ordinance war materiel provided by the AEC.²¹³ By the latter part of CY57, SAAMA was heavily involved in the missile and aircraft programs and special weapons. There was no chemical

²¹¹ History of SAAMA, Kelly AFB, Texas, 1 January 1955–30 June 1955, pp. 21-23.

²¹² History of SAAMA, Kelly AFB, Texas, 1 January 1956–30 June 1956.

²¹³ History of SAAMA, Kelly AFB, Texas, 1 July 1956–31 December 1956.

warfare office identified in the organization nor was there any construction of CW-related projects identified.²¹⁴

In the first half of CY58, SAAMA's basic mission to manage assigned weapons systems and engines, and to buy, supply, and repair AF materiel was not changed. AMC Regulation 23-1, dated 30 April 1958, delineated the specific responsibilities of the Commander, SAAMA. The regulation also delineated special weapons and nuclear materiel responsibilities.²¹⁵ SAAMA's mission directive was rewritten to include specific responsibilities previously assigned, such as acting as management single point of contact for the Nuclear Ordnance Commodity Management System. Another responsibility was to "provide AF-wide maintenance engineering support for chemical, radiological, and biological decontamination as required by TO 00-110-2," which was first assigned in 1952 and clarified and reemphasized by later publications.²¹⁶ SAAMA's responsibilities for managing assigned weapon systems and commodity classes were somewhat modified during the latter part of 1958. However, the mission basically continued to be management of assigned commodity classes and weapon systems worldwide; management of base facilities, personnel and assigned installations; and providing technical assistance within specific geographical areas.²¹⁷

During the first half of 1960, an officer from SAAMA attended a four-week course at the US Army Chemical School, Ft. McClellan, Alabama. The course, 3A-F1, was a CBR Course for Officers. A five-day TDY trip to AMC, Wright-Patterson AFB, Ohio, was made to discuss Radioactive Training Source Requirements and problem areas relative to Atomic, Biological and Chemical Warfare.²¹⁸

Another continuing worldwide specific responsibility assigned to SAAMA was the preparation of chemical, radiological, and biological decontamination procedures for the Air Force as required

²¹⁴ History of SAAMA, Kelly AFB, Texas, 1 July 1957–31 December 1957.

²¹⁵ AMCR 23-1, App 3, 17 February 1958.

²¹⁶ History of SAAMA, Kelly AFB, Texas, 1 January 1958–30 June 1958.

²¹⁷ History of SAAMA, Kelly AFB, Texas, 1 July 1958–31 December 1958.

²¹⁸ FY60 History of SAAMA, Kelly AFB, Texas, Vol. 1, 1 January 1959–30 June 1960.

by TO 00-110-2 in AMCR 23-1, App 3, 31 March 61.²¹⁹ SAAMA had worldwide function for providing radiological decontamination procedures and contracts for radioactive waste disposal.²²⁰

In FY65, in support of Disaster Control, 13 employees were given specialized training qualifying them as Industrial Radiological Monitors. The trainees handled and worked with a radioactive alloy of magnesium-thorium. In support of the Emergency War Plans and the KAFB Disaster Control Plan, 464 personnel were given specialized team training by the Disaster Control Training Office. Seven of the 464 personnel were given training in Biological and Chemical Survey Teams.²²¹

In December 1966, SAAMA was assigned system support management responsibilities for the OV-10 aircraft and its power plant. The OV-10 could carry 3,000 pounds of cargo and armament in addition to fragmentation, chemical or demolition bombs, rockets, and sidewinder missiles.²²²

AMCR 23-1 was superseded by AFCLR 23-30, App 3, dated 20 August 1976. SAAMA responsibilities did not mention any BW/CW mission and included the following:

- "Provide Air Force-wide technical support in the area of radiological control and decontamination of aircraft, aircraft support equipment, personnel equipment, and air base facilities (para 4).
- Provide worldwide logistics and technical support to the Air Force for fuels, chemicals, liquid propellants, and DoD herbicide and vegetation control materials (AFLC23-45) (para 8).

²¹⁹ FY61 History of SAAMA, Kelly AFB, Texas, Vol. 1, 1 July 1960–30 June 1961.

²²⁰ FY62 History of SAAMA, Kelly AFB, Texas, Vol. 1, 1 July 1961–30 June 1962.

²²¹ FY-65 SAAMA History, Appendix 15, p. 4.

²²² FY-67 SAAMA History, Ch III, p. 54.

- Assume accountability and responsibility for the storage and maintenance of all existing stocks of Herbicide Orange (NSN 6840-00-926-9025) pending successful disposition as instructed by the program manager, AFLC/LOS.”

CW Buildings

- Building 920, Training Air Gas Chamber, was 956 square feet and can be found for the first time on a 1942 map.²²³ The building was located at the northerly end of the base map at approximate map coordinates N33+00 by W93+00. Building 920 was approximately 500 feet north of Leon Creek and serviced by the westerly end of Colin Kelly Drive. In terms of the Environmental Zones, Building 920 was located in the westerly area of Zone 5.²²⁴ The building was said to have been demolished by a contractor, date unknown.
- Building 650, Gas Instruction Building, was located at the southerly end of the base at approximate map coordinates S49+00 by W39+00.²²⁵ The building was approximately 800 feet due south of Military Road and approximately 1,000 feet west of the intersection of Military Road and Westover Road. In terms of the Environmental Zones, Building 650 was located in the northwesterly area of Zone 2.²²⁶ This is the area near where the current engine test cells are located. Building 650 has long since been demolished--probably well before the test cells were built.²²⁷ The first test cells were built in the 1950s.
- Building 187, Gas Instruction Building, was located at the southerly end of the base, approximately 1,200 feet due west of the northwest end of the NW-SE Kelly runway and the line of hangars along the north apron.²²⁸ Building 187 was identified as a temporary building. There were no roads identified on the map. In terms of the

²²³ Kelly Master Plot Plan, drwg #SAASC 45-235, sheet 66/234, dtd 30 July 1944.

²²⁴ Personal communication with R. Rohne, SA-ALC/EMRR, Kelly AFB.

²²⁵ Kelly Master Plot Plan, drwg #SAASC 45-235, sheet 68/234, dtd 28 July 1944.

²²⁶ Kelly Master Plot Plan, drwg #SAASC 45-235, sheet 68/234, dtd 28 July 1944.

²²⁷ Personal communication, Mr. Chuck Meschako, Base Conversion Agency.

²²⁸ General Plan, Kelly Field Texas, #2161-2900-3.1, USACE, 9/10/42.

Environmental Zones, Building 187 was located in the northwesterly area of Zone 1.²²⁹

- Building 43, Chemical Warfare Office, was identified as space for the Chemical Warfare Service and the Corps of Engineers warehouse. From the Real Property Record Card, the building name and function changed in 1951 to Administration/ Supply Building. The building is in current use and is presently located outside the base fence. Among other offices, the Base Conversion Agency is located in this building along with the other BRAC contractors. The building was redesignated on 18 May 1956.

Environmental

Landfill Site D-1 is located at the northern end of Zone 1 near the base boundary and within the Leon Creek floodplain. The site is divided into a northern area and a southern area. The northern area extends underneath the Westover Road Bridge to just northeast of current Building P962. This site is believed to be near the original location of Building 650, Gas Instruction Building. The Site D-1 area was in active use from 1917 to 1942. The site initially served as a bombing range and later for landfill operations. The landfill consisted of construction debris, scrap metal, and general refuse. Site D-1 is located at the northern end of Zone 1 near the base boundary within the Leon Creek flood plain. The site is divided into a northern area and a southern area. The northern area extends underneath Westover Road Bridge to just northeast of current Building P962. This site is believed to be near the original location of Building 650, Gas Instruction Building. The Site D-1 area was in active use from 1917 to 1942. The site initially served as a bombing range and later for landfill operations. The landfill consisted of construction debris, scrap metal, and general refuse. The site was originally believed to contain WW I munitions; however, later investigations and the timing of the landfill tends to disprove this theory. The south area of the site was previously used by Lackland AFB as a landfill. Kelly AFB currently owns the southern area property.

From 1969 to the present, Site D-1 has been used as a golf course. The first subsurface data from the Site D-1 area was collected in the early 1960s. During construction of Building P962

²²⁹ Personal communication with R. Rohne, SA-ALC/EMRR, Kelly AFB.

core borings showed 15 to 18 feet of construction debris and general refuse, under three to four feet of topsoil. In 1988 chemical data was obtained from Site D-1. A soil sample indicated chromium at two times the ABL. No organic analyses were performed.

A Site 1 Remedial Investigation (RI) was conducted in 1992. The chemicals of concern were determined by the sampling and chemical analyses that were performed during the RI. There were 21 volatile organic compounds, 41 semivolatile compounds, and 17 inorganic compounds plus cyanide. Twenty-four of these compounds are known as potential human carcinogens.

Interviews

Mr. Russ Rohne, Zone 1 Program Manager, SA-ALC/EM: Most of the landfills are located in Zone 1, which is the area in the south end of the base and primarily under the golf course. No testing or sampling was done for CW agents.

Ms. Anne Hussey, former chief historian, SA-ALC/HO: A CW Officer was assigned during WW II; herbicides (agents Orange, Blue, and White) were at Kelly during the Vietnam War; and finally, the assigned responsibility for BW/CW decontamination was probably management only. She knew of no activity, including training, at Kelly.

Sgt. Harper, SA-ALC/HO: He was unaware of any current gas chamber on Kelly. His mobility training for BW/CW consisted of classroom instruction and reading. At the most, he had to don the gear. No test of mask seal was made with any type of agent or simulant.

Conclusions

- SAAMA was assigned responsibility for the preparation of CBR decontamination procedures for the Air Force in 1952. This responsibility was dropped from the mission statement in the early 1970s.
- CW training for personnel assigned to Kelly AFB, included CW instruction in the field identification of chemical agents, gas chamber exercises, and gas mask drills. Except for the CW instruction in field identification of chemical agents, there is no other indication that any CAIS were ever present at Kelly AFB. If CAIS sets were used for training, either on base or off base, the CAIS would likely have been stored in the Chemical Warfare Office

warehouse (Building 43). There is judged to be a low risk that Chemical Agent Identification sets would be found on Kelly AFB.

- Three gas chambers were built and utilized on Kelly AFB. All gas chamber buildings have been destroyed, dates unknown. As far as is known, the exercises were conducted with tear gas only, although there is a possibility of the use of chlorine.
- Building 43 housed the Chemical Warfare Office and supplies. The building is currently outside the base fence and houses the Base Conversion Agency and other BRAC contractors.
- The land fill Site D-1 is located in the southern part of Kelly AFB, in the vicinity of the site of one of the gas chambers, now occupied by a golf course. A Remedial Investigation conducted in 1992 detected 80 chemicals comprised of volatile organics, semivolatile compounds, and inorganic compounds. Twenty-four of these compounds are known as potential carcinogens. No tests have been conducted for detection of CW agents buried in landfills.

McClellan AFB, California

McClellan Field

The Sacramento Air Service Command was opened in 1939 as a specialized depot providing support to the Army Air Corps.²³⁰ The 4th Air Service Area Command was originally located in downtown Sacramento, California, until early 1943 when it moved to McClellan Field.

McClellan Field, formerly named the Sacramento Air Depot, was located seven miles northeast of downtown Sacramento on approximately 3,000 acres. The move was the result of the reorganization of the Army Air Service Command into 11 different areas--each area designated as an Air Depot Control Area Command. McClellan Field was noted for its modern shops designed for aircraft and engine repair and overhaul as well as for supply.

The 4th Air Service Area Command was redesignated Sacramento Air Depot Control Area Command (SADCAC). The SADCAC was renamed the Sacramento Air Service Command in June 1943 and later became the Sacramento Air Materiel Area (SMAMA). Operations progressed from the maintenance of bombers in WW II and the Korean War to the maintenance of the jet aircraft of the 1960s.

In 1954 SMAMA's mission was to provide:

1. Worldwide support for its assigned weapons systems.
2. Worldwide management responsibilities for those weapons systems and assigned property classes.
3. Zonal responsibilities for certain assigned property classes.
4. Special logistical support for Air Force depots in the geographical area.
5. Distribution of supplies to the Pacific area.

²³⁰ History of the Sacramento Air Service Command, Chapters VII to XII, 1/1/39–1/3/42.

SMAMA's prime weapons were the government contracted output of the North American Aviation and Lockheed Aircraft Corporations.²³¹

In the 1960's SMAMA's mission became more communications—electronic and space logistics oriented. SMAMA was the point of Specialized Repair Activity for USAF ground communications electronic equipment and provided supply and maintenance services to support the beginning of space program operations.²³² Eleven aircraft models remained at SMAMA for system support management and inventory management purposes. SMAMA took over nearly all area aircraft support functions from the San Bernardino AMA.²³³ SMAMA provided worldwide support for 5,666 aircraft at 349 bases in 39 countries.²³⁴ During the operations in Southeast Asia SMAMA was involved in an all-out effort to support AF operations. In the 1966-67 time frame there were 25,000 to 26,000 personnel working at SMAMA.²³⁵ By 1971 the manning levels were at 18,000 personnel.²³⁶ Manning levels are currently at about 5,000 personnel. The Sacramento Air Logistic Center has been included on the BRAC and will close in year 2001.

Camp Kohler

The present-day Camp Kohler Annex consists of approximately 35 acres located approximately one mile east of McClellan AFB. The triangular shaped camp originally consisted of 785 acres bounded along one side by the Southern Pacific railroad. It is alluded that the base was first used for farm labor. With the attack on Pearl Harbor almost all West Coast residents of Japanese ancestry were removed to assembly centers such as the Walerga Collection Center, located on the Camp Kohler land, by June of 1942. The personnel were then removed inland to internment centers for the duration of the war. By July 1942, the War Department authorized

²³¹ History of SMAMA, 1 January 1954–30 June 1954, page 2.

²³² History of SMAMA, 1 July–30 June 1961, pages 1-3, 7.

²³³ History of SMAMA, 1 July–30 June 1962.

²³⁴ Sacramento Air Materiel Area Historical Study No. 55, Fiscal Year 1963, Mission and Management, 1 July 1962-30 June 1963.

²³⁵ Sacramento Air Materiel Area Historical Study No. 62, Fiscal Year 1967, Mission and Management, 1 July 1966-30 June 1967.

²³⁶ Sacramento Air Materiel Area Historical Study No. 69, Fiscal Year 1971, Mission and Management.

the acquisition of Walerga for an U.S. Army Signal Corps replacement training center. The facility had space for 5,000 men and could quickly be made available to the Signal Corps. The training center was deactivated on 30 October 1944.²³⁷

In 1946, the Air Force took over the Kohler area and began operating a laundry. In the following years the Air Force continued to lease the main portion of the Kohler area, but through condemnation proceedings, obtained title to the 35 acres on which the laundry was located. On 21 June 1947, a newspaper article describes a grass fire that swept through Camp Kohler with 50-mph winds.²³⁸ Of the 585 barracks, less than 100 were saved. The laundry was not damaged. All of the WW II era buildings and structures such as antenna masts have since been dismantled or burned.

For several years before 1954 McClellan AFB used the leased acreage at Camp Kohler to alleviate storage problems. Stored items included auxiliary fuel tanks, North America Aviation spares, engine stands and boxes, communications equipment, and household goods. Approximately 20,000 tons of items were stored at the Camp. Work done at Camp Kohler included the fuel tank reconditioning program and ground radar preinspection work. The Team 101 of the 1009th Special Weapons Squadron worked out of the area. The lease on the land was due to expire on 30 June 1954--the owners of the land wanted it back due to the increase in property value. The lease was extended for one year with the understanding that the property would be vacated by 1 July 1955.²³⁹ By 30 June 1955 SMAMA had completed its evacuation of the leased acres of Camp Kohler.

In the period of 1 July--31 December 1955 the Air Force purchased 12.97 acres of land adjacent to the existing Camp Kohler area to be used as an antenna farm by Detachment 5, 6936th Communications Security Squadron.²⁴⁰ The McClellan AFB Real Estate Holdings

²³⁷ Windmiller, Ric. Final Report on a Cultural Resources Inventory of Camp Kohler, McClellan AFB, November 1995.

²³⁸ Sacramento Union, 21 June 1947.

²³⁹ History of SMAMA, McClellan AFB, 1 January--30 June 1954, p. 180.

²⁴⁰ Administrative History, SAMA, McClellan AFB, California, 1 July 1955--30 June 1955, p. 117.

declared that as of 30 June 1958, the Camp Kohler land area was 44.02 acres.²⁴¹ In the first half of CY58 McClellan AFB purchased one additional acre of land for the Camp Kohler site, thus making the area a total of 45.02 acres. In FY61 Camp Kohler was listed in the McClellan AFB Real Estate Holding as having 40.28 acres.²⁴² In FY66 Camp Kohler was reduced in size to 36.3 acres.²⁴³ (The Air Force had deeded the land on which the sewage plant was sited to the county.) The real estate for Camp Kohler remained fixed at 36.3 acres through FY68,²⁴⁴ FY70,²⁴⁵ FY71,²⁴⁶ and FY72.²⁴⁷

In 1969, the 1155th Technical Operations Squadron began laboratory operations at Camp Kohler. The primary function of the facility was testing and modification of electronic systems used by the Air Force Atomic Energy Detection Systems. The 1155th departed Camp Kohler in 1987.

The main buildings of the present 35-acre site were the laundry facility, boiler room, wells, access roads, and antenna field. The laundry was a major operation and handled up to nine million articles of clothing a year. Laundry operations ceased in 1973 and the building was demolished in the late 1970's or early 1980's. Housing tracts (Foothills Farms) have been constructed extensively on the original land leased as part of Camp Kohler. Interstate 80 covers a portion of the original leased area as well. Presently, the site consists of the cement foundations and pads of the demolished buildings.²⁴⁸

²⁴¹ Sacramento Air Materiel Area, Mission and Management, 1 January–30 June 1958, Atch 15, McClellan AFB real estate holdings.

²⁴² Sacramento Air Materiel Area Mission and Management, 1 July 1960–30 June 1961, Exhibit 7.

²⁴³ Sacramento Air Materiel Area Historical Study No. 60, FY66, Mission and Management, 1 July 1965–30 June 1966, p. 57.

²⁴⁴ Sacramento Air Materiel Area Historical Study No. 64, FY68, Mission and Management, 1 July 1967–30 June 1968.

²⁴⁵ Sacramento Air Materiel Area Historical Study No. 68, FY70, Mission and Management.

²⁴⁶ Sacramento Air Materiel Area Historical Study No. 69, FY71, Mission and Management.

²⁴⁷ Sacramento Air Materiel Area Historical Study No. 70, FY72, Mission and Management, 1 July 1971–30 June 1972.

²⁴⁸ Report on a Cultural Resources Inventory of Camp Kohler, McClellan AFB, Sacramento County, California, by Ric Windmiller, for USACE.

Discussion

Chemical Warfare Training

McClellan Field. A review of a listing by function of the officers and enlisted personnel assigned to the Sacramento Air Depot contained no reference to chemical officers or enlisted personnel, nor to the Chemical Corps, during the period of 1939–January 1942.²⁴⁹ However, in early 1942, a map of McClellan Field identified a “Gas Instruction Chamber” south of the North-South runway on the south boundary of the Parade Field and Parking Area.²⁵⁰ The date of construction of the gas chamber was not known. If the gas chamber were constructed earlier than 1942, a chemical staff would have been necessary for administration of the training program prior to 1942.

An organizational chart, dated 20 July 1943, listed a Lieutenant Colonel (O-5) as Chief of the Chemical Warfare Section. Within the CW Section were two branches--the CW Personnel and Training Branch and the CW Supply and Maintenance Branch, each managed by a Lieutenant. Under the Personnel and Training Branch were a CW Personnel Unit, an Area CW Training Unit, and a Chemical Company Training Unit. The Supply and Maintenance Branch had only the Area CW Supply and Maintenance Unit.

The Commanding General, SASC, had a conventional military staff made up of 11 officers representing each branch of the Army (e.g., Engineer, Signal, Medical, etc.) and included a Chemical Officer (O-5). A similar staff organization was in place for the air base including a Chemical Officer (O-2).

The Sacramento Air Service Command, formerly the 4th Air Service Area and the Sacramento Air Depot Control Area Command, expended considerable effort in preparing chemical units for overseas assignments during the period of August 1942 to April 1944. In 1942 thirty chemical units were organized at Merced Fairgrounds, California (95 miles SSE of Sacramento). The organization of these units, for the most part chemical air operations and a few chemical maintenance and chemical depot companies, was completed in the latter part of 1942. The

²⁴⁹ History of the Sacramento Air Service Command, Chapters VII to XII, 1 January 1939–3 January 1942, pp. 294-295.

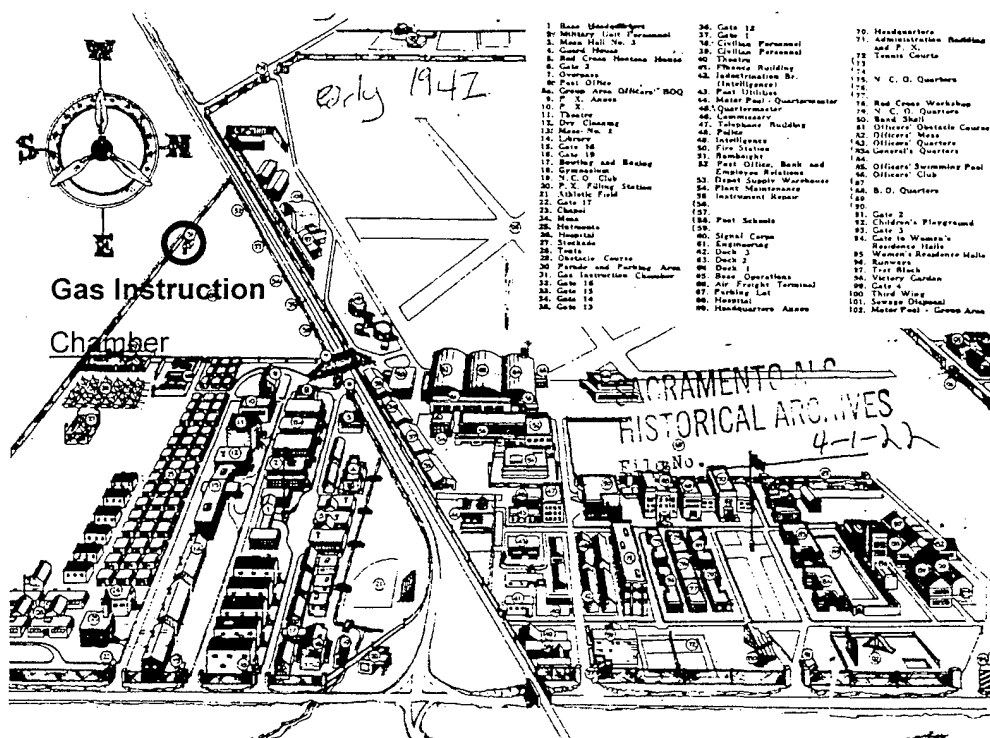


Figure 4. Map of McClellan, Early 1942

training of the chemical units at Merced Fairgrounds was conducted under the supervision of the CW Special Staff Officer, 4th Air Service Area. In January 1943, 24 of the 30 units were transferred to the Reno Army Air Base, Reno, Nevada, due to the availability of better training facilities. In July 1943 all chemical units and activities stationed at Reno Army Air Base were transferred to Fresno Basic Training Center, Fresno, California, to accommodate the Air Transport Command move into Reno for training in high altitude cold weather flying.²⁵¹

In early 1943 the Sacramento Air Service Command area headquarters moved from downtown Sacramento to McClellan Field. The chemical section was housed in Building 10 (Administration Building) across the street and between the fire station and the hospital adjacent to the HQ, SADCAC. In September 1943, the Chemical Section was moved from Building 10 to Building 53 in the Industrial Area. In November 1943, all Special Staff Sections were reorganized by transfer of all operating functions into the operating divisions. The

²⁵⁰ Sacramento ALC Historical Archives, File No. 4-1-22.

²⁵¹ Sacramento ALC Historical Archives, File No. 16-3-5, History of Activities Connected With Chemical Section, SASC for Period August 1942-April 1944, p. 1.

Chemical Warfare Personnel Officer and Chemical Warfare Training and Operations Officer was transferred into the Personnel and Training Division and the Chemical Warfare Supply Officer was transferred into the Supply Division. In early December the Chemical Section was moved back to Building 10 for convenience and for providing more space for expanding activities in the Industrial Area.²⁵²

Due to the transfer and disbanding of chemical units, the effort of the chemical section was directed toward training of other than chemical units in the defense against chemical attack.²⁵³ The Sacramento Air Technical Service Command conducted more training in 1944 than any other period in its history and thereby increased the CW training to a new high. With the exception of four chemical air operations companies, all units in training during January 1944 were other than chemical. The CW training accommodated the change by revising the CW training from the offensive phase to the defensive phase for the Air Corps, Ordnance, Quartermaster, and Signal Corps units. Approximately 17 service groups, and over 50 miscellaneous units, were trained at ATSCC, Fresno, California; Port of Stockton; and McClellan Field, California.²⁵⁴

Until November 1944, the chemical warfare property branch had no storage facilities for high explosives, i.e., primacord and electric detonators. Storage space for these types of items was located two miles from the group area where other CW ammunition was stored. This required a four-mile round trip each time a high explosive item was required in training exercises. Suitable magazines for high explosive storage were obtained near the other CW storage warehouses. White phosphorus (WP) grenades were stored separately from other ammunition in converted 55-gal oil drums. WP grenades were sometimes used for demonstration purposes and sometimes to generate smoke obscuration.²⁵⁵

During 1944, the Base Chemical Section of McClellan Field conducted 48,000 man-hours of training. Training consisted of qualifying unit gas officers (UGO), unit gas non-commissioned

²⁵² *ibid*, p. 2-4.

²⁵³ *ibid*, p. 4.

²⁵⁴ Annual Report of Chemical Warfare Activities, 1 January 1944-31 December 1944, p. 1-2.

²⁵⁵ *ibid*, p. 3.

officers (UGNCO), training of decontamination and anti-incendiary personnel, and conducting basic chemical training for units. Each quarter all enlisted men went through the gas chamber, using chloroacetophenone (a tear gas) and chlorine. Approximately 9,200 personnel passed through the gas chamber during the year. The lectures and outdoor exercises were supplemented with approximately 10,000 man training-film hours. Merger of the Materiel Command and the Air Service Command had no effect on the operation of the Base Chemical Section at McClellan Field.²⁵⁶

At some point in the training of UGOs and UGNCOs the identification of chemical warfare agents would have been addressed. This was usually done by use of the CAIS.²⁵⁷ The containers of diluted agent would be presented to the trainees for identification of the CW agent by odor. In some cases the basic training units would also be exposed to this level of training.

In the first half of 1945, CW training consisted of qualifying UGO, UGNCO, and training of gas defense personnel. Gas chamber exercises were conducted periodically using tear gas and chlorine. AAF Regulation No.-50-25B, dated 14 February 1945, directed that all personnel of this command would participate in gas chamber exercises every three months. In the first part of May 1945, it became necessary to move the CW property from its current storage building, T-405. A small building was secured and moved to the gas chamber area for purposes of issuing and receiving CW supplies and equipment.²⁵⁸

A Chemical Training Unit was formed on 1 June 1948 in order to institute refresher classes in CW for all personnel assigned to McClellan AFB and to conduct UGO and UGNCO courses for the entire SMAMA area. Four classes of ten hours each were developed as refresher courses. The classes consisted primarily of reacquainting personnel with the fundamentals of CW, necessary precautions, and first-aid measures for safety. The Chemical Training Unit was formed by a Chemical Officer who was also on the Technical Services Staff. In this capacity,

²⁵⁶ *ibid*, p. 3.

²⁵⁷ Appendix A contains additional information on CAIS.

²⁵⁸ History of Chemical Office, SATSC, 1 January 1945–30 June 1945.

he advised the Commanding General and other staff officers on all technical matters pertaining to chemical warfare on the base and in the Area.²⁵⁹

An organizational chart of SMAMA, dated August 1949, lists the Chemical Officer and Ordnance Officer slots on the Technical Services Staff as filled by the same individual. The October 1949 SMAMA organizational chart lists an Ordnance Officer on the Technical Services Staff but no longer lists a Chemical Officer.

The 2942nd Depot Training Wing formalized Standard Operating Procedures for Biological Warfare Defense Training and Chemical Warfare Defense Training at McClellan AFB during 1952.²⁶⁰ The biological warfare defense training, which complied with AFR 355-5, AFL 355-3, and AMCR 50-13, was divided into two phases:

1. An indoctrination phase of 1-2 hours duration for all military personnel, all civilian supervisory personnel, and all security personnel.
2. A security phase of 2-3 hours duration for all security personnel.

The CW defense training, which complied with AFR 50-25, AFR 355-3, and AMCR 355-1, was of a duration not less than one hour for all military personnel assigned to McClellan AFB. Both courses were to be conducted in Theater Number 1.

The 2942nd Depot Training Group reported in December 1953 the courses presented and the number of military personnel completing each course.²⁶¹ The Radiological Defense and Chemical Warfare courses were each completed by 240 personnel. There was no course offering for the subject of Biological Warfare.

In 1954, the preparation of the SMAMA history departed from the old system of historical reporting to a functional approach.²⁶² Under the functional approach major projects

²⁵⁹ History, SMAMA, McClellan AFB, California, 1 January–30 June 1948, pp. 172-174.

²⁶⁰ History of 2542nd Depot Training Wing, SMAMA, 1 April-June 1952.

²⁶¹ History, SMAMA, McClellan AFB, California, 1 July 1953–31 December 1953, p. 296.

²⁶² History, SMAMA, McClellan AFB, California, 1 January 1954–30 June 1954, Preface.

predominated and minor developments were played down or left out. The 2942nd Depot Training Wing was not significant enough to warrant a reporting of its training program. Therefore, it cannot be determined that the programs for Radiological Defense and Chemical Warfare courses were still viable during this period.

In FY60 the Base Provost Marshall Division reported offering training courses, which were attended by its troops--no BW/CW training was listed.²⁶³ A sampling of the courses offered included Management I, Effective Writing, Radiological Monitoring, Specialized Security Training, etc. There was no evidence found that indicated any BW/CW training was conducted by any organization at McClellan Field in any of the following years.

Camp Kohler. Camp Kohler was used by the Signal Corps as a replacement training facility from July 1942 through October 1944. In February 1944, a Schedule of Buildings for Camp Kohler listed Building T-3968, Gas Chamber and Building T-3969, Chemical Magazine. The gas chamber was 1,200 square feet, on a concrete floor, with frame and paper (tarpaper) construction. The chemical magazine was 60 square feet built of reinforced concrete. The presence of the gas chamber and CW magazine at Camp Kohler would indicate that the unit personnel would have received CW training, both classroom lectures and gas mask exercises.

In July 1948, an inspection of the Camp Kohler area and buildings was conducted by the Air Inspector and his team. The inspection was done to determine how well HQ SMAMA accomplished command responsibilities with regard to Camp Kohler.²⁶⁴ A list of buildings at Camp Kohler identified those designated for retention. A similar list of property at Walerga sub-depot and Camp Kohler identified those designated for disposal. Among the buildings designated for disposal was T-3969, Chemical Magazine, 60 square feet, with no installed property. The Gas Chamber Building, T-3968, built on a concrete floor, with wood frame and paper (tarpaper) construction, was probably destroyed in the grass fire of 1947.²⁶⁵ The Chemical Magazine, constructed of reinforced concrete, probably would not have suffered

²⁶³ Sacramento Air Materiel Area Mission and Management, 1 July 1959--30 June 1960, p. 11.

²⁶⁴ Routing and Record Sheet, Air Materiel Command, Subj: Command Responsibility--Camp Kohler, 16 July 1948.

²⁶⁵ Sacramento Union, 21 June 1947.

much damage from the fire. The lack of a gas chamber and chemical magazine at Camp Kohler would strongly suggest that a CW training program was probably not in evidence after the grass fire of 1947 and certainly not in evidence after the chemical magazine was listed for disposal in 1948.

Davis Global Communication Site. The Davis Global Communication Site,²⁶⁶ located 15 miles west of Sacramento and 2 miles south of Davis, is situated on 316 acres. Wilson Park is adjacent to the Davis Site on 320 acres. The land of Wilson Park was originally part of the Davis Site (636 acres) but was deeded to Yolo County in 1973 for the development of a park. Wilson Park is now classified as a Formerly Used Defense Site and is under investigation by the USA Corps of Engineers. An area of the park's land was reportedly used by the Air Force as a burial or burn pit during the 1950s and 1960s.

There is a minimal risk that CW training was ever conducted at the Davis Site. The relatively small number of personnel on duty at the site, at any one time, could be given CW training more efficiently by utilizing the SMAMA CW training program of instruction and gas chamber facilities.

Lincoln Receiver Site. The Lincoln Receiver Site²⁶⁷ is located approximately 15 miles north of McClellan AFB and 5.5 miles west of the city of Lincoln; the size of land parcel was not specified. Three diesel underground storage tanks were removed from the site in 1988. Contaminated soil from around the tank locations was removed in June 1989. There appears to be no other problems.

There is minimal risk that any CW training was ever conducted at the Lincoln Site. As in the case with the Davis Site, the small number of personnel on duty at the site could be given CW training more efficiently by utilizing the SMAMA CW training program of instruction and gas chamber facilities.

²⁶⁶ McClellan Air Force Base 1997 Base Realignment and Closure (BRAC) Cleanup Plan, SM-ALC/EM (from: www.mcclellan.af.mil/EM/), para. 1.5, Offbase Property/Tenants.

²⁶⁷ Ibid.

Landfills

McClellan AFB has identified over 250 individual Installation Restoration Program (IRP) sites requiring investigation and possibly remediation. The main contaminants are VOCs. The IRP program had removed approximately 650,000 pounds of VOCs by April 1997. The groundwater actions at the base include operation of several localized groundwater extraction systems. These wells are placed to contain the area of the contaminated ground water plume and to remove the mass of contamination in the groundwater.

As of 1997, 257 sites under the jurisdiction of McClellan AFB were tracked for cleanup contamination. There were 254 listed sites on the base and 3 off-base sites, one each at Davis, Lincoln, and Camp Kohler. At the end of 1996, 73 sites were recommended for No Further Investigation or had remedial action taken. Twelve of the 73 sites have been officially closed and are tracked now under one site.²⁶⁸

Conclusions

- Extensive chemical warfare training took place at McClellan AFB. There is a reasonable chance that CAIS may have been used in the rather extensive CW training exercises at McClellan, particularly for the UGOs and UGNCOs. However, there is no hard evidence to support or deny the use of CAIS. Therefore, it is considered a moderate risk that CAIS debris could have been buried in a landfill operable during the training period. If any of the CAIS agent containers were broken when buried in the landfill, only the hydrolyzed agent byproducts would be detectable at this date.
 - A "Gas Instruction Chamber" was identified south of the North-South runway on the south boundary of the Parade Field and Parking Area, McClellan AFB, in early 1942.
 - Suitable magazines for high explosive storage were obtained near other CW storage warehouses. WP grenades were stored separately from other ammunition.
 - All enlisted men went through the gas chamber each quarter, using chloroacetophenone (a tear gas) and chlorine. In 1944, approximately 9,200 personnel passed through the gas chamber.

²⁶⁸ *ibid*, Chapter 3.

- During 1944, the Base Chemical Section of McClellan Field conducted 48,000 man-hours of training in qualifying unit gas officers, unit gas non-commissioned officers, and decontamination and anti-incendiary personnel as well as in basic chemical training for units.
- Camp Kohler had a gas chamber and a chemical magazine in February 1944. The Signal Corps unit may have received CW training during the period of February through October 1944 when the Corps was reassigned. It is highly unlikely that any further CW training was ever conducted at Camp Kohler.
- There is a minimal risk that any CW training was ever conducted at either the Davis Site or the Lincoln Receiver Site. However, the paucity of records available for both sites precludes an assertion of zero risk.

Hanscom AFB, Massachusetts

Background

Location

Hanscom AFB is located five miles south-southwest of Bedford, Massachusetts, and 15 miles northwest of Boston, Massachusetts. It is named for Laurence G. Hanscom, a Boston pilot and newspaper reporter involved in the founding of the Massachusetts Civil Air Reserve. While the base has had several other designations, the current name--Hanscom Air Force Base--was assigned in January 1977.²⁶⁹

History

During World War II, the Office of Scientific Research and Development (OSRD) and the National Defense Research Council were created by Executive Order to mobilize scientific manpower and facilities. They were to coordinate research and development on weapons, devices of warfare, and problems of military medicine. Two organizations conducting research for the Army Air Force under OSRD were the Massachusetts Institute of Technology (MIT) and Harvard University. MIT operated a Radiation Laboratory and Harvard operated a Radio Research Laboratory.²⁷⁰ The Bedford Army Air Field (early name for Hanscom AFB) became a test facility for radar and radio research by MIT and Harvard University.

Shortly after Victory in Europe day, MIT announced deactivation of the Radiation Laboratory and Harvard began dissolving the Radio Laboratory. The Army Air Force wanted to continue this electronics research program at the AAF electronics laboratories at Wright Field, Dayton, Ohio, and at the Watson Laboratories at Red Bank, New Jersey. Officers from the Watson Laboratories went to Cambridge in August 1945 to review the ongoing projects at the two laboratories and to hire personnel to continue their work for the AAF. It was planned that all

²⁶⁹ Mueller, Robert. Reference Series, Air Force Bases, Vol I, Active Air Force Bases Within the USA on 17 September 1982. USAF Historical Research Center, 1989.

²⁷⁰ History of Watson Laboratory, Cambridge Field Station, 3 September 1945-30 June 1946.

property, personnel, and projects would be moved to a permanent location at Wright Field, Dayton, Ohio.²⁷¹

The Air Technical Service Command decided to establish a new station to absorb essential personnel and projects in the interim, prior to the planned transfer to Wright Field. The new station, under supervision of the Watson Laboratories, was known as Watson Laboratories, Cambridge Field Station located at 224-230 Albany Street, Cambridge, Massachusetts. Several outlying facilities were also included--the Ipswich Antenna Station, Ipswich, Massachusetts, and several buildings at Bedford Army Air Field (now Hanscom AFB). By June 1946, the Cambridge Field Station was fully functioning with six laboratories: Antenna, Radar, Relay Systems, Visual Design, Radio Frequency Components, and Navigation.²⁷²

The Cambridge Field Station was moved from the jurisdiction of Watson Labs to the jurisdiction of the AMC in December 1947. The Geophysical Research Division of Watson Laboratories moved to the Cambridge Field Station in 1948. Cambridge Field Station was redesignated the Air Force Cambridge Research Laboratories (AFCRL) in July 1949. AFCRL was reassigned from AMC to ARDC in April 1951. AFCRL became part of the newly formed AF Cambridge Research Center (AFCRC) in June 1951.²⁷³

Facilities for geophysics, electronic, nuclear, and chemistry research were built at Hanscom AFB, and the base became part of the Air Force Cambridge Research Center in 1952-1954. By 1955, the whole of AFCRC relocated at the base. By 1960, Hanscom had become the principal USAF base electronic research site and responsible for the development of electronic systems. The Electronic Systems Division, which was formed in 1961 as part of the Air Force reorganization, occupied its new headquarters building in September 1963 and a new systems design laboratory was dedicated in December 1963. A special computation laboratory was completed in March 1971. All USAF flying activities were terminated at Hanscom AFB by 1 September 1973.

²⁷¹ *ibid.*

²⁷² *ibid.*

²⁷³ Liebowitz, R.P. and P.A. Maria. A Historical Chronology of Hanscom AFB, 1941-1997. History Office, Electronic Systems Center, Hanscom AFB Massachusetts, November 1997.

Between 1943 and 1971, there were 45 major off-base and detached sites established by AFCRC or its predecessor. Approximately 15 sites were Electronic Research Annexes, 12 sites were Geophysics Research Annexes, 3 sites were Radar Research Annexes, and 1 site was a missile early warning facility. Geographically, the sites were predominately located in the Boston area with some sites at various locales within Massachusetts. Sites were also located in Alaska, Arizona, California, Delaware, Minnesota, New York, and New Hampshire,

Environmental Investigations

Hanscom Environmental Office has conducted environmental restoration efforts under the USAF IRP. In 1984 an Installation Assessment/Records Search was completed for the Hanscom AFB/L.G. Hanscom Field complex and for off-base property under the control of Hanscom AFB.²⁷⁴ The purpose of this investigation was to identify the potential for environmental contamination from past waste management practices, evaluate the probability of contaminant migration, and assess the potential hazard posed by past disposal activities. The effort identified 13 specific sites to be included in the restoration program. Subsequent discoveries have increased the number of IRP sites to 22.²⁷⁵ The sites are identified as follows:

- Site 1--Fire Training Area II
- Site 2--Paint Waste Disposal Area
- Site 3--Jet Fuel Residue/Tank Sludge Area
- Site 4--Sanitary Landfill
- Site 5—Fire Training Area I
- Site 6—Former Filter Bed Area
- Site 7—Industrial Wastewater Treatment Plant
- Site 8—Scott Circle Landfill
- Site 9—Administration Building Jet Fuel Spill

²⁷⁴ Installation Restoration Program, Phase I, Records Search, Hanscom AFB, Massachusetts, August 1984.

- Site 10—Mercury Spill at Building 1128
- Site 11—Various Fuel Spills on Runways and Taxiways
- Site 12—AAFES Service Station Gasoline Leak
- Site 13—Motor Pool Gasoline Leak
- Site 14—Multi-Site Underground Storage Tank Investigation
- Site 15—Multi-Site Underground Storage Tank Removal
- Site 16—Petroleum Contamination at Building T-860
- Site 17—Petroleum Contamination at Building 1102-C
- Site 19—Suspected Dump Site
- Site 20—Suspected Fire Training Site
- Site 21—Unit 1 Petroleum Spill
- Site 22—AAFES Base Service Station Petroleum Leaks

In support of the Hanscom IRP the Environmental Protection Agency conducted an analysis of historical aerial photographs to confirm IRP sites previously identified and identify any other potential sites such as landfills, disposal areas, or spills.²⁷⁶ This effort did not uncover any additional areas of concern.

Discussion

Technical Service Staff

A Technical Service Staff, established 1 December 1948 for the Cambridge Field Station, included requirements for a Chemical Officer, Ordnance Officer, Quartermaster Officer, and Communications Officer. However, the only Officer assigned was the Communications Officer. There were no existing functions within the Station applicable to the other technical services.²⁷⁷

²⁷⁵ Installation Restoration Program, Management Action Plan for 1999, Hanscom AFB, Massachusetts, April 1999.

²⁷⁶ Aerial Photographic Analysis, Hanscom AFB, Bedford, Massachusetts, Environmental Protection Agency, June 1998.

²⁷⁷ Unit History, Cambridge Field Station, AMC, 3160 Electronics Station, Cambridge, Massachusetts, Vol. VIII, Parts I and II, 1 July 1948–31 December 1948, p. 42.

In 1949, the organizational structure for the Cambridge Research Laboratories remained essentially the same with the exception that the Chemical and Ordnance elements were deleted and an Armament Officer added.²⁷⁸ In 1950, the Technical Services staff was declared inactive.²⁷⁹ It is reasonable to conclude that if no existing functions within AFCRL required a Chemical Officer on the technical services staff, then there probably were no CW programmatic items within the AFCRL.

Buildings

A historical information folder of Hanscom AFB, circa April 1951, provided a schedule of buildings in Area 1. The detail was sufficient that the Low Trap House (T-382) and the High Trap House (T-381) were listed along with the Control Tower (T-383) for the skeet range. A schedule of buildings in Area 2 listed an Armament Building (T-218). Area 1 and Area 2 did not list any chemical warfare building for training or gas chamber use.

In 1952, a list of nine separate specialized buildings for the proposed consolidated Air Force Reserve Training Center included a requirement for a 1,000-sq. ft. CWS building.²⁸⁰ While there was evidence that some of the specialized buildings were eventually constructed, there was no evidence that the CWS building was ever approved for construction. A review of the property records indicated that no such a building was constructed at Hanscom AFB. A review of the AFCRC Public Works Construction Schedule revealed that no building was designated for chemical warfare materiel storage or usage.²⁸¹ A drawing²⁸² of an addition to the Technical Training Building, 7 July 1964, AW-28-14-04, shows the plan of Bldg 1697, which was built for use by the AF Reserve Training Center. The building consisted of offices and classrooms. No chemical training chamber was indicated on the plans. A drawing of the Existing Building

²⁷⁸ Air Force Cambridge Research Laboratories, HQ and HQ Squadron, 3160 Electronics Group, Cambridge, Massachusetts, Vol X, 1 July 1949–31 December 1949, p. 5.

²⁷⁹ Historical Data, Vol XI, HQ and HQ Squadron, 3160 Electronics Group, 230 Albany St., Cambridge, Massachusetts, 1 January 1950–30 June 1950, p. 3.

²⁸⁰ History of the Air Force Cambridge Research Center, 1 January–30 June 1952, Vol XVI, Part I, Appendix 30, Consolidation of AFRTC Buildings.

²⁸¹ Air Force Cambridge Research Center, Review, 10 December 1954.

²⁸² Documents found in the Civil Engineer's Map Vault.

Schedule, dated 1 January 1966, listed several small chemical storage buildings for paint and miscellaneous items, but no buildings were listed for the storage of CW materials.

Geophysics

The Geophysics Research Division published a report²⁸³ on the methods for prediction of the diffusion of contaminating matter in the atmosphere. The report outlined the general relationship between meteorological conditions and the use of tactical weapons. The Army Chemical Corps requested copies of the report for use in the evaluation of the expected behavior and effectiveness of CBR agents in the lower atmosphere.²⁸⁴

In 1954, the Atmospheric Analysis Laboratory conducted extensive studies and analyses of atmospheric turbulence and diffusion. The mission of the laboratory was to develop techniques for preparing specialized meteorological forecasts for use by the military forces. Essentially all of the fieldwork was done off-site. There is no indication that any CW, BW, or RW agents and/or associated weapon systems were used by the Atmospheric Analysis Laboratory during the course of their study.²⁸⁵

The Atmospheric Circulation Laboratory, Geophysics Directorate, carried out meteorological research related to the motions of the atmosphere and handled problems of interest to the Air Force. Aerosol studies were designed to increase knowledge of the effects of atmospheric circulation on particle distribution. Radioactive and stable aerosols, natural and artificial, were sampled, collected, and analyzed.²⁸⁶

- To provide data for construction of boundary-layer models, a 1521-ft TV tower located near Dallas, Texas, was especially instrumented for meteorological measurements. The system provided routine observations of the westerly and

²⁸³ Davidson, B. Forecasting Diffusion in the Lower Layers of the Atmosphere. Atmospheric Analysis Laboratory, 1952.

²⁸⁴ History of Air Force Cambridge Research Center, Vol XVI, Part 1, 1 January–30 June 1952.

²⁸⁵ Documents from a file entitled "AFCRC Documents, 1950's," Inclosures 1 and 5, 1954.

²⁸⁶ Air Force Cambridge Research Center, Geophysics Research Directorate, Annual Report, 1960, AFCRL 637, Air Force Cambridge Research Laboratories.

southerly components of the wind at 12 levels from 30 ft to 1,428 ft above ground. Sonic anemometers, mounted at five levels on the tower, measured the intensity of atmospheric turbulence up to heights of 1,300 ft above ground. The Dallas Tower trials provided analysts with significant data for use in their development of transport and diffusion models.²⁸⁶

- Detailed diffusion measurements were made in 1956 (Prairie Grass)²⁸⁷ near O'Neill, Nebraska. The tests provided a significantly improved picture of the diffusion process over a range of 800 meters over flat, uniform terrain. This Prairie Grass work was extended by a series of experiments (Green Glow)²⁸⁸ conducted in the summer of 1959 near Richland, Washington, at the Hanford Reservation, US Atomic Energy Commission site. These experiments, conducted at night, provided measurements of horizontal and vertical diffusion over ranges of 16 and 2 miles respectively.²⁸⁶
- In 1961, the Atmospheric Circulation Laboratory conducted tests at Cape Canaveral (Ocean Breeze)²⁸⁹ followed by tests at Vandenburg AFB (Dry Gulch)²⁹⁰ for the AF Ballistics Systems Division. This series of tests described the potential pollutants that, when exposed to the atmosphere, emit toxic vapors that create a pollution hazard during the launch of the Titan II missile.

While the data collected by these series of transport and diffusion trials was valuable to the customer, other analysts could use the data in the development of their transport and diffusion models. There was no indication that any of these trials were for or involved the Army Chemical Corps. No BW/CW agents or weapons systems were used in these trials.

²⁸⁷ Barad, M. L. Project Prairie Grass, A Field Program In Diffusion, Vol. I. AFCRC-TR-58-235(1), July 1958. (AD152572)

²⁸⁸ Barred, M. L. and J. J. Fuquay. The Green Glow Diffusion Program, Vol I. AFCRL-62-251(1), January 1962. (ADA275123)

²⁸⁹ Haugen, D. A. and J. H. Taylor. The Ocean Breeze and Dry Gulch Diffusion Programs, Vol II. AFCRL-63-791(1), December 1963. AD427687

²⁹⁰ Ohmsted, W. E., R. K. Dumbauld, and G. G. Worley. Ocean Breeze/Dry Gulch Equation Review. ESL-TR-83-05, December 1983. ADB080677

Training

In 1955, the HQ Squadron Section, 6520th Air Base Group, provided administrative and supply facilities for personnel assigned to the Air Base Group Headquarters. The 6520th was assigned the following missions:

- The Training Section administered and completed the Basic Indoctrination Course. The training classes for the 14th Air Police Squadron consisted of 15 troops per class. They were instructed in the following subjects: military law, Air Police records, radiological warfare, familiarization with the handling and firing of automatic weapons, chemical warfare, physical training, military drill, funeral ceremonies, manual of arms, and military justice.
- The 6520th Field Maintenance Squadron provided field maintenance for all aircraft and for project installation on aircraft used by the AFCRC R&D program.
- The 6520th USAF dispensary completed blood counts on all personnel exposed to radioactivity during the six-month period. The Preventative Medicine Officer lectured on radiobiological health to a class of personnel being trained to conduct classes on their own. A medical doctor lectured on biological and chemical warfare.²⁹¹

The Plans and Training Branch, reporting directly to the Commander, Air Base Group, was responsible for providing small arms marksmanship training for all attached and assigned military personnel. The Branch also provided training and indoctrination in support of the Base Disaster Control, Defense and Domestic Emergency Plans.²⁹² The Wing Operations Plan 2-62 specified that all the CBR equipment (radiac sets, butyl rubber suits, gas masks, films) on the Base be under direct control of the Plans and Training Branch. The Branch would also coordinate emergency procedures with CBR monitors of the Groups under the Air Base Wing.

Special Orders were prepared for the Air Base Group Monitor and Survey and Personnel Decontamination teams. A Staff Sergeant was assigned as the Air Base Group CBR/Disaster Control Monitor with a Lieutenant assigned as Air Base Group Disaster Control Officer. Each

²⁹¹ History, 6520th Air Base Group, 1 July–31 December 1955.

²⁹² History of the HQ 3246th Air Base Group, 1 January–31 December 1961.

team received an initial training period of 11 hours with the expectation that refresher courses would be made available later. Because of workloads in other Divisions, the refresher courses were not realized.²⁹³ There is no indication that the training relative to chemical and biological warfare was continued as part of the program.

It is known that CBR training was conducted by the 14th Air Police Squadron in 1955. No further confirmation of CBR training was found until 1962. No further confirmation of CBR training was found after 1962. Whether the CBR training program was continuous between 1955 and 1962 is not known, nor is it known if the CBR training program preceded 1955 or continued beyond 1962. It is highly probable that the CBR training program did not include any CW agent usage on base. This conclusion is based on the lack of evidence indicating the presence of a gas chamber and lack of a chemical agent storage facility. It is postulated that the training most likely consisted of lectures and film viewing.

Installation Restoration Program Results

The Installation Restoration Program of testing and monitoring of 22 sites has not found any evidence that would support the presence of chemical warfare agents in the landfill sites. No specific testing for chemical agents has been conducted; however, the current evidence does not support the requirement for CW agent tests.²⁹⁴

Conclusions

- The lack of a Chemical Corps Officer on the Technical Service Staff and subsequent inactivation of the Technical Service Staff, is a strong indicator that no chemical warfare programs were conducted by the AFCRL.
- No chemical warfare building was built for training or gas chamber use.

²⁹³ 3246th Air Base Group, January–June 1962, Air Base Historical Report, Period 1 January 1962–30 June 1962, Plans & Training Branch.

²⁹⁴ Installation Restoration Program, Management Action Plan for 1999, Hanscom AFB, Massachusetts, April 1999.

- The Atmospheric Circulation Laboratory conducted extensive studies and analyses of atmospheric turbulence and diffusion. The studies were primarily basic research or were conducted specifically for the AF Ballistics Systems Division programs.
- Based on the evidence that neither gas chamber nor chemical agent storage facility existed, the BW/CW training conducted by the Air Base Group CBR Disaster Control Office most likely consisted of lectures and film viewing.
- There is no evidence that Chemical Agents Identification Sets were ever used at Hanscom AFB.
- The Installation Restoration Program of testing and monitoring of 22 sites has not found any evidence that would support the presence of chemical warfare agents in the landfill sites. No specific testing for chemical agents has been conducted; however, the current evidence does not support the requirement for CW agent tests.²⁹⁵

²⁹⁵ *ibid.*

Tinker AFB, Oklahoma

Background

Tinker Air Force Base is located within the corporate limits of Oklahoma City, approximately six miles southeast of the downtown business area.²⁹⁶ In 1941, the War Department planned for a maintenance and supply depot to be located in the central part of the United States. A group of civic and business leaders from Oklahoma City targeted a 480-acre site with an option for an additional 960 acres adjoining the property. The land was offered to the War Department, and Oklahoma City was officially awarded the depot on 8 April 1941. Currently the base occupies approximately 5,000 acres.

Construction started on 30 July 1941 with the ground breaking for a depot that was to perform aircraft repair.²⁹⁷ The depot, originally named the Midwest Air Depot, was renamed the Oklahoma City Air Depot on 1 March 1942.²⁹⁸ On 27 October 1942, the field was named Tinker Field.²⁹⁹ A short time later the depot was renamed the Oklahoma City Air Service Command (OCASC).³⁰⁰

In the early 1940's, over 13,000 civilians, 3,400 enlisted personnel, and 450 officers were working at the Field. The first troops--the 17th Air Depot Group--arrived at the field in April 1942. In December 1942 the OCASC was assigned work on B-24's, B-17's, and B-29's. Engine repair and modifications were also done on the Wright R-3350 engines.³⁰¹

In November 1944 the OCASC was redesignated the Oklahoma City Air Technical Service Command (OCATSC). In 1945, the OCATSC was renamed the Oklahoma City Air Materiel Area (OCAMA).

²⁹⁶ Tinker Air Force Base Management Action Plan, 30 December 1996, pp.1-6.

²⁹⁷ A History of the Oklahoma City Air Technical Service Command, 30 July 1941--25 March 1944.

²⁹⁸ *ibid.*, pp. 11-12.

²⁹⁹ *ibid.*, p. 12.

³⁰⁰ *ibid.*, p 14.

³⁰¹ 20th Anniversary Issue, History of Oklahoma City Air Materiel Area, Tinker AFB, Oklahoma, 1 March 1941-30 June 1962, Installment XXXI, Vol. 1, p. 7.

Following World War II, Tinker annexed the Douglas Aircraft Company Maintenance Center, which became known as Areas A and B of the base.³⁰² In February 1947 the jet engine work was transferred from San Bernardino Air Materiel Area to OCAMA.³⁰³ In 1949 OCAMA became the worldwide repair depot for the B-36 aircraft and maintenance worked on its first jet aircraft-- a B-45.³⁰⁴

In the last half of 1950, the mission statement for OCAMA read:

"The primary functions of Oklahoma City Air Materiel Area, Tinker Air Force Base, have been to serve the United States Air Force in the reconditioning, modification, or modernization of aircraft and aircraft engines, accessories, and associated equipment; to repair and overhaul all types of vehicles as staff cars, carryalls, jeeps, trucks, crash trucks, truck tractors, materials-handling equipment, and similar conveyances; to receive Air Force materiel to store, issue, salvage, and account for materiel received; to perform administrative control over organizational components, operations, military and civilian personnel; to exercise command jurisdiction over assigned subordinate installations; to furnish technical assistance and information on maintenance and supply matters to other Air Force activities located within the Oklahoma City Air Materiel Area; to conduct on-the-job training for personnel of the Air Force reserve units; to accomplish priority projects assigned by the Commanding General, Air Materiel Command."³⁰⁵

On June 1952 the OCAMA was assigned worldwide supply requirements and distribution functions for all Boeing aircraft. Worldwide maintenance for the aircraft soon followed.³⁰⁶ OCAMA became the lead AMA for the B-52 in June 1955;³⁰⁷ received responsibility for worldwide inventory of all USAF aircraft engines in July 1956; and in 1957 became the logistic support center for guided air missiles.³⁰⁸

³⁰² *ibid.*, p. 9.

³⁰³ *ibid.*, p. 11.

³⁰⁴ *ibid.*, p. 13.

³⁰⁵ History, Oklahoma City Air Materiel Area, Tinker AFB, Oklahoma, 1 July--31 December 1950, Installment X, Ch 1, Mission, p. 1.

³⁰⁶ *ibid.*, p. 15.

³⁰⁷ *ibid.*, p. 19.

³⁰⁸ *ibid.*, p. 20.

For fiscal year 1962, the major weapon system programs at the base included the B-47, B-52, B-50, KC-97, KC-135, the GAM-77, -72, and aircraft engines.³⁰⁹ OCAMA "had logistics support responsibility for virtually all of the nation's strategic bombers, aerial tankers, and in-service guided missiles. The command had important responsibilities for a number of other aircraft, including the C-135 cargo and troop carrier, and was inventory manager for a large number of engines that provided other aircraft with the power to strike."³¹⁰ The depot facilities continue to be used to overhaul and modify aircraft, missiles, engines, and components.

During the 1970's the base added the A-7D Corsair, the E-3A Airborne Warning and Control (AWAC) aircraft, the E-4 Airborne Command Post, and the air- and ground-launched cruise missiles. In 1974 the depot was renamed the Oklahoma City Air Logistics Center (OC-ALC). The B-1 bomber, the medium-range surface-to-air missile, and the F108-100 engine were added to OC-ALC management responsibilities.

Discussion

Chemical Warfare Training

An obstacle course was constructed at Tinker Field, circa 1943. The course included barbed wire, double-apron fences, areas of liquid gas contamination, and dynamite emplacements (to simulate artillery fire). Clouds of smoke and tear gas were released so that personnel would depend on their gas mask during the exercise. Tear gas was used as a simulant for mustard gas. A photo of pool players, wearing their gas masks, appears in a March 20, 1943, issue of *Take-off*, the base newspaper.³¹¹ Location of the Tinker Field obstacle course was not given, but was most likely located south of the built-up area of the base.

In November 1943 the Military Training Section, Personnel and Training Division, OCATSC, assumed responsibility for the training of tactical organizations committed to service and maintain the newly developed B-29 bomber.³¹² The objective of the OCATSC program was to

³⁰⁹ History, Oklahoma City Air Materiel Area, Tinker AFB, Oklahoma, Installment XXX, 1 July 1961–30 June 1962, Part 1, Vol. 1.

³¹⁰ *ibid.*, p. 2.

³¹¹ *Take-off* (Tinker Base Newspaper), circa 1943.

³¹² Oklahoma City Air Technical Service Command, Military Training Section, B-29 Project, undated.

organize and train specialized maintenance and supply sections capable of performing third and fourth echelon supply and maintenance for fighter and bombardment groups under combat conditions. The Military Training Section, consisting of a single officer, was augmented by officers from the Air Corps and the Arms and Services.³¹³ The officers established training programs and schedules in Chemical Warfare, Signal, Quartermaster, Ordnance, Corps of Engineers, Air Corps Supply and Maintenance, and basic military subjects. The training of the enlisted men was provided for under a master plan from HQ, ATSC. The plan required completion of all individual training at the ATSC training centers at Warner Robins, Kelly Field, Fresno, and Tinker Field.

The final phase training for the Air Depot Groups at Tinker Field was accomplished in the Depot Supply and Maintenance activities and in specific schools tailored for their needs. Courses and classes for the pure military subjects, i.e., camouflage, demolition, chemical warfare, ordnance, armament, signal, etc. were set up under supervision of the Military Training Section officers. This program trained over 20,000 officers and enlisted men.

The name of the training section was changed to Military Training and Operations³¹⁴ in January 1944. Arms and Services Training Officers were added from the fields of Ordnance, Supply, Signal, Quartermaster, Maintenance, Chemical Warfare, Camouflage, and Engineers. Beginning in February 1944, the Base Commander was responsible for the training of the troops in the field. The objectives were that by the end of the six-months training the soldiers were ready for overseas service with a depot group, a service group, or a mobile unit or squadron. At this time, they were expected to know how to repair an engine under battle conditions and how to protect themselves while doing it.

The training of Air Service Groups and Air Depot Groups was well underway in the early part of 1944. As the program expanded, Service Groups and Air Depot Groups arrived in the OCATSC area for approximately one month of training. Training equipment, i.e., signal, chemical, corps of engineers, ordnance, air corps supply, air corps maintenance, was drawn

³¹³ *ibid.*, p. 1.

³¹⁴ A History of the Oklahoma City Air Service Command, 1943, p. 16.

from a "custodial unit" operated by the Supply Division. At this point, the equipment necessary for training during the month's stay at Tinker Field would be assembled.

During their stay at Tinker Field, personnel completing their requirements were placed for on-the-job advanced training in their Military Occupational Specialty (MOS). The personnel completed training with their issue weapons. Personnel assigned to crew-served weapons (e.g., .50-caliber) were trained at Camp Irwin, California. Other specialists were sent to schools for MOS training not available at Tinker Field.

On completion of the training, the Service Groups were transferred to Second Air Force bases in the Kansas and Nebraska area, but remained under the supervision of the OCATSC Military Training and Operations.

The Air Service Group moved to its new training base by truck convoy and bivouacs.³¹⁵ During the convoy, the referees would declare roads bombed out, bridges washed out, fords impassible, and areas along the route to be under gas attack. Personnel learned from experience that a gas mask must be worn and fitted properly to be effective.

In March 1944, a General Staff and a Special Staff advised and assisted the Commander, OCATSC. Included in the General Staff was the Personnel and Training Division, which included the Military Training and Operations Section.³¹⁶ The Special Staff included an Area and Base Chemical Officer and an Assistant Chemical Officer and Assistant Air Inspector (Chemical). The Chemical Office was organized in accordance with ASC Regulation No. 20-1S, 7 December 1943 and OCASC Memorandum No. 20-13, 3 May 1944.³¹⁷

Data submitted by subordinate units were compiled and charted in the Chemical Office. The charts provided information on all tactical units in the OCASC relative to gas personnel. A list of publications relevant to Chemical Warfare Service Officers in OCASC was maintained, and portfolios of these publications were provided to incoming Group Chemical Officers. New CWS

³¹⁵ Oklahoma City Air Technical Service Command, Military Training Section, B-29 Project, undated, p. 5.

³¹⁶ History of OCATSC, Year 1944, p. 1.

³¹⁷ *ibid.*, p. 18.

Officer arrivals were briefed concerning their duties in the Service Group (Special). Entry and Pre-Primary Operator Maintenance (POM) inspections of tactical units were made by either the Chemical Officer or his assistant.³¹⁸

The Chemical Office maintained close liaison with Military Personnel, Supply Division, Training Operations, and Base Training, and took a substantial part in both Area and Base chemical schools. The status of chemical training, supply, and maintenance in the Area reached high levels consistent with policies indicated by Headquarters, Air Service Command and Headquarters, Army Air Forces.³¹⁹

The Chemical Warfare Service Section engaged in an extensive training program for all enlisted personnel on the post. Regular classes in CW were held in the updated lecture rooms in the hangars. Demonstrations were held in the CW area just south of the area known as the hutments. The Gas Chamber, Bldg. T-881, was located approximately 200 feet south of the hutments area. All enlisted personnel at Tinker Field attended a CW demonstration in June 1944. The demonstration emphasized the importance of proper decontamination.³²⁰

The usual procedure was to place mustard agent from a CAIS that contained quantities of bulk mustard on a volunteer vehicle or area and then teach the soldiers how to don protective clothing and effectively decontaminate the agent. The section supervised enlisted men as they entered the chlorine and tear gas chambers, tested for gas, and smelled the fumes for a few seconds. Donning of the gas mask was taught in two ways. In the first way, the mask was donned by the test subject prior to entry in the tear gas chamber. The subject would enter the tear gas chamber, remove his mask, inhale, and then leave the chamber. In the second way, the test subject, without mask, would enter the chlorine chamber, inhale, then don his mask, clear it by exhaling and inhaling air filtered by his mask, then leave the chamber.

The Base Chemical Supply functions and items were transferred to accountability of the Chief, Supply Division in October 1944. The Assistant Area Chemical Officer was transferred to

³¹⁸ *ibid.*, p. 19.

³¹⁹ *ibid.*, p. 19.

³²⁰ *ibid.*, p. 67.

Training and Operations Section, Personnel and Training Division. Further reorganization of the Chemical Office occurred in November following consolidation of Base and Area activities, with certain of the chemical training functions still to be accomplished by the Chemical Officer and his assistant.³²¹

Three hundred and fifty officers of Tinker Field completed a Chemical Warfare Service examination or five-hour refresher course given by the Chemical Warfare Branch, Personnel and Base Services Division. Three hundred and fifty officers of Tinker Field were given the Chlorine Chamber exercise by this Branch. The Unit Gas Officer and Unit Gas Non-Commissioned Officer schools were given for five Service Groups, four AAF Base Units, and two Air Depot Groups. Twenty-seven officers and 101 enlisted men were qualified. A weapons munitions school was given for six Service Groups, one AAF Base Unit, and one Air Depot Group. Eight officers and 15 enlisted men were qualified.³²²

"All military personnel in the area averaged two hours per month of scheduled chemical warfare training and two hours per month of unscheduled training. Chemical Officers in six Service Groups and two Air Depot Groups were given thorough briefings in Area Policies and Final Phase Training. Ten officers received at least three hours each. Civilian defense personnel of Oklahoma City were given three hours of Chemical Warfare Service training. One hundred fifty civilians participated."³²³

"During [January through March 1945], the Chemical Officer performed entry and pre-POM inspections on units in the Area as a member of the tactical team, Air Inspector's Office. ... During January [1945], one Unit Gas Officer School, one Unit Gas Non-Commissioned Officer School, and one Air Chemical Munitions Course was conducted for personnel of tactical units. Seventeen officers and 41 enlisted men qualified. ... During February, one Unit Gas Officer School and one Unit Gas Non-Commissioned Officer School was conducted. Four officers and eight enlisted men were qualified. ... No schools were conducted in March, although other chemical training was conducted throughout the period. ...

³²¹ *ibid.*, p. 159.

³²² *ibid.*, Personnel and Base Service Division Fourth Quarter Report, p. 10.

³²³ *ibid.*

Monthly publication of the Chemical Warfare Information Letter was maintained."³²⁴

During the period 1 April to 1 July 1945, the Chemical Officer performed entry and pre-POM inspections as a member of the tactical team of the Air Inspector's Office on one air service group and six air service squadrons. Approximately 10,000 man-hours of training were conducted or supervised by Chemical Personnel at Tinker Field during the period. Two schools were conducted for Unit Gas Officers and Unit Non-Commissioned Officers resulting in five officers and 47 enlisted being qualified. Two Anti-Incendiary Team Schools resulted in the qualification of 58 enlisted men and three Decontamination Team Schools resulted in the qualification of 82 enlisted men.³²⁵

A Standard Operating Procedure for training of the Chemical Warfare Service Supply Section was completed and sent to all OCATSC tactical units, training teams, and HQ, ATSC. Gas sentinel, anti-incendiary, and decontamination schools for qualifying Air Service were completed by approximately 180 enlisted men. Chemical Warfare Service field problems and demonstrations were conducted throughout the field exercises of three air service squadrons.³²⁶

An OCATSC organization chart for the period of 1 January–31 March 1946, did not list a Chemical Officer on the staff. In May 1948 General Order Number 48 announced the reorganization of the Oklahoma City Air Materiel Area under the "Two Directorate Plan." A technical services staff was established with a Chemical Officer, Ordinance Officer, Quartermaster Officer, and Communication Officer. The staff reported directly to the vice-commander.³²⁷

³²⁴ A History of the Oklahoma City Air Technical Service Command, 1 January 1945–31 March 1945, p. 9-10.

³²⁵ History of the OCATSC, 1 April 1945–30 June 1945, p. 13.

³²⁶ History of the OCATSC, 1 April 1945–30 June 1945, p. 13.

³²⁷ History, HQ Oklahoma City Air Materiel Area, Tinker AFB, Oklahoma, 1 January–30 June 1948, Appendix No. 8.

Training in chemical warfare continued at the base. One officer and seven enlisted men enrolled for the training during the first half of 1948.³²⁸ From the 1 July–31 December 1948 report of the Military Personnel Branch of the Troop Commandant, Personnel and Administration Office, "Biological Warfare training was received by 92 officers 325 airmen, including personnel from tenant organizations. Chemical Warfare Training was received by 495 airmen of tenant organizations."³²⁹

The Military Training Section reported that during the first half of 1949, "Qualified gas officers were appointed and chemical warfare training was administered to designated military personnel, as required by current directives."³³⁰ During the first half of 1950, a chemical warfare instructor's course was organized. The first period of the prescribed course was held during April 1950. Classes were held daily for ten days with two-hour periods of instructions. The two officers and 13 airmen who completed the course were given practical instruction in the classroom settings, as well as practical application in the field.³³¹

The Training Section reported that one officer and 14 airmen enrolled in the unit gas officer and non-commissioned officer course during the second half of 1950. The training was conducted in compliance with AF Regulation No. 50-25, which specified that each unit have one unit gas officer and two unit gas non-commissioned officers for each 200 men assigned.³³²

An organizational chart of the Technical Services Staff, dated 1 November 50, listed only an Armament Officer, a Quartermaster, and a Communications Officer. The Chemical Officer was not listed in the Technical Services Staff.³³³

³²⁸ History, HQ Oklahoma City Air Materiel Area, Tinker AFB, Oklahoma, 1 January–30 June 1948, p. 119.

³²⁹ History, HQ Oklahoma City Air Materiel Area, Tinker AFB, Oklahoma, 1 July–31 December 1948, p. 244.

³³⁰ History, Oklahoma City Air Materiel Area, Tinker AFB, Oklahoma, 1 January–30 June 1949, p. 79.

³³¹ History, Oklahoma City Air Materiel Area, Tinker AFB, Oklahoma, 1 January–30 June 1950, p. 158.

³³² History, Oklahoma City Air Materiel Area, Tinker AFB, Oklahoma, 1 July–31 December 1950.

³³³ *ibid.*, Supporting Documents, Technical Services Staff Organizational Chart, 1 November 1950.

The Military Training Branch of the Personnel and Administrative Office reported that the unit gas officer and non-commissioned officer course was conducted in January 1951, with one officer and 12 airmen attending.³³⁴

Higher headquarters required that Tinker review its existing passive defense plan for compliance with AF Regulation 355-3 and AF Letter 355-3 in 1952. To that end, a civilian was designated to attend a 30-day course on atomic, biological, and chemical warfare to be held during the month of January 1953, at the US Army Chemical School, Fort McClellan, Alabama.³³⁵ In FY53, the Military Training Branch of the Personnel and Administration Office reported that the Passive Defense Section trained approximately 24,000 civilian and military personnel on Tinker AFB in radiological, biological, and chemical warfare.³³⁶ In the first half of FY 54, the training program for radiological, biological, and chemical warfare was not in evidence.³³⁷

There were no further reports of any training program for radiological, biological, and chemical warfare through 30 June 1972.

Maps and Real Estate Records

Building T-881 is identified on a map, circa 1945, as a "Gas Chamber." The building was located approximately 1,350 feet due west of the Patrol Road, 200 feet south of the hutment area, and 650 feet north of Taxiway 1, in the general vicinity of the present day BX facility.³³⁸ The gas chamber was 24 ft x 32 ft of nonstandard construction. No plan number was furnished. It was built by the military in 1944 (probably between April and July), using salvage

³³⁴ History, Oklahoma City Air Materiel Area, Tinker AFB, Oklahoma, 1 January–30 June 1951, p. 169.

³³⁵ History, Oklahoma City Air Materiel Area, Tinker AFB, Oklahoma, 1 July–31 December 1952, Installment XIV, p. 86.

³³⁶ History, Oklahoma City Air Materiel Area, Tinker AFB, Oklahoma, 1 January–30 June 1953, Installment XV, p. 155.

³³⁷ History, Oklahoma City Air Materiel Area, Tinker AFB, Oklahoma, 1 July–31 December 1953, Installment XVI.

³³⁸ Building and Street Layout, Utilities Dept., Army Air Base, Tinker Field, Oklahoma City, Oklahoma, Engineering Branch, Drawing # M-1007, circa 1945.

materials, and later additions and repairs were built by the Utilities.³³⁹ In the Base Master Plan, September 1955, T-881 is listed as "Training Aid, Gas Chamber Building," and assigned a life expectancy of zero.³⁴⁰ The building was probably destroyed in the 1954–55 era. This would coincide with the apparent demise of the CW training program beginning in 1954. From an October 1967 listing of all buildings at Tinker, no CW chambers or chemical warfare storage buildings were evident.³⁴¹

Environmental Management Installation Restoration Program

The IRP was reviewed for information on landfills that were operable for the period of 1942 to 1955--the period of chemical warfare training at Tinker AFB. Six landfills, used for disposal of refuse were identified at Tinker AFB. Three of the six landfills were in use within the time frame of interest:

- Landfill No. 1 (LF-1), 1.2 acres in size, was operable from 1942–1945. It contains primarily general refuse from the base. The refuse was disposed of in trenches, 10 to 25 feet deep and was typically burned to reduce volume. Volume of fill is estimated at 30,000 cubic yards.³⁴²
- Landfill No. 2 (LF-2), 20 acres in size, was operable from 1945–1952. It contains primarily general refuse from the base plus small quantities of paints and solvents. Waste was disposed of in trenches, 20 feet deep by 35 to 40 feet in width. Volume of fill is estimated at 500,000 cubic yards.³⁴³
- Landfill No. 3 (LF-3), 8 acres in size, was operable from 1953–1961. It contains primarily general refuse from the base plus quantities of paint buckets, insecticide cans, empty barrels, and a number of low-level radioactive vacuum tubes. Trenches

³³⁹ Basic Layout Map, 30 June 1954, Drawing #M-1058.

³⁴⁰ AMC Master Plan for Tinker AFB, Oklahoma, 28 September 1955, Tab C-1, sheet 4 of 7.

³⁴¹ Tinker AFB Facility Directory for Areas A-B-C, prepared by OCSFSO, October 1967.

³⁴² Installation Restoration Plan, Phase 1: Records Search, Tinker AFB, Oklahoma, Engineering Science, Atlanta, GA, April 1982, Findings, Ch 4, pp. 4-16.

³⁴³ *ibid.*, pp. 4-21.

run the length of the landfill to a depth of 25 feet. Volume of fill is estimated at 200,000 cubic yards. LF-3 is located adjacent to LF-2.³⁴⁴

These landfills, LF-1, LF-2, and LF-3 were ranked by their potential for contaminant migration using a hazardous assessment rating methodology (HARM). LF-1, LF-2, and LF-3 were assessed HARM scores of 45, 65, and 60. Based on the HARM scores, the potential for contaminant migration of the three landfills is considered low for LF-1, high for LF-2, and moderate for LF-3.³⁴⁵

The Laboratory Analytical Procedures section of the Facility Investigation Work Plan presents the analytical methods to be used to analyze the soil, water, and air samples collected during the investigation.³⁴⁶ The list of analytes for soil and water samples includes 34 volatile compounds, 65 semi-volatile compounds, and 12 metals. No chemical warfare agents or their hydrolysis products were listed as analytes for the soil and water samples.

Conclusions

- Tinker AFB conducted a very active chemical warfare training program from 1943 through 1949. The training included gas chamber, field exercises, obstacle courses, and bivouacs. The CW training program from 1950-1951 was comprised principally of unit gas officer and unit gas NCO coursework. In 1952, the CW training was assimilated into a passive defense plan that included CBR warfare primarily structured in a lecture format. By the end of the first half of 1953, approximately 24,000 civilian and military personnel had completed the course. No further reports of any CBR training through 30 June 1972 were found. Due to the amount of CW training conducted at the Oklahoma City Air Materiel Area, there is a good probability that Chemical Agent Identification Sets could have been disposed of on Tinker AFB property.
- Landfills 1 and 2 were in operation during the period when chemical warfare training was at its most active. There is a good probability that chemical warfare materiel (e.g., CAIS)

³⁴⁴ *ibid.*, pp. 4-21.

³⁴⁵ *ibid.*, pp. 5-1-5-4.

³⁴⁶ Resource Conservation and Recovery Act (RCRA) Facility Investigation Work Plan (RFI), Tinker AFB, 20 December 1991, pp. 5-2-5-4.

could have been disposed of in these landfills. There is a low probability that Landfill 3 would have chemical warfare materiel buried within its boundary. The remaining landfills were in operation well beyond the time periods of the chemical warfare training at Tinker AFB.

- For Landfills 1, 2, and 3, the analytes for soil and water samples list 34 volatile compounds, 65 semi-volatile compounds, and 12 metals. There are no chemical warfare agents or their hydrolysis and decomposition products listed as analytes for the soil and water samples.
- No other tie-in to the BW/CW program other than training was found.

Eglin AFB, Florida

Background

General

In 1935, Maxwell Field, Montgomery, Alabama, leased the Valpariso Airport, Valpariso, Florida, as the headquarters for a bombing and gunnery range. Shortly afterwards, the land on which the range was located was donated to the US government. In 1937, the military reservation at Valpariso was designated Eglin Field. Its mission, until 1940, was to provide facilities for the Air Corps Tactical School and National Guard Units.³⁴⁷

In 1939, Eglin Field and its adjacent areas were selected as the most suitable location for development of a proving ground for the Army Air Forces. In May of 1939, the justification for acquisition of additional land for development of an Air Corps Proving Ground included the statement: "Tests in coordination with the Chemical Warfare Service." On 13 May 1939 the Air Corps Board submitted a report to the Chief of Air Corps including the following:

"Tests in coordination with the Chemical Warfare Service in the numerous phases of the problem of the offensive use of chemicals from aircraft and of the defensive requirements for protection of personnel, equipment, and facilities against such attacks."³⁴⁸

"In consideration of the requirements for restricted areas will permit all types of bombing not only practice but with demolition bombs and chemicals of various kinds..."³⁴⁹

On 27 June 1940, the Choctawatchee National Forest was transferred to the War Department. In 1940, the Air Corps Headquarters determined that a series of auxiliary flying fields should be constructed in the outlying areas, principally in the western portion, and that gunnery training should be confined to those fields. The main field and suitable range areas in the eastern portion of the base were to be reserved for proving and test activities.

³⁴⁷ History of the Army Air Forces Proving Ground Command, Part 1, Historical Outline, 1933-1944, pp. iii – vii, 16.

Air Proving Ground Command and Its Successors

The Air Corps Proving Ground (APG) was established with headquarters at Eglin Field in May 1941. Construction of laboratories, technical buildings, ranges, and flying facilities progressed such that by the spring of 1942 the Proving Ground was ready for a full-scale testing program. On 1 April 1942, the Air Corps Proving Ground was redesignated as the Air Force Proving Ground Command.³⁵⁰

Several organizations and individuals with chemical warfare responsibilities were assigned to the APG. On 10 December 1940, a Captain was appointed Post Chemical Warfare Officer, in addition to his duties as Post Quartermaster and Post Ordnance Officer. On 1 September 1941, the Decontamination Detachment, 2nd Chemical Company, Service (Aviation) was activated. On 16 December 1941, the unit was redesignated CWS (Decontamination), 67th Materiel Squadron. On 10 April 1942, Detachment CWS (Decontamination) was inactivated and CWS personnel were assigned to the 780th Chemical Company, Service (Aviation). On 1 October 1942, the Detachment 780th Chemical Company (Decontamination) was relieved from attachment to the 67th Service Squadron and was attached to the 51st Air Base Squadron. In December 1943, all units were reorganized. All Detachments were reassigned from the 51st Base Headquarters, and Air Base Squadron to the Headquarters and Headquarters Squadron. The 51st became a transportation unit.³⁵¹

On 1 January 1945, the APG was designated as a permanent facility and put under the jurisdiction of the Air Proving Ground Command in Orlando, Florida. The mission statement of the APG³⁵² did not explicitly include BW/CW missions. However, one of the APG's responsibilities was to "maintain detachments at proving grounds of other arms and services as requested by such arms and services to facilitate the establishment of AAF qualitative

³⁴⁸ History of the Army Air Forces Proving Ground Command, Part 1, Historical Outline, 1933-1944. Exhibit 6, Ltr, from Col Weaver, President, Air Corps Board, to the Chief of the Air Corp, 13 May 1939. Subject: Proving Ground for Aircraft Armament. Para. 4g.

³⁴⁹ *ibid.*, Para. 7.

³⁵⁰ History of the Army Air Forces Proving Ground, Part 1, Historical Outline, 1933-1944.

³⁵¹ *Ibid.*

³⁵² Army Air Force Regulation 20-17, 1 June 1945.

requirements and as approved by the Commanding General."³⁵³ The APG operated under this mission statement until June 1946. In July 1946, the APG was redesignated the Air Proving Ground Command (APGC). The units at Aberdeen, Maryland; Edgewood, Maryland; Dugway, Utah; and Muroc, California, were the only outlying units for which the Proving Ground was then responsible.³⁵⁴

In 1947 the number of units under the APGC was much smaller than in the previous seven months. A new unit, the 608th, Chemical and Ordnance Test Group, had been established with headquarters at Aberdeen Proving Ground, Maryland, and squadrons at Aberdeen and Edgewood Arsenal, Maryland, and Muroc, California.³⁵⁵ The 608th Base Unit was redesignated as the 3208th Chemical and Ordnance Test Group with headquarters at Aberdeen, Maryland, in 1948.³⁵⁶

The Offices for the Chemical and Ordnance Officers were established as special staff offices at the APGC in July 1947. A year later these offices were discontinued and the Office of the Director of Armament established. The Director of Armament advised the commander and staff on all types of weapons, explosives, and CW, BW, and RW weapons.³⁵⁷

Among APGC's testing agencies was the Armament Test Division.³⁵⁸ The Armament Test Division consisted of three directorates and a test group. The 3210th Chemical and Ordnance Test Group, located at Phillips Field, Aberdeen, Maryland, was to assist the Ordnance Department at Aberdeen Proving Ground, Maryland, and the Chemical Corps at Edgewood Arsenal, Maryland, in the testing of specific types of Air Force armament, equipment and materials, using facilities furnished by the Army in conjunction with Air Force test support

³⁵³ Air Proving Ground Historical Data, 2 September 1945–30 June 1945.

³⁵⁴ Ibid.

³⁵⁵ History of the Air Proving Ground Command, Vol I, II, and III, 1 July–31 December 1953, p. 175.

³⁵⁶ Air Proving Ground Historical Data, 1948.

³⁵⁷ Ibid.

³⁵⁸ History of the Air Proving Ground, Eglin AFB FL, Vol 1, 1 January–30 June 1951, p. 29.

equipment.³⁵⁹ The 3210th worked on 18 projects for the Army Chemical Corps during the first quarter and 18 (15 local bombing projects, 6 test support projects, and 1 tracking project) for the Chemical Corps during the second quarter.³⁶⁰ In late 1951, the Armament Test Division (including the 3210th) was removed from the APGC and was established as the AFAC.

In November 1957, the Air Proving Ground Command was terminated and the Air Proving Ground Center was activated and placed under the Air Research and Development Command. A month later, the Air Force Armament Center was redesignated the Armament Division and assigned to the Air Proving Ground Center. At the same time, the AF Operational Test Center was redesignated the Operational Test Division of APGC³⁶¹. Among the subordinate units of the Operational Test Division was the 3245th Test Group (Bombardment and Support), which was responsible for the BW/CW employment and suitability testing. Both Divisions were combined under the Deputy Commander for Development and Test.³⁶² Two years later (October 1959), that office was abolished and recreated as the Deputy Chief of Staff, Test.³⁶³

The Ballistic Test Facility of the 3208th Test Group (Technical Facilities) was located at Edwards AFB and assigned to the APGC. This Group was responsible for the collection and reduction of test data in support of the engineering, development, and bomb ballistic.³⁶⁴

"On 11 January 1961, the armament development function was placed under the jurisdiction of the Wright Air Development Center as Detachment No. 4, Eglin AFB, Florida. With the transfer of Det No. 4 (to the Wright Air Development Center), the APGC ceased to engage in any *development* activities."³⁶⁵

³⁵⁹ History of the Armament Test Division, Air Proving Ground, Eglin AFB FL, 1 October–30 November 1951, p. 65.

³⁶⁰ Ibid., p. 54.

³⁶¹ History of the Air Proving Ground Center (ARDC), Vol 1, Text, 1 December 1957–31 December 1957.

³⁶² History of the Air Proving Ground Center (ARDC), Vol I, Narrative, 1 January–31 December 1959.

³⁶³ Ibid.

³⁶⁴ History of the Air Proving Ground Center (ARDC), 1 January 1958–30 June 1958, Vol I, Narrative, p. 20.

³⁶⁵ History of the Air Proving Ground Center (AFSC), Vol I, Narrative, 1 January–30 June 1964, p. 11.

In the first half of 1962 the APGC mission statement included the test of non-nuclear munitions, biological, and chemical warfare delivery systems, pyrotechnics, aerial targets, scorers, and related equipment as designated by AFSC. The testing of BW/CW delivery systems was a new entry. An Ad Hoc Committee for Tactical Warfare was established at APGC and felt that APGC could play an important role in the development of weapons for a limited war scenario. Projects under this initiative included "Evaluation of BW/CW Delivery Techniques."³⁶⁶

In the first half of 1964, the general mission of the APGC supported testing and USAF programs including 120 projects supporting 36 USAF programs. Of these, 11 projects in the mission area of chemical/biological munitions were in support of three USAF programs.³⁶⁷ In the second half of 1964, the number of projects in the mission area of chemical/biological munitions increased to 13 projects in support of the three previous USAF programs plus one new AF program.³⁶⁸

On 1 August 1968, the APGC was redesignated the ADTC and was assigned responsibility for the initial acquisition of AF non-nuclear munitions. The Director of Acquisition was additionally charged with providing program management for as well as accomplishing initial acquisition of AF non-nuclear munitions. The Bombs and Fuzes Branch, BW/CW Branch, Guns and Rockets Branch, and Dispensers/Clusters Branch accomplished those functions for the assigned munitions programs. In accordance with AFSC Letter 25-11, the scope of the munitions acquisition included all non-nuclear munitions developed and acquired for AF use. Chemical and biological agent dispensers, containers, and associated equipment were included.³⁶⁹

The Organizational Planning Document for the ADTC No. 68-2, dated 1 August 1968, included the mission and responsibility for engineering development for non-nuclear munitions. This workload included four program elements, one of which (64707F) was for CB Operational Support. The ADTC had a dual responsibility in the BW/CW mission area: to provide test

³⁶⁶ History of the Air Proving Ground Center (AFSC), Vol I, Narrative, 1 January–30 June 1962.

³⁶⁷ History of the Air Proving Ground Center (AFSC), Vol I, Narrative, 1 January–30 June 1964, p. 103.

³⁶⁸ History of the Air Proving Ground Center (AFSC), Vol I, Narrative, 1 July–31 December 1964, p. 36.

³⁶⁹ History of the Armament Development and Test Center, 1 August 1968–30 June 1969, Vol 1, Narrative, pp. 36–39.

support to the AF CB program and to provide for the initial acquisition of CB systems. Support was provided by planning, designing, and conducting tests associated with methods of delivery and dissemination; detection, identification, warning, and protective devices; decontamination procedures; and decontamination equipment. In short, the ADTC was to provide those systems (equipment, weapons, etc.) that allowed the AF to conduct CB warfare if called upon and to be able to protect itself and to operate in a contaminated environment if attacked by enemy CB systems. The ADTC also participated in CONUS and OCONUS testing at Dugway Proving Ground, Utah, and the joint service Deseret Test Center, Fort Douglas, Utah.³⁷⁰

AFSC Regulation 23-7, Organization and Mission--Field: Armament Development and Test Center, dated 16 November 1970, provided the mission of ADTC. BW/CW requirements were no longer included in the mission statement. An organizational chart for the Air Force Armament Laboratory, 1 March 1970, shows the Development Division absent the BW/CW Branch.

Air Force Armament Center and Its Successors

General Order Nbr. 24, dated 29 November 1951, established the AFAC as a separate reporting entity, responsible directly to the ARDC and as a tenant of Eglin AFB. The mission of the Center was to accomplish tests of material in the armament field and conduct the related research and development as well as to provide support to ARDC and to provide test facilities for contractors and other government agencies. The 3210th Chemical and Ordnance Group was renamed the 6570th Chemical and Ordnance Group. It remained located at Aberdeen Proving Ground, Maryland, with the same mission.^{371, 372}

AFAC consisted of the following elements: Armament Engineering Test Division, Armament Test Facilities Laboratory, and 6570th Chemical and Ordnance Test Group. The Test Operations Branch of the Armament Engineering Test Division consisted of the Fire Control, Bombing, Weapons and Missiles, BW/CW, and Aero Ballistics Sections and was the center of operations. Three-fourths of all AFAC personnel at EAFB were concentrated in the Armament

³⁷⁰ Ibid., 1919pp. 50-52.

³⁷¹ History of the Air Force Armament Center, Eglin AFB FL, Vol VII, 1 December 1951-30 June 1952.

Engineering Test Division. The BW/CW Branch functioned both as a testing and monitoring agency. It accomplished testing (developmental, contractor, and standardization) and monitoring of items through development and acceptance at agencies at other bases. Liaison with Department of Army, Aberdeen, Maryland, continued in order to achieve maximum results on all BW/CW tests.³⁷³

The AFAC organizational chart, 1 April 1955, listed a BW/CW Branch under the Directorate of Test Operations. The BW/CW Branch was to design, conduct, and report on engineering evaluation and/or functional tests of biological and chemical warfare armament items to include bombs, warheads, spray tanks, related devices, and support equipment. Such items were to be evaluated from a maintenance and logistics standpoint. The Branch was to furnish technical support to contractor-conducted tests of these items and analyze technical reports of such tests. The Branch also was to support the development testing of BW/CW items as required by higher headquarters and maintain liaison with the Department of Army in the conduct of tests on items developed for the USAF. There were three sections in the BW/CW Branch--BW Munitions, CW Munitions, and Agent Assessment.³⁷⁴

The AFAC organizational chart also listed a Bio-Chemical Branch under the Armament Test Equipment Laboratory. The Bio-Chemical Branch planned and developed new measurement systems and components required in support of the Center's BW/CW test program. It also developed design requirements for BW/CW complexes. The Bio-Chemical Branch consisted of two sections: Dispersion Measurement and Bio-Chemical Research. The Dispersion Measurement section concentrated its efforts on the development of plans for dispersion measurement systems, micro-meteorological systems, and measurement devices. The Bio-Chemical section concentrated its efforts on the research and development required to produce new test methods and techniques in support of the Center's BW/CW test program.³⁷⁵

³⁷² History of Air Research and Development Command, Vol 1, 1 July 1951–31 December 1952, p. 64.

³⁷³ History of the Air Force Armament Center, ARDC, Eglin AFB FL, 1 July–31 December 1952, p. 14.

³⁷⁴ History of the Air Force Armament Center (ARDC), Vol III, 1 January–30 June 1955, Appendix 2, Organization Charts of the Air Force Armament Center, Chart No. 14.

³⁷⁵ *ibid.*, Chart, Chart No. 17.

In 1956, AFAC divided the Directorate of Test Operations into two directorates: the Directorate for Airborne Systems Testing and the Directorate of Munitions Testing. That Directorate was given responsibility "for the effective and timely testing of assigned weapons and missiles, fuze tests, and BW/CW projects..." A BW/CW Branch was one the four units of the Directorate. AFAC was to assume the responsibility of establishing ballistic tables for conventional, BW/CW, and atomic bombs during the first quarter of 1956.³⁷⁶

AFAC also created an Air Munitions Development Laboratory that consisted of a Gun and Ammunition Branch, a Bomb Branch, a Rocket Branch, and a BW/CW Branch as well as administrative offices.³⁷⁷ The mission of the BW/CW Branch was to perform and administer applied research, design, development, product improvement, and initiate standardization actions for BW/CW weapons, dispensers, aircraft spray systems, suspension and release gear and devices, BW/CW weapon ground handling equipment, special tools, controls, and related items.³⁷⁸

AFAC was redesignated as the Armament Test Division and was assigned to the APGC as part of the reorganization of ARDC and APGC in 1957.³⁷⁹ In 1958, the Armament Division of APGC was discontinued.³⁸⁰ It was combined with the AF Operational Test Center in the Deputate for Development and Test.³⁸¹ On 11 January 1961, the armament development function was placed under the jurisdiction of the Wright Air Development Center as Detachment #4 at Eglin AFB.³⁸²

³⁷⁶ History of the Air Force Armament Center, Vol 1, Text, 1 January–30 June 1956, p. 21.

³⁷⁷ History of the Air Force Armament Center, Vol 1, Text, 1 January–30 June 1956, Chapter I, Organizational Changes, pp. 1-4.

³⁷⁸ History of the Air Force Armament Center (ARDC), Vol III, Documents, 1 January–30 June 1957, AFAC Organization Charts, Master Chart 1 and Chart No. 14C.

³⁷⁹ History of the Air Proving Ground Command, Narrative, July–November 1957, p. 2.

³⁸⁰ History of the Air Proving Ground Center (ARDC), 1 January 1958–30 June 1958, Vol 1, Narrative, Chronology.

³⁸¹ History of the Air Proving Ground Center (ARDC), Vol 1, Narrative, 1 January–31 December 1959.

³⁸² History of the Air Proving Ground Center (AFSC), Vol 1, Narrative, 1 July–31 December 1964, p. 65.

In March 1966, the AFATL was activated at Eglin AFB. AFATL included the former Detachment No. 4.³⁸³ Included in the mission of the AFATL was the obligation to plan, formulate, present, and execute the AFSC Exploratory and Advanced Development Programs for the non-nuclear and BW/CW weapons, BW/CW defense, and BW/CW marking and detection. AFATL was also to conduct the AFSC engineering development program for non-nuclear and BW/CW as required by appropriate system divisions.³⁸⁴

In June 1970, the AFATL was reassigned to the Armament Development and Test Center. The BW/CW test projects included:³⁸⁵

- Environmental Test of CNU-89/E23 Shipping and Storage Container
- Development Test of the CBU-61/A Chemical (CS) Munition
- Alignment Test of the AN/GAQ-1 Nerve Agent Alarm Set
- Skittering Characteristics Test of the BLU 39/B23/FMU-65/B Chemical (CS) Bomb
- Test of the TMU-66/A Dispenser.

On 6 June 1969, the Biological-Chemical Division of the AFATL was renamed the Non-Explosive Munitions Division. Its branches were renamed Assessment, Area Munitions, and Pyrotechnics.³⁸⁶ The Division Chief directed that all contracts for chemical and biological weapons and defense systems be terminated within existing funds due to the removal of requirements and lack of funding for chemical and biological advanced and exploratory development. The Advanced Development Project 698U, Chemical and Biological Weapons and Defensive Systems, was cancelled due to the zero funding of the program for the FY70-75 time period and to the elimination of manpower associated with the BW/CW program. All contracts pertaining to biological weapon systems were immediately terminated. Contracts for chemical weapons systems and CB defensive systems were terminated if any overrun situation was imminent. Existing contracts that could be completed with programmed funds were

³⁸³ History of the Air Proving Ground Center, Vol I, Narrative, 1 July 1966–30 June 1967, Chronology.

³⁸⁴ History of Air Proving Ground Center (AFSC), Vol I, Narrative, 1 July 1967–31 December 1967, pp. 17-18.

³⁸⁵ History of the Armament Development and Test Center, Vol 1, Part 1, 1 July 1969–30 June 1970, pp. 109, 126, 183, 245, 275.

³⁸⁶ History of the Air Force Armament Laboratory, Vol I, Part 2, 1 January–31 December 1969.

completed; however, all deliverable hardware was deleted from these contracts by amendment. All efforts that were not allowed to run to completion would be retired with a final draft report in the file. Three efforts, Airstrike Exercise Munition, Decontamination of Organophosphorus Insecticides, and Advanced Aircrew Respiratory Protection, were allowed to run to completion.³⁸⁷

Detachment 4, Aeronautical Systems Division

In February 1962, the BW/CW responsibilities of the Limited Warfare Office at the ASD, Wright-Patterson AFB, Ohio, were reassigned to Detachment 4 at Eglin AFB, Florida. Detachment 4 had been assigned previously the function of armament development in 1961.³⁸⁸ Additionally, the former AFSC BW/CW Project Office (including project No. 5400, "AF Evaluation of BW/CW") previously assigned to the Deputy Commander for Technology (ASR) of ASD, was reassigned to Detachment 4.³⁸⁹

The APGC Program Summary, for Detachment 4, ASD, Research and Development Projects, listed only one CW project for screening munitions in September and October 1962. In October 1962, the APGC Support Projects listed BW/CW Technical Facilities.³⁹⁰ As part of the reassignment of the Detachment to the RTD during the reorganization of AFSC in 1962, the Detachment was assigned the mission of planning and accomplishing the exploratory and advanced engineering development programs for non-nuclear and chemical and biological munitions, targets and scorers, and ballistics.³⁹¹ Detachment 4 had a budget of over \$13 million in FY64 with a FY65 budget project of \$18.5 million for 32 BW/CW projects.

³⁸⁷ History of the Air Force Armament Laboratory, AFSC, Vol 1, Appendix 2, 30 June 1970, p. 6.

³⁸⁸ History of the Air Proving Ground Center (AFSC), Vol 1, Narrative, 1 January–30 June 1964, p. 11.

³⁸⁹ Ltr, 30 June 1962, from ASD/ASRSM to ASD/ASRSOO, Subj: Semi-Annual History, Systems Study Division, 1 January 30-June 1962.

³⁹⁰ History of the Air Proving Ground Center (AFSC), Vol II, Documents, 1 July–31 December 1962: APGC Programming Summary, 4 September 1962, p. 11 and APGC Programming Summary, 1 October 1962, pp. 7-8.

³⁹¹ History of the Research and Technology Division, Vol 1, Administrative Data, 4 April 1962–30 June 1964, p. 35.

In March 1966, the AFATL was activated at Eglin AFB. AFATL encompassed the former Detachment No. 4.³⁹²

Programs

1960. In September 1960, the ARDC Technical Objectives for Advanced Weapons 740A, HQ ARDC, USAF, specified the capability desired by the end of FY64 to include the following tasks: 2317A--to develop BW/CW agents, both lethal and nonlethal and 2318A--to obtain BW/CW agent munition delivery systems. The Weapons Laboratory at the APGC was assigned responsibility for both programs. Due to renewed AF interest in BW/CW, a project to provide ARDC with BW/CW analysis capability was added to the program.³⁹³

1963. In February 1963, the APGC Program Summary³⁹⁴ listed Project Number 8780V24, B/C Technical Facilities as the only BW/CW related project. Under Detachment No. 4, R&D Projects listed were:

- Tactical BW Munitions (No. 2522)
- Airborne Defoliation Systems (No. 2525)
- Anti-Crop System (No. 2523)
- AF Evaluation of BW/CW (No. 5400)
- CW Screening Munitions (No. 530A)³⁹⁵.

The APGC Program Summary, 1 June 1963, listed:

- Test and Evaluation of A/B 45Y-3 Defoliant Spray Tank (No. 2525W2)
- Engineering Evaluation of TMU-28/E Liquid Agent Spray Tank (No. 2833W2)
- Development of General Mills External Spray Tank (TX) (No. 2523W1)
- B/C Technical Facilities (No. 8780V24).

³⁹² History of the Air Proving Ground Center, Vol I, Narrative, 1 July 1966--30 June 1967, Chronology.

³⁹³ ARDC Technical Objectives for Advanced Weapons 740A, HQ ARDC, USAF, September 1960.

³⁹⁴ APGC provided Program Summaries to its command headquarters, ARDC, on a monthly basis.

³⁹⁵ History of the Air Proving Ground Center (AFSC), Vol II, Documents, 1 January--30 June 1963, Air Proving Ground Center Program Summary, 1 February 1963, pp. 7-8

Under Detachment No. 4, R&D Projects were listed:

- Tactical Bio Munitions (No. 2522)
- Anti-Crop System (No. 2523)
- CW Screening Munitions (No. 5137)
- AF Evaluation of BW/CW (No. 5400)³⁹⁶

In December 1963, the APGC Program Summaries included 12 projects:

- Fairchild Spray Tank
- Development Test of Dry Agent Dispenser System
- Dev. Test of A/B 45Y-2 Spray Tank, (TX)
- Test and Evaluation of A/B 45Y-3 Defoliant Spray Tank
- Development Test of Hayes Chemical Spray System Internal
- Engineering Evaluation of TMU-28/E Liquid Agent Spray Tank
- Engineering Evaluation of CB munition control panel
- Tactical Bio Munitions (R&D)
- Anti-Crop System (R&D)
- Airborne Defoliation System (R&D)
- CW Screening Munitions (R&D)
- AF Evaluation of BW/CW (R&D)³⁹⁷

1964. The APGC Program Summaries, 1 January 1964, included:

- The Fairchild Spray Tank
- Development Test of the Dry Agent Dispenser System
- Development Test of the A/B 45Y-2 Spray Tank (TX)
- Development Test of the Hayes Chemical Spray System Internal
- Engineering Evaluation of the CB Munition Control Panel

The Detachment No. 4, ASD, projects included:

- Tactical BW Munitions (R&D)
- Anti Crop system (R&D)
- Airborne Defoliation System (R&D)
- CW Screening Munitions (R&D)
- AF Evaluation of CB (R&D)

³⁹⁶ History of the Air Proving Ground Center (AFSC), Vol II, Documents, 1 January–30 June 1963, Air Proving Ground Center Program Summary, 1 June 1963, pp. 5, 7-8.

³⁹⁷ History of the Air Proving Ground Center (AFSC), Vol II, Documents, 1 July–31 December 1963, pp. 5, 10.

The projects in suspension were:

- The CB Munitions Trials (DPG/APGC)
- The Test and Evaluation of A/B 45Y-3 Defoliant Spray Tank
- The Engineering Evaluation of the TMU-28/E Liquid Agent Spray Tank
- Development Test of the Fairchild Pressure Spray System Internal.³⁹⁸

The APGC Program Summary, APGC, 1 June 1964, listed only:

- The Dry Agent Dispenser System A/B 45Y-4
- Development Test of the A/B 45Y-2 Spray Tank (TX)
- Engineering Evaluation of the CB Munition Control Panel
- Engineering Evaluation of Chemical Bombs.

Detachment No. 4, ASD projects listed 1 June 1964 were unchanged from the 1 January 1964 listing. Projects in suspension were:

- The Test and Evaluation of the A/B 45Y-3 Defoliation Spray Tank
- Development Test of the Hayes Chemical Spray System Internal
- Engineering Evaluation of the TMU-28/E Liquid Agent Spray Tank
- The CB Munitions Trials (DPG/APGC)³⁹⁹

1965. There was an increase in the mission activity for the first half of 1965. The number of test projects for the Chemical/Biological Munitions ranged from 12 to 17, with four of the months having 13 test projects each month.⁴⁰⁰ The APGC Program Summary, 1 May 1965, listed:⁴⁰¹

- DPG/APGC CB Munitions Trials
- Project Big Tom
- Dry Agent Dispenser System A/B 45Y-4
- Test of modified A/B 45Y-1 Spray Tank
- Performance Test of A/B 45Y-1 on A1E Air Craft
- Development Test of A/B 45Y-2 Spray Tank (TX)
- Test and Evaluation of A/B 45Y-3 Defoliant Spray Tank
- Development Test of COIN (Counterinsurgency) Defoliant Dispenser
- Environmental Test of TMU-28/B and Equipment

³⁹⁸ History of the Air Proving Ground Center (AFSC), Vol II, Documents, 1 January–30 June 1964, Air Proving Ground Center Program Summary, 1 January 1964.

³⁹⁹ Ibid., Air Proving Ground Center Program Summary, 1 June 1964, pp. 6, 9, 12.

⁴⁰⁰ History of the Air Proving Ground Center (AFSC), Vol I, Narrative, 1 January–30 June 1965, p. 7.

⁴⁰¹ History of the Air Proving Ground Center (AFSC), Vol II, Documents, 1 January 1965–30 June 1965, Air Proving Ground Center Program Summary, 1 May 1965, pp. 6, 13.

Engineering Evaluation of TMU-28/E Liquid Agent Spray Tank.

One project, Development Test of BZ Bomblets, was suspended for test item redesign.

In May 1965, Det. No. 4, R&D projects⁴⁰² included:

- CB Safety and Handling Technique
- DITA⁴⁰³ Munitions
- Defoliation & Anti-Crop
- CB Detection and Warning
- CB Protection and Decontamination
- CB Defensive Techniques
- CW Screening Munitions
- AF Evaluation of CB

The most notable change in the Det. No. 4 research and development projects is the shift from a predominately offensive CB program to a predominately defensive CB program. A later listing of Det. No. 4, R&D projects listed Tactical Bio Munitions and Anti Crop System in addition to the listing of May 1965.⁴⁰⁴

A summary of the projects for 1965 reflects the emphasis on limited war activities. In 1962, 4,400 flight missions were completed; in 1965, 10,600 missions were completed. The BW/CW munitions program reflected increased emphasis with 13 projects per month in January-May, increasing to 32 projects per month in November-December.⁴⁰⁵ This level of programming carried over into the first half of 1966, averaging approximately 30 projects per month for the six-month period.⁴⁰⁶

1966. The APGC Program Summary listed 282 projects by priority. The CB related projects by priority were:

⁴⁰² *ibid.*, pp. 15-16.

⁴⁰³ DITA (Direct Injection Toxic Ammunition).

⁴⁰⁴ History of the Air Proving Ground Center, Vol III, Documents, 1 July-31 December 1965, Air Proving Ground Center Program Summary, 1 December 1965, pp. 23-24.

⁴⁰⁵ History of the Air Proving Ground Center, Vol I, Narrative, 1 July-31 December 1965, pp. 6, 8-9.

⁴⁰⁶ History of the Air Proving Ground Center, Vol I, Narrative, 1 January-30 June 1966, p. 28.

- (58) Development Test of COIN Defoliant Dispenser
- (65) Test of modification to A/B 45Y-1
- (93) Incapacitating Disseminator
- (95) Development Test of A/B 45Y-2 Spray Tank (TX)
- (124) Engineering Evaluation of TMU-28E Liquid Agent Spray Tank
- (125) Engineering Evaluation of Chemical Bomblets
- (126) 1st Article Test TMU-28B Liquid Agent Spray Tank
- (135) Dry Agent Dispenser System A/B 45Y-4
- (136) Test of Modified A/B 45Y-1 Spray Tank
- (139) Test and Evaluation of A/B 45Y-3 Defoliation System
- (143) Engineering Evaluation of CB Shelter
- (145) Feasibility Test of BZ Bomblets (BLU-20/B23)
- (220) DPG/APGC CB Munitions Trials
- (223) Fit, Flight, and Function Test of Improved Dry Bio Disseminator⁴⁰⁷

1967. In FY67, the APGC mission, with respect to BW/CW programs, remained essentially unchanged from that of the FY66 program. The FY67 mission was to "test nonnuclear munitions, biological and chemical warfare delivery systems, pyrotechnics, aerial targets, scorers, and related equipment." The increase in the development of conventional munitions, BW/CW munitions, and the testing of delivery systems for counterinsurgency and limited war support required mission emphasis on testing and on the use of land test areas. Test Area C-52A was the BW/CW test facility. It was used for testing aerial delivery hardware for BW/CW weapons filled with simulant agents. During the period of 1 July 1966-30 June 1967, the number of BW/CW munitions test projects averaged 34 projects per month with a monthly low of 31 projects and a high of 42 projects. The BW/CW monthly projects were approximately 9% of the total APGC monthly projects (375 average per month).⁴⁰⁸

Current BW/CW projects for the APGC dated 1 June 1967 were given as:

- Test A/B 45Y-2 Spray Tank with F-105 (SEEK EAGLE)
- DPG/APGC CW Munitions Trials
- Test of Wide Area Bio System (B-47/SUU-24A)
- Test Mark 12 Mod as CB Exercise Munitions
- Testing of Riot Control Munitions
- Dry Agent Dispenser System A/B 45Y-4
- 1st Article Test A/B 45Y-1 (SEEK EAGLE)

⁴⁰⁷ History of the Air Proving Ground Center, Vol III, Documents, 1 July-31 December 1965, Air Proving Ground Center Program Summary, 1 December 1965, pp. 13-19.

⁴⁰⁸ *ibid.*, History of APGC, vol I, Narrative, 1 July 1966-30 June 1967 pp. 32-61.

Evaluation of Destruct Mechanism for BW Weapons
Test of TMU-66/A Chemical Anti-Crop Dispenser
Test of A/B 45Y-1 Optimized System
Portable CB Shelter Decontamination Unit
Aircraft CB Protective Overlay/Entrance

Current BW/CW projects for the AFATL were given as:

CB Program
CB Safety
CB Assessment
Incapacitating Agent Dispensers
Riot Control Munitions
DITA Munitions
CB Bomblets
Anticrop System
Defoliation Dispenser
CB Detection and Warning
CB Protection and Decontamination
CB Defense Technology
Chemical Weapons Technology
BW Technology
CW Screening Munitions
Chemical Bomblet for Dispenser
Lethal Bio Weapons
Anticrop System
Non-Lethal Chemical Weapons
Non-Lethal Biological Weapons
Special Chemical Bombs
BW Shipping Container
Chemical Weapons Container
CB Technical Evaluation
CB Medical Evaluation⁴⁰⁹

Test Facilities

In 1953, Range No. 4A was used for CW operations. It was located approximately eight miles northwest of the main portion of Eglin AFB and consisted of 320 acres (one mile x 0.5 mile in size). The range had the capability to handle air-to-ground gunnery, CW operations, and special missions without munitions. The range had one permanent building that was used for

⁴⁰⁹ History of Air Proving Ground Center (AFSC), Vol IV, Documents, 1 July 1966–30 June 1967, Air Proving Ground Program Summary, 1 June 1967.

chemical operations.⁴¹⁰ The BW/CW Branch installed an operational range in the western section including micro-meteorological towers and sampling stations.⁴¹¹

Located in the northwest corner of the Reservation, Auxiliary Field No. 6, served as a staging base for tactical squadrons using bombing and gunnery ranges. It was also used by the APGC and the AFAC for BW/CW testing. The greater share of tests conducted by the APGC came from the Air Force research and development program. Other tests came at the request of a variety of sources, including the Army Corps of Engineers, Army Chemical Corps, and Army Signal Corps.⁴¹²

Plans and specifications for the BW/CW Laboratory at Auxiliary Field No. 6 were submitted to the Air Proving Ground in June 1955. The BW/CW laboratory was estimated to cost \$742,000 and the range improvements for the BW/CW portion of Range 76-X were estimated at \$586,000. The range was to be operational in 1957; the BW/CW portion was to be three miles wide and three miles long. Its purpose was provide "facilities for the engineering testing of BW and CW agent and munition combinations involving the principle of aerosol distribution." The Land Pattern Bombing Range (Range 75), scheduled for operational use in 1956, was also used by the BW/CW program; however, it "could not be used for 'hot' testing of BW/CW agents or for drops requiring very wide dispersion."⁴¹³ Construction of additional facilities and modification of existing facilities were to continue as this program expanded.

The Technical Advisory Group at AFAC recommended in 1956 that the BW/CW range facilities be moved as soon as possible to Range 75C. The BW/CW Branch of the Directorate of Munitions Testing initiated action to move the BW/CW Grid Area from Range 4A to Range 75C.

⁴¹⁰ History of the Air Proving Ground Command, 1 January–30 June 1953, Vol. II, APGC Reg 55-10, Atch 1, Appendix C.

⁴¹¹ History of the Air Force Armament Center, Vol 1, Text, 1 January–30 June 1955, p. 76.

⁴¹² History of the Air Proving Ground Command, 1 July 1956–31 December 1956, Narrative, p. 90.

⁴¹³ History of the Air Force Armament Center, Vol 1, Text, 1 January–30 June 1955, pp. 32, 38, 54, 55.

"Upon completion of the programmed permanent Biological Warfare Testing Facilities, the AFAC was to possess the capability to conduct large scale simulant BW/CW tests."⁴¹⁴

A Special Munitions Range (76) provided an engineering testing facility for BW/CW munitions that involved aerosol distribution. The range covered an area of 3 x 3 miles square and was capable of supporting various tests pertinent to aerosol clouds. The range had the following restrictions: simulant agent only and flight paths NW to SE or SE to NW. The range was fully instrumented for micro-meteorology, radar target, spotting tower, air sampling equipment, horizontal/vertical sampling, photo theodolite, communications.⁴¹⁵

During 1958, Auxiliary Field No. 6 housed members of three branches of the armed forces. The Army used six buildings for billeting, the Navy used a runway for "touch and go" jet training, and the Air Force used three buildings for its BW/CW program. A test was scheduled in December 1958, for the item 935JW02, Test of Type E-132, Chemical Munition.⁴¹⁶ In 1960, Auxiliary Field No. 6 was still used by the Army and Navy with their regular programs, and Air Force had three buildings for "certain test activities."⁴¹⁷

In the latter part of 1962, the Department of Justice selected Auxiliary Field No. 6 as the site for the location of a minimum-security prison. The US Navy still conducted "touch-and-go" landings from the Pensacola Naval Air Station. There was no indication that the BW/CW laboratory was still in operation.⁴¹⁸

By 1967, the BW/CW testing area had moved to Test Area C-52. Test Area C-52 was a large and diverse cleared land test area consisting of formerly designated areas Test Area C-52, Auxiliary Field No. 8, and Test Area C-57. The cleared area was about 2.25 miles wide east to west and 3.75 miles north to south. The northern portion of the Test Area was used for air-to-ground delivery of live high explosive (HE) bombs, live napalm, live rockets, gunnery, soft-field

⁴¹⁴ History of the Air Force Armament Center, Vol 1, Text, 1 January–30 June 1956, pp. 45, 98, 138.

⁴¹⁵ History of the Air Force Armament Center (ARDC), Vol II, 1 July–30 November 1957.

⁴¹⁶ History of the Air Proving Ground Center (ARDC), Vol I, Narrative, 1Jul–31 December 1958.

⁴¹⁷ History of the Air Proving Ground Center (ARDC), Vol I, Narrative, 1 January–30 June 1960, p. 27.

⁴¹⁸ History of the Air Proving Ground Center (AFSC), Vol I, Narrative, 1 July–31 December 1962, p. 23.

landings, and drop-zone testing. The central portion of the Test Area was used for testing air-to-ground anti-personnel (AP) munitions, static test detonations of HE bombs, and resolution testing of airborne photo resolution targets. The southern portion of Test Area C-52A, adjacent to the southern edge of C-52, was scheduled for BW/CW testing. It was used for testing aerial delivery hardware for chemical and biological weapons by use of simulants. A BW/CW laboratory, approximately 9,000 square feet, located at Site C-1 (Field No. 8), was available for analysis of the BW/CW test samples.⁴¹⁹

Instrumentation of the BW/CW test grid included:

- Five phototheodolites, centered about the CB test area
- Six portable ballistic cameras (located on the central portion of the CB test area)
- One portable harp
- One permanent harp
- Four spotting towers
- One square mile micrometeorological and CB sampling grid with permanently installed power distribution and instrumentation control system (Test Area C-52A)
- Portable micrometeorological stations to cover a 100-square-mile CB test area.⁴²⁰

Test Area C-52A was the BW/CW Test Facility located adjacent to the southern edge of C-52. It was used for testing aerial delivery hardware for CW and BW weapons by use of [agent] simulants. A one square mile controlled grid system was instrumented with fixed sampler stations, and a 100 square mile area surrounding the grid was also available for portable sampling equipment when greater dispersion measurements of [agent] simulants were required. The facility included a laboratory that housed the assessment and grid control equipment. For the six-month period of July 1967-December 1967, the number of missions for BW/CW munitions averaged almost 41 missions per month.⁴²¹

⁴¹⁹ History of the Air Proving Ground Center (AFSC), Vol I, Narrative, 1 January–30 June 1963, p. 32.

⁴²⁰ History of the Air Proving Ground Center (AFSC), Vol IV, Documents, 1 January–30 June 1963, Air Proving Ground Center Technical Facilities Manual, Vol II, Land Test Areas, September 1963, pp. I-19–I-1.

⁴²¹ *ibid.*, History of Air Proving Ground Center (AFSC), Vol. I, Narrative, 1 July 1967–31 December 1967, pp 30, 35.

The procedures for the use and storage of chemical munitions at Eglin AFB were provided in the Explosive Ordnance Safety Criteria for Chemical Munitions:

"The chemical munitions will be handled and stored as outlined in AFM 32-6, Chapter 9. The procedures for handling chemical munitions are generally the same as for explosives except personal protective equipment and first-aid equipment are required for chemical munitions. Safety procedures are required for operations involving chemicals in accordance with AFR 32-20 and APGC Supplement 1 thereto and APGCR 80-1."⁴²²

Discussion

Chemical Warfare Training

Authorization was obtained in 1942 for a gas instruction building at Eglin Field.⁴²³ It is unknown if this building was ever built or, if it was, where it was located.

APGC Regulation 355-1, HQ, APGC, EAFB, Florida, dated 14 October 1952, addressed the issues of Atomic, Biological, Chemical, and Conventional Defense. The regulation established a complete program of passive defense for APGC units and personnel in accordance with AF Reg 355-3. All unit personnel were to be trained in individual and collective defense measures. Requirements were:

1. A minimum of one-hour training in passive defense per month for all military personnel.
2. Training in the adjustment, use, and maintenance of the gas mask, with gas chamber exercises for all military personnel at least once a year.
3. Passive defense tests would be held at frequent intervals.

Equipment and supplies required for implementation were authorized. Expendable chemical and quartermaster supplies were to be procured per AF Manual 67-1.⁴²⁴

⁴²² Ibid., Part V, Explosive Ordnance Safety Criteria, p. V-3.

⁴²³ History of the Army Air Forces Proving Ground Command, Part 1, Historical Outline, 1933-1944, Exhibit 8, Directive Register (US Engineers), Eglin Field. Job No. A-2, Job No. A(2-24), Construction Number A3065, Gas Instruction Building, authorized 8 July 1942, Contract No. 3910, Contractor: P&R.

The number of years that the training program remained in effect could not be determined. The documents that were reviewed made no further entries that would indicate the location of the gas chamber(s) on EAFB or the continuance of the CW training program until 1967. It is known that Chemical Agent Identification Sets were procured for training at Eglin Field in 1945.⁴²⁵ Appendix A provides a description of CAIS. In May 1950, a letter was sent to the Air Materiel Command that requested disposition instructions of chemical munitions and equipment, including two Set Accessories, M1 Gas Identification Set.⁴²⁶ The eventual disposition of the CAIS is unknown.

In 1967, the Air Force was directed to maintain a current offensive and defensive C/B warfare capability. The Mark 12 Mod 0 Chemical Smoke Tank was modified for use as a C/B simulant dispenser for use in training personnel in C/B warfare. The tank was modified to disseminate either liquid or dry C/B agent simulants at rates and concentrations comparable to modern C/B delivery systems. Thirty-six tests were conducted with 12 tests each using talc, propylene glycol, and BG slurry.⁴²⁷

On 18 March 1967, the first class of AFATL personnel were authorized to train at the Army school for BW/CW at Ft. McClellan, Alabama, CW at Edgewood Arsenal, Maryland, and BW at Fort Detrick, Maryland.⁴²⁸ No other references to BW/CW training were found during this review.

⁴²⁴ History of the Air Proving Ground Command, 1 July – 31 December 1952, Vol II of II, Documents, APGC Reg 355-1, 14 October 1952.

⁴²⁵ Preliminary Draft of the Archives Search Report for Chemical Warfare Materials at Eglin Air Force Base, Fort Walton Beach, Florida, prepared by the US Army Corps of Engineers, St. Louis District, February 1996, para. 1.1.4.1.11.

⁴²⁶ *ibid*, para. 1.1.4.1.16.

⁴²⁷ History of the Air Proving Ground Center, Vol 1, Narrative, 1 July–31 December 1967, p. 261.

⁴²⁸ History of the Air Force Armament Laboratory (AFATL), Vol I, Narrative (Draft), 1 March 1966–30 June 1968, p. x, Chronology.

Chemical Warfare Testing

Field Test, Decontamination of Airplanes.⁴²⁹ 430, 431. On or about 4 October 1943, the Chemical Warfare Board (CWB), in conjunction with the Army Air Forces at Eglin Field, Florida, conducted a field test of decontamination of airplanes by flight and aeration at Eglin. All work was done on Auxiliary Field No. 8, Eglin, Florida, between 30 September-15 October 1943 using an A31 A1 aircraft and repeated with a RB-23 two-engine bomber. The chemical agents used were plant-run mustard (H) and plant-run lewisite (L).

Regulation aircraft metal panels were cut to 6 × 6-in. size, and painted with regulation OD paint. Four metal panels and two plexiglass panels (4 × 4-in. each) were taped on either wing. A metal panel was also taped to the left rear fuselage. The wings were sprayed with a three-gallon decontaminating apparatus. The right wing was sprayed with L and the left wing was sprayed with H to levels of 0.2-0.6 ounces per square yard. The concentrations of the H and L were determined prior to flight and after various periods of flight. The effectiveness of using hot air for decontamination was determined by blowing hot air (118°C) into the cockpit of a BT-9B single-engine plane. Three series of tests were made with painted and unpainted panels lightly contaminated with H at 0.25 oz/square yards, heavily contaminated panels at 0.5-0.7 oz/yards, and grossly contaminated panels at 1.0-1.25 oz/square yards. The panels were completely decontaminated by the hot air at 15 minutes (light contamination), 1 hour (heavy contamination), and 1.5 hours (gross contamination).

Physiological tests were made on 10 men with a metal panel, taken from the left rear fuselage (H contamination level of 0.5 oz/square yards), being placed on their arm. A second test was made on 10 men with a metal panel taken from the left wing after contamination levels with H proved negative. The men removed the metal panel samples from their arms after 30 minutes

⁴²⁹ Letter Report, Subject: CWB Project 406, Field Test, Decontamination of Air Planes, dated 30 November 1943, from: War Department, Office Chief, Chemical Warfare Service, to: President, Chemical Warfare Board, Edgewood Arsenal, Maryland.

⁴³⁰ Fritz, J. H., Investigation of Methods for the Decontamination of Military Airplanes, Preliminary Field Tests, TDMR 782, Edgewood Arsenal, Maryland: Chemical Warfare Board, 31 January 1944. ADB969740

⁴³¹ Report, Project No. 406, Field Test Decontamination of Airplanes, Chemical Warfare Board, 8 December 1943.

of contact. There was no further discussion of this particular series of tests, nor were any of the physiological test results reported.

The reports did not discuss the disposal procedures for the bulk H and L used in the tests. The decontamination procedures used on the aircraft would be adequate to neutralize the H and L used on the aircraft. Bulk agent left over after completion of the tests could have been buried in bulk on-site; decontaminated prior to burial; returned to a CW agent storage site on base if available; or returned to Army Chemical Corps. The disposition of the bulk agent is not known.

A/B 37B-1 Dispenser and Smoke Bomb.⁴³² The A/B 37B-1 dispenser consisted of a cylindrical steel tank loaded with 500 BLU-6/B 37B-1 Bomb Smoke, Spheres. The spheres, 2.56 inches diameter, were fabricated from two aluminum hemispheres and pressed together. Half the spheres were fitted with a 0.5-inch hole and half were fitted with a 0.125-inch hole. The A/B 37B-1, designed for external carriage on high-speed tactical aircraft, was designed to disseminate liquid smoke for screening of friendly troop operations. The APGC recommended that the A/B 37B-1 dispenser not be released for production or considered for tactical use. The dispenser failed to produce a dependable smoke pattern. Det 4, ASD, concurred and announced cancellation of the program.

Aero 14B Airborne Spray Tank.⁴³³ Operational compatibility testing was conducted on the Aero 14B airborne Spray Tank. No mention was made of the type of fill or the results of the test.

E-40 Spray Tank Tests.⁴³⁴ Testing of the E-40 Spray Tank was authorized by Det 4, ASD, letter request, dated 1 October 1962. The E-40 tank was 175 inches long, 22.5 inches in diameter with a capacity of 182 gallons. The tank weighed 167 pounds empty and 1,722 pounds when full. The tank had two port openings for filling and dispersing. The opening for the filling was also the entry port for ram air. The opening at the bottom rear of the tank was the point of exit for the agent. The tank would function when two shaped charges over each of the ports were detonated to open the port covers allowing the ram air to push the agent out the rear port.

⁴³² History of the Air Proving Ground Center (AFSC), Vol I, Narrative, 1 January–30 June 1963, pp. 63, 68.

⁴³³ *ibid.*, p. 71.

⁴³⁴ *ibid.*, pp. 105–107.

The purpose of the tests was to determine the compatibility of the E-40 with the F-100D aircraft. During the three-flight test program, contamination of the aircraft was observed. The tank was filled with water and 2.5 pounds of methylene blue. The APGC was unable to determine the specific amounts of contamination on the aircraft. The Center felt that a better design and degree of workmanship would have eliminated the excessive leakage around the seal of the spray tube. The test did establish that the E-40 was carried satisfactorily on an F-100D aircraft with 14-inch lug spacing at airspeeds less than 400 knots indicated airspeed and a plus 4g force.

A/A 45Y-2 Pressurized Anti-Foliant Dispenser.⁴³⁵ The A/A 45Y-2 was tested as part of APGC Project 5957W1. The test determined how the dispenser mated with the aircraft. The recommendation was made to redesign the dispenser.

A/A 45Y-1 Internal Defoliant Dispenser.⁴³⁶ The A/A 45Y-1 Internal Defoliant Dispenser, 958 gallon capacity, was tested at EAFB. The location of the testing was not determined. Defoliant agents used were Purple, Orange, Blue, and White.

Mk 116 Mod 0 (WETEYE) Chemical Bomb.⁴³⁷ Compatibility testing and an engineering evaluation of the Mk 116 Mod 0 (WETEYE) Chemical Bomb was conducted with F-100 and F-105 aircraft under APGC Project 698UW4. The bomb was designed for fill with nerve agents GB and VX. The tests were conducted with ethylene glycol and water fill to simulate the weight and volume of GB or VX agents.

A/B 45Y-2, Dry Agent Spray Tank.⁴³⁸ Development testing of the A/B 45Y-2, Dry Agent Spray Tank, was conducted. The tank was designed for use as an anti-crop and dry-agent spray tank. Tests with live agents and field tests were conducted at Dugway Proving Ground, Utah.

⁴³⁵ History of the Air Proving Ground Center (AFSC), Vol I, Narrative, 1 July–31 December 1964, p. 113.

⁴³⁶ Preliminary Draft of the Archives Search Report for Chemical Warfare Materials at Eglin Air Force Base, Fort Walton Beach, Florida, prepared by the US Army Corps of Engineers, St. Louis District, February 1996, p. 1-28.

⁴³⁷ History of the Air Proving Ground Center (AFSC), Vol I, Narrative, 1 January–30 June 1965, p. 87.

⁴³⁸ History of the Air Proving Ground Center (AFSC), Vol I, Narrative, 1 July–31 December 1965, p. 144.

The Directorate of Armament Development had a contract with the US Army Biological Laboratories to provide both the test item and data.

TMU-38/A Incapacitating Agent Disseminator.⁴³⁹ APGC conducted a feasibility test of the TMU-38/A Incapacitating Agent Disseminator. The TMU-38/A external spray tank was designed to dispense dry chemical agents at very high flow rates from fighter-bomber aircraft flying at supersonic speeds. Testing was conducted to determine the performance characteristics of the disseminator and to obtain engineering data for advanced disseminator development. Physical testing began 30 March 1965 and was completed on 1 December 1965. Data reduction and analysis were completed on 17 January 1966. There was no information as to the agent or simulant fill or location of the test--most likely Eglin AFB.

Development Test of Defoliant Dispenser, A/B 23Y-1.⁴⁴⁰ The APGC conducted a development test of the COIN defoliant dispenser, A/B 23Y-1, as installed on the A-1E aircraft. The primary aircraft of interest was the B-26K; however, no flight limitations were available for the A/B 23Y-1 when flown on the B-26K and the flight-testing was waived by AFATL. The test objectives were to determine the compatibility of the A/B 23Y-1 with the A-1E aircraft by:

- Analyzing the adequacy of the operation and maintenance manual provided by the contractor and the recommended handling equipment.
- Conducting fit tests on all possible pylon stations on the A-1E and the B-26K.
- Flight testing and functioning of the dispenser to determine the flight characteristics of the aircraft carrying the A/B 23Y-1 dispensers.

CW Screening Munitions.⁴⁴¹ APGC conducted a production acceptance tests of the CBU-11A, CBU-12A, and the CBU-13A Smoke Munitions. The purpose of the tests was to evaluate the engineering modifications on the separation and smoke-dispensing characteristics of the HC (BLU-16/B) and WP (BLU-18/B) bombs when disseminated from SUU-7B/A dispensers. The

⁴³⁹ History of the Air Proving Ground Center, Vol I, Narrative, 1 January–30 June 1966, p. 103.

⁴⁴⁰ *ibid.*, p. 105.

⁴⁴¹ *ibid.*, p. 120.

BLU-16/B and BLU-17/B were components of the CBU-11/A, CBU-12/A, and CBU-13/A munitions.

BLU-20/B23 BZ Bomblet with SUU-13A Munition Dispenser.⁴⁴² A feasibility test of the BLU-20/B23 BZ Bomblet with the SUU-13A Munition Dispenser was conducted at EAFB during October 1965 to January 1966. The test items were filled with simulant agent: sand and red smoke.

CBU-30/A Munitions.⁴⁴³ The CBU-30/A munition was developed for air delivery of riot control agent CS as an intense line source. The CBU-30/A munition consisted of the BLU-39/B23 bomb cluster carried in the SUU-13/A dispenser. Each CBU-30/A munitions contained 1280 BLU-39/B23 CS filled bombs. The purpose of the project was to determine if the reliability of the CBU-30/A munition would allow the award and release of the production contract. Later, a First Article Test of the CBU-30/A Munitions was conducted.⁴⁴⁴

CBU-7/A Munition.⁴⁴⁵ The purpose of this test was to determine the compatibility of the CBU-7A munition and BLU-1C/B bomb, CS-1 filled, with the F-100D aircraft under specified load, flight, and jettison conditions. Specific objectives were to test:

- Safe jettison of empty CBU-7/A munition from the inboard and outboard wing stations on the F-100D aircraft.
- Safe carriage of the CBU-7/A munition within limits specified by AFATL.
- Compatibility of the finned BLU-1C/B bomb (CS-1 filled) with the inboard and outboard wing stations of the F-100D aircraft.
- The safety of carriage and release of the finned BLU-1C/B (CS-1 filled) within specific limits in level flight and 15-degree dives.

⁴⁴² History of the Air Proving Ground Center, Vol I, Narrative, 1 July 1966–30 June 1967, p. 111.

⁴⁴³ History of the Air Proving Ground Center, Vol 1, Narrative, 1 July–31 December 1967, p. 134.

⁴⁴⁴ *ibid.*, p. 327.

⁴⁴⁵ *ibid.*, p. 148.

M-138, BZ Filled Bomblets. In August 1984, the TEU, Aberdeen Proving Ground, Maryland, removed six M-138 BZ filled bomblets (two not fuzed, four fuzed) from Range 52. A dumpsite was observed to have 30 to 40 M-138 bomblets in deteriorated condition. Sand was observed as the filler. The two unfuzed M-138 bomblets were removed to Pine Bluff Arsenal, Arkansas, for disposal.⁴⁴⁶

In December 1984, the TEU was sent to EAFB to investigate an incident with M-138 bomblets suspected of having BZ fill. The bomblets were opened and were observed to have filler composed of red smoke and sand. Project notebooks were reviewed and no record of testing with BZ filled M-138 bomblets could be found. TEU personnel opened four additional M-138 bomblets which were held in a storage bunker and determined that sand and red smoke were used as fillers. The conclusion was that none of the M-138 bomblets had been filled with BZ.⁴⁴⁷

Biological Warfare Testing

Operation Green. Operation Green was conducted by a joint effort of the Chemical Corps and Air Proving Ground Command at Auxiliary Field 7 in May–September 1951. Four hundred test animals (swine) were flown in from Ottawa, Canada, by the 32110th Chemical and Ordnance Test Group for use in testing of BW munitions delivering pathogenic agent. Test pens were constructed on a grid pattern and test animals were placed in the pens. The agent was dispersed from a bomb dropped by aircraft. The test animals were sacrificed, autopsied, and disposed of by burial in a pit. The agent posed no hazard to humans at any time and posed no hazard to animal life other than the test animals.^{448, 449}

⁴⁴⁶ Preliminary Draft of the Archives Search Report for Chemical Warfare Materials at Eglin Air Force Base, Fort Walton Beach, Florida, prepared by the US Army Corps of Engineers, St. Louis, February 1996, p. 1-4, para. 1.1.1.2.1, pp 1-4.

⁴⁴⁷ *ibid*, p 1-4, para. 1.1.1.2.2.

⁴⁴⁸ Personal recollection of the author.

⁴⁴⁹ History of the Air Proving Ground, Eglin AFB, Florida, Vol I, 1 January–30 June 1951; Preliminary Draft of the Archives Search Report for Chemical Warfare Materials at Eglin Air Force Base, Fort Walton Beach, Florida, prepared by the US Army Corps of Engineers, St. Louis, February 1996, pp. 1-28.

Exercise Brown Derby.⁴⁵⁰ In November 1953, a joint Chemical Corps–Air Force logistic exercise, Brown Derby, was conducted to determine the capabilities of the planned support system for supplying biological munitions to the Air Force in theater. Air Materiel Command was in operational control of the exercise.

The PDL, Pine Bluff Arsenal, Arkansas, filled M-114 bombs with simulant agent (SM) and clustered the bombs with inert fuzes and bursters in the M-33 cluster bomb unit. Under Chemical Corps Technical Escort, the M-33 clusters were transported, in AF refrigerated trailers, to Barksdale Field, Shreveport, Louisiana. The refrigerated trailers with the clusters were loaded into two Military Air Transport Service cargo aircraft for shipment to the APGC--the forward air base for the exercise. On arrival, APGC assessed the condition of the munitions, using Chemical Corps procedures. On conclusion of the testing at APGC, the refrigerated trailers with the M-33 cluster units were loaded into the cargo aircraft for return shipment to Barksdale Field. The refrigerated trailers, with clusters, were trucked to the Production Development Laboratory, Pine Bluff Arsenal, Arkansas.

The simulant agent filled in the M-33 clusters posed no risk to the personnel of Brown Derby at any time. All of the materiel was returned to the Production Development Laboratory, Pine Bluff Arsenal, Arkansas. The simulant agent was properly disposed of and the cluster hardware was either recovered for return to stockpile and reused or scrapped.

Development Test of the A/B 45Y-1, Liquid Biological Agent Spray Tank. APGC conducted a development test and evaluation of the A/B 45Y-1 liquid BW agent spray tank to qualify it for use with the F-100D and F-105D aircraft.⁴⁵¹ The spray tank was tested at Dugway Proving Ground on an F-100D and F-105D aircraft using the live agent. In 1963, the A/B 45Y-1, mounted on an F-105D aircraft, was tested with live agent for Project Night Train. Project Night Train was conducted in Alaska by personnel from the US Army Deseret Test Center.⁴⁵² In

⁴⁵⁰ Summary of Major Events and Problems, Fiscal Year 1954, Historical Office, Office of the Chief Chemical Officer, September, pp. 4-5.

⁴⁵¹ History of the Air Proving Ground Center (AFSC), Vol I, Narrative, 1 January–30 June 1964, p. 98; History of the Aeronautical Systems Division, January–June 1963, Vol II.

⁴⁵² Aeronautical Systems Division, Historical Report, 1 July–31 December 1963.

March 1965, 14 flying tests were conducted using the modified A/B 45Y-1 liquid BW spray tank. The development tests included spray tank ejection characteristics, flight compatibility, function, performance, and aircraft contamination. Target area SM-6 on TA B-70 was used as the spray tank impact point, and TA C-52 was used for simulant dissemination flights. The specific agent simulant used is unknown.⁴⁵³ In February 1967, a compatibility test of the A/B 45Y-1 spray tank on an A-1E Aircraft was conducted on Range C-52A. Spray missions were flown over the CB grid to determine particle size of the dyed-water spray from the A/B 45Y-1.⁴⁵⁴

Feasibility Test of the E41 Dry Agent Dispensing System.⁴⁵⁵ The E41 dispensing system was a research prototype system developed for the US Army by General Mills, Inc. The only available E41 was loaned to the AF to permit qualification of the E41 on high-performance aircraft. The E41 had been previously tested at Dugway Proving Ground, Utah, on US Navy aircraft. Testing began on 27 June 1963 and was completed on 23 December 1963.

The purpose of the test project was to evaluate the feasibility of using the E41 on high-performance Tactical Air Command fighter aircraft operating at low altitudes. The APGC found the F-100D and F-105D aircraft capable of being modified to permit use of the US Army E41 dry agent dispensing system. During in-flight operations, the E41 did not contaminate the aircraft with the disseminated agent simulant when the tank was installed on the intermediate station of the F-100D or the inboard station of the F-105D aircraft.

A/B 45Y-4 Dry Agent Disseminator. Development tests were conducted to prove system feasibility and effectiveness leading to Air Force standardization of the A/B 45Y-4 disseminator. The disseminator was tested at EAFB for mechanical and electrical compatibility with 14- and 30-inch lug spacing for all stations of the F-100D, D-105D, and F-4C aircraft.⁴⁵⁶ Functional tests were conducted at EAFB using talc-filled disseminators. Additional functional tests of the A/B

⁴⁵³ Preliminary Draft of the Archives Search Report for Chemical Warfare Materials at Eglin Air Force Base, Fort Walton Beach, Florida, prepared by the US Army Corps of Engineers, St. Louis District, February 1996, p 1-8, para. 1.1.3.5.3.

⁴⁵⁴ *ibid.*, p 1-10, para. 1.1.3.5.12.

⁴⁵⁵ History of the Air Proving Ground Center (AFSC), Vol I, Narrative, 1 January–30 June 1964, pp. 100–102.

⁴⁵⁶ History of the Air Proving Ground Center (AFSC), Vol I, Narrative, 1 July–31 December 1967, p. 183.

45Y-4 were conducted at Dugway Proving Ground, Utah, with BW simulants and live BW agents from June 1964 through December 1966.⁴⁵⁷ In August 1965, field assessment trials of the improved biological dry disseminator were conducted at EAFB, on Range TA-C52A, using compacted and noncompacted BG.⁴⁵⁸

Biological Bombs, BLU-21/B45 and BLU-22/B45.⁴⁵⁹ Field tests were conducted at EAFB, November 1964 through August 1966, with the BLU-21/B45 and BLU-22/B45 BW bombs. The test site(s) and type of filler is not known. In September 1967, tests were conducted to demonstrate the feasibility of the BLU-21/B45 bomblet dissemination concept. Tests with the dry agent dispenser were conducted on Range 52 and Range 71 using the agent simulants SM and BG.

BW/CW Protection

The following programs were managed and/or tested by the AFATL:

AN/GAQ-1 Nerve Agent Alarm System.⁴⁶⁰ Technical development of the AN/GAQ-1 nerve agent alarm system was completed in 1968. The Defense Branch of the Armament Laboratory was responsible for its development. Three phases of testing were conducted at the following locations: Edgewood, Eglin, and Dugway. The live agent testing was conducted at Edgewood.

Portable BW/CW Shelter/Decontamination Unit, A/E 29P-1. The A/E 29P-1 was developed to protect key flight-line personnel during a CB attack and was part of an integrated system under development to provide protection for forward air bases. Objectives of the test were to ensure portability; to evaluate the capability to protect personnel in a simulated CB environment using BG; and to evaluate the shelter in various environmental conditions, e.g., high temperature, low

⁴⁵⁷ *ibid.*, p. 187.

⁴⁵⁸ Preliminary Draft of the Archives Search Report for Chemical Warfare Materials at Eglin Air Force Base, Fort Walton Beach, Florida, prepared by the US Army Corps of Engineers, St. Louis District, February 1996, pp. 1-9, para. 1.1.3.5.7.

⁴⁵⁹ *ibid.*, pp. 1-11, para. 1.1.3.5.15.

⁴⁶⁰ History of the Air Force Armament Laboratory (AFATL), Vol I, Part I, Narrative, 1 July–31 December 1968, p. 134.

temperature, rain, wind, and shock.⁴⁶¹ The testing was conducted from 12 September 1969 to 5 February 1970.

The CB Interconnect Adapter Kit.⁴⁶² The interconnect adapter kit formed a safe passageway between the CB modified flight line taxi and the service module of the modification kit for structures. This permitted an exit from the taxi into the noncontaminated areas for aircrews and support personnel during a BW/CW environment from an attack. Testing demonstrated that the CB interconnect adapter kit was capable of protecting personnel in biological simulant (BG) concentrations above 106 organisms per cubic meter and chemical simulant (methyl acetoacetate) concentrations above 100 milligrams per cubic meter, so long as the doors on the mobile and static section remained closed on disconnect.

Interview

Mr. Don Harrison, AFRL/MNMI, worked in AFATL in the late 60's and is currently a section chief in the Air Force Research Laboratories' successor to AFATL.

1. He stated that the major emphasis in the late 60's was on defoliants--agents Orange, Blue, and White. Testing was conducted at the C-52A test grid.
2. Surplus herbicide was shipped to Johnson Island in the 1971-72 time frame.
3. The anticrop work was contracted from Eglin but was not done on the base.
4. The only CW agents on base were CS and CS-2.
5. He was not aware of any nerve agents ever being on the base.
6. Simulants were used in the decontamination studies.
7. The efforts were mainly development of equipment. No need existed to have the agent on the base.
8. He knew nothing of the BW/CW work done on the base in the 40's and 50's.

⁴⁶¹ History of the Armament Development and Test Center, Appendix B, 1 July 1970–30 June 1971.

⁴⁶² *ibid.*

9. In 1983, a conceptual program for binary agents was included in the laboratory's tasking. The effort was to examine binary concepts. The tests were conducted at the contractor's facility using simulants. No work was done at Eglin--not even with simulants.

Conclusions

- Organizations at Eglin Air Force Base were deeply involved in the Air Force BW/CW program. This statement is proved by two of the tasks assigned to the Weapons Laboratory of the APGC by the ARDC: task 2317A, to develop BW/CW agents and task 2318A, to obtain BW/CW agent munition delivery systems. The APGC Program Summaries which reported to ARDC status of all APGC efforts in the 1960's further define the multitude of programs generated as a result of this tasking. In addition, an indirect indication of Eglin's involvement was the development of the BW/CW test facilities at Eglin including a BW/CW laboratory on Auxiliary Field 6 and a BW/CW test grid. No assessment of the actual presence of the agents and munitions can be made due to unavailability of records.
- Chemical warfare training was conducted at Eglin for at least 10 years. A Gas Instruction Building was approved in 1942. CAIS were in use at APGC from 1945 through 1950. No information was found as to the total quantity of CAIS used at the base nor of the disposition of other than two sets. Therefore, the probability exists that CAIS were used and disposed at Eglin AFB.
- Various tests of CW-related hardware were conducted at Eglin AFB. Records from one test conducted in 1943 indicated the use of live agent (H and L). Tear gas and defoliant agents were used at Eglin. All other known CW testing conducted at Eglin used simulant.
- The only known BW testing using live agent at Eglin was Operation Green, which occurred in 1951. The agent used posed no hazard to humans or animal life (other than the test animals). Other known BW testing used simulants.
- BW/CW protection testing involved only simulant.

Edwards Air Force Base, California

Background

General

Edwards AFB, California, is located approximately 70 miles northwest of Los Angeles and 35 miles northeast of Lancaster, California. The original name of the base was Muroc Lake Bombing and Gunnery Range; it was renamed Muroc Army Airfield in November 1943 and Muroc Air Force Base in 1948. On 5 December 1949, it was renamed Edwards Air Force Base in honor of Captain Glen Edwards, who died in the crash of a Northrop YB-49, Flying Wing.⁴⁶³

The Muroc site was first utilized by March Army Air Field, Riverside, California, in September 1933 when gunnery and bombing ranges were laid out on the Rogers Dry Lake area and maintained for military aircraft assigned to March Field. The area was used as a bombing range by the Army Air Corps from 1933 until July 1942. At that time the Fourth Air Force Headquarters established Muroc Army Air Field at the site as an independent air field to train combat crews during World War II.⁴⁶⁴

The south end of the Rogers Dry Lake was used primarily as a training field for P-38, B-25, and B-24 flight crews. A 650-foot realistic replica of a Japanese cruiser was used by bomber crews for practice bombing with practice bombs--other pilots and crews in southern California used the site for strafing, identification, and skip bombing practice.⁴⁶⁵

In 1942, the Muroc field was selected as the site for testing the first jet powered airplane. A temporary testing area was established at the north end of Rogers Dry Lake under jurisdiction of Air Materiel Command. The F-80, F-84, B-43, B-45, and the Bell X-1 aircraft were tested.

By the second half of 1950, the mission of the Base was to conduct flight testing of experimental aircraft and components, and research and development as assigned by the

⁴⁶³ Mueller, Robert. Air Force Bases, Volume 1, Active Air Force Bases Within the United States of America. Washington, DC: Office of Air Force History, 1989. p. 123.

⁴⁶⁴ History of the Edwards AFB, California, 1 January–30 June 1953, Vol. 2, pps. 41-45.

⁴⁶⁵ *ibid.*

Director, Research and Development of AMC. The Military Training Section was responsible for the training of all assigned and attached military personnel and units. Military training consisted of drills, parades, films, lectures, and intelligence briefs on the war.⁴⁶⁶

The Air Force Flight Test Center, established in June 1951, has maintained the same mission over the years: to conduct flight test of aircraft and components and to provide facilities for contractors and other government agencies in support of research and development. The Flight Test Center originally reported to the Air Research and Development Command and currently reports to the Air Force Materiel Command.

Findings

Maneuvers and Training

A large war game was conducted at Muroc Lake in May 1937. All together, approximately 300 aircraft were involved; this comprised virtually the entire US Army Air Corps. The munition requirements per bomb and attack squadron for this exercise included practice M-38 bombs, 10,000 lbs. of smoke (FS)⁴⁶⁷, 3,850 lbs. of tear gas (CND),⁴⁶⁸ and 1,400 lbs. of lime. Lime water as well as plain water was used to simulate chemical agents.⁴⁶⁹

The Unit History of Muroc Army Air Field⁴⁷⁰ provides photographs from the 1937 maneuvers of planes conducting gas attacks as well as troops filling bombs with sand. The final series of photographs are of a Chemical Warfare School conducted at Muroc. In 1944, approximately 1,960 man-hours of chemical warfare training were conducted at Edwards.⁴⁷¹ During the first half of 1950, chemical warfare training was provided at Edwards; however, "Edwards AFB was

⁴⁶⁶ History of Edwards Air Force Base, Muroc, California, 1 July–31 December 1953, p. 1.

⁴⁶⁷ FS is sulfur trioxide in chlorosulfonic acid.

⁴⁶⁸ Chloroacetophenone mixed with Adamsite (a vomiting gas).

⁴⁶⁹ File Folder at AFFTC/HO, Maneuvers conducted at Muroc AAF, May 1937.

⁴⁷⁰ Unit History of Muroc Army Air Field, 1 January 1939 to 31 December 1943.

⁴⁷¹ Archival Research Findings, Edwards Air Force Base, California, June 1969, Air Force Flight Test Center, Edwards AFB California, draft report, p. 4-3.

exempted from the requirements of Physical Training and Chemical Warfare Training for a 60-day period, beginning 1 March.”⁴⁷²

Aberdeen Bombing Mission

The Precision Bombing Range, east of Rogers Dry Lake and south of the Rocket Test Station, was instrumented and operated by the Aberdeen Bombing Mission (ABM). The ABM was a branch of Development and Proof Services, Aberdeen Proving Ground, Maryland, Ordnance Corps, US Army. Its mission was to conduct research and develop experimental and standard aerial bombs and components. Instrumentation designed for the range was used to obtain accurate data on bomb trajectory. This data was then used to develop Air Force bombing tables. In December 1952 the ABM was staffed with two officers, 19 enlisted men assisted by 70 civilians.^{473, 474} By joint Army and Air Force agreements, the ABM was transferred to the Air Force in July 1956, and was renamed the Ballistic Test Facility (BTF). The BTF was an organization under the Air Force Armament Center (Eglin AFB, Florida).⁴⁷⁵

The Ballistic Test Facility operated the Precision Bombing Range and conducted research and development on experimental and standard aerial bombs and components. The data gathered from the test bombing runs were used to generate the Air Force bombing tables.⁴⁷⁶ The collected test data were reduced in support of the engineering development and bomb ballistics programs of the Air Force Armament Center, Air Force Special Weapons Center, Atomic Energy Commission, Army Chemical Corps, Army Ordnance Corps, and Naval Air Special Weapons Facility.⁴⁷⁷

⁴⁷² History of Edwards Air Force Base, Muroc, California, 1 January–30 June 1950, pp. 23-24.

⁴⁷³ History of Air Force Flight Test Center, Edwards AFB, Edwards, California, 1 July–31 December 1951, p. 63.

⁴⁷⁴ History of Air Force Flight Test Center, Edwards AFB, California, 1 July–31 December 1952, Vol 1, p. 11.

⁴⁷⁵ History of Air Force Flight Test Center, July–December 1957, Vol. 1, p. 45.

⁴⁷⁶ History of the Air Force Flight Test Center, 1 January–30 June 1956, Vol. 1, Narrative: Pamphlet, Office of Information Services, Air Force Flight Test Center, 1956, p. 4.

⁴⁷⁷ History of Air Force Flight Test Center, July–December 1957, Vol. 1, p 46.

Toxic Gas Yard Construction

A first indorsement from GHQ to the Chief of the Air Corps, dated 2 November 1940, referred in para. 4 to a letter dated July 19, 1940, which *recommended* the establishment of chemical storage facilities at certain locations. The first indorsement specified that for one mission by a light bombardment wing the following bulk chemicals were required: 55 tons of mustard (HS), 80 tons of lewisite (M1), 80 tons of smoke (FS), and 58 tons of tear gas solution (CNS). The indorsement further stated that it was *desired* that sufficient chemicals for one complete mission be stored at gas yards to be established at Westover Field, Massachusetts; MacDill Field, Florida; March Field, California; and McChord Field, Washington. Bulk chemicals supply credits for the GHQ AF were to be established for 220 tons of mustard, 320 tons of lewisite, 320 tons of smoke, and 232 tons of tear gas solution.⁴⁷⁸

A letter, dated 23 June 1941 from the Adjutant General's Office, Washington, to the Chief of Engineers, Subject: CW Materiels at GHQ AF Installations referenced a letter from the Office of Chief of Air Corps, dated 31 August 1940, subject "CW Materiels" with nine endorsements. The letter granted authority for the construction of temporary buildings and facilities requested in referenced letter for CW Service facilities at GHQ AF Installations. Nineteen sites were approved for construction of warehouses. Eight of the 19 sites were also approved for a Gas Storage Yard. In addition to those sites, Muroc, California, and MacDill, Florida, were approved for Gas Storage Yards. The other eight sites approved for Gas Storage Yards were: Savannah, Georgia; Manchester, New Hampshire; Fresno, California; Bowman, Kentucky; Oklahoma City, Oklahoma; Lawson, Georgia; Westover, Massachusetts; and McChord, Washington. The total funding of \$582,700 allocated \$401,700 for warehouses and \$181,000 for the 10 gas storage yards (\$18,100 each). Construction was not to proceed until the Chief of the Air Corps approved the layout plan.

Studies conducted for the Air Mobility Command/CEV, Scott AFB, Illinois, did not find any documentation to indicate that ton containers of mustard (HS) were ever shipped to McChord AFB, Washington, or MacDill AFB, Florida. It is known that the toxic gas yard and CWS magazine were built at McChord AFB on 16 acres of land now used for fairway and golf

⁴⁷⁸ 1st Indorsement, HQ, GHQ Air Force, Langley Field, Virginia, to the Chief of the Air Corps, D.C., 2 November 1940.

maintenance area. The CW Area built at MacDill, AFB, occupied 26.6 acres, and is now covered by the main runway apron.

A letter from the Base Chemical Officer, March Field, California, to Chief, Chemical Warfare Service, Washington, DC, dated 17 December 1941, recommended relocation of the proposed toxic gas storage yard at Muroc Field. Reasons were related to:

1. The immediate proximity to tactical units and base installations within 100 yards of the current runway and within 50 yards of the extended runway.
2. Prevailing wind in the event of a spill or accident.
3. Lack of drainage facilities.
4. Location within 8 feet of the lowest point in the area.
5. Congestion of existing rail facilities.

Both the Commanding Officer of March Field and the Sub-Base Commander at Muroc Field considered the site as hazardous.⁴⁷⁹

An alternative site selected by the Chemical Officer, March Field, and the Chemical Officer and Engineer, 4th Air Force was subsequently approved by the Chief, Chemical Warfare Service and the Chief of the Air Corps.⁴⁸⁰ The US Engineer Office, Los Angeles, California, awarded a contract (29 May 1942) for construction of the Toxic Gas Yard for \$58,850; however, only \$18,100 were available. A request for \$40,750 of additional funding was forwarded to the Division Engineer, San Francisco. The Division Engineer concurred with the request for additional funds.⁴⁸¹

⁴⁷⁹ Letter, 17 December 1941, from: Office, Chemical Officer, March Field, California, To: Chief, Chemical Warfare Service, DC, Subject: Toxic Gas Yard Type 5.

⁴⁸⁰ First Indorsement, Subject: Location of Toxic Gas Yard at Muroc Bombing and Gunnery Range, California, from: Office, Chief of Engineering, to Division Engineer, San Francisco, California, dated 3 January 1942.

⁴⁸¹ Letter, dated 11 June 1942, from US Engineer Office, Los Angeles, California, to Office, Chief of Engineers, US Army, Washington DC, Subject: Request for Funds: Substitution of Type VII in Lieu of Type V Chemical Warfare Service Toxic Gas Yard for Muroc Bombing Range, Muroc, California.

A revised location drawing of survey ties for a Toxic Gas Yard at Muroc Bombing Range, dated February 1942, was located and reviewed.⁴⁸² The gas yard was sized at 2,124 feet by 1,315 feet. The east corners were located at N 110,232.12, E 88,933.35, and N 108,917.21, E 88,949.12. A 2,400-foot rail spur off the Atcheson Topeka and Santa Fe railroad main line and a road 280 feet south and parallel to the spur were specified.

Biological Warfare Testing in 1960's

Project Directive No. 67-32, dated 16 September 1966, provided approval for testing of the US Army Rapid Warning System at Edwards. Edwards was to provide space on Rosamond Dry Lake, clearance of vehicles, and 20 cubic feet of refrigerated storage space.⁴⁸³ The Army requested that its contractor, Midwest Research Institute, be allowed to conduct the tests "which involved the scattering and collection of harmless bacteria".⁴⁸⁴ The project was scheduled for completion in May 1968.⁴⁸⁵

Discussion

Maneuvers and Training

Maneuvers: May 1937. Maneuvers were conducted at Muroc AAF in May 1937. A requisition was issued for 250 practice M-38 bombs; 10,000 lbs. of FS (smoke); 3,850 lbs. CND (tear gas), and 1,400 lbs. of lime. The smoke and tear gas were to be shipped by rail; the lime was to be purchased locally. The M-38 bombs were for the bombardment squadron, and the smoke, tear gas, and lime were for the attack squadron. An additional 750 M-36 practice bombs were obtained on credit from the Air Base Commander, Hamilton Field.

The Operation Orders for the maneuvers state that the various air groups were to "attack (the) airdrome with Chemicals (simulated)." Further, the Operation Orders stated the chemicals

⁴⁸² Muroc Bombing Range, Toxic Gas Yard, survey ties, revised location, US Engineer Office, Los Angeles, California, February 1942.

⁴⁸³ History of the Air Force Flight Test Center, Edwards Air Force Base, California, FY 67, 1 July 1966-30 June 1967, Vol. 2: Project Directive 67-32, 16 September 1966, AFFTC.

⁴⁸⁴ History of the Air Force Flight Test Center, Edwards Air Force Base, California, FY 67, 1 July 1966-30 June 1967, Vol. 2: Project Directive 67-32A, 8 March 1967, AFFTC.

⁴⁸⁵ History of the Air Force Flight Test Center, Edwards Air Force Base, California, FY 67, 1 July 1966-30 June 1967, Vol. 2: Project Directive 67-32B, 3 October 1967, AFFTC.

were to be "simulated by 20 gallons of lime water in each chemical tank." One report on the results of a mission states that "the attack was well executed and the field appeared to be well contaminated by the spray. Heavy deposits of lime water were discovered on all personnel and equipment in the target area." Several of the problem scenarios presented to the various commanding officers state that water was to be used as the chemical, with or without lime.⁴⁸⁶

CW Training at Edwards. Prior to 1941, the military personnel at Muroc Field were given CW training although very little information is available on the training. After 1941, the scope and duration of the BW/CW training of the personnel at EAFB is not well defined. Other than the previously mentioned references including 1,960 man-hours of training in 1944, few references to CW training were discovered. A 1943 US Engineers Office's map of Muroc Army Airfield indicated a chemical magazine in the munitions storage area, a chemical warfare gas instruction building, and a chemical warfare warehouse. The location of a field training area where CW agents would have been released in the air has not been discovered.

The results of previous record searches have indicated that the CW training involved the use of a CW gas chamber and involved storage of CW training material supplies. As part of the field-training curriculum, CW agents may have been released in small quantities.

Aberdeen Bombing Mission

General. A publication describing Edwards in November 1950 describes the mission of the ABM:

"Aircraft dropping inert loaded bombs of all sizes on a designated target from a high altitude are photographed by precision ground cameras from which the altitude, location, speed, and direction of the plane at the time of release of the bomb are accurately determined, and the bomb trajectory is plotted. The data gained is used to prepare bombing tables."⁴⁸⁷

The following provides a description of ABM operations:

⁴⁸⁶ File Folder at AFFTC/HO, Maneuvers conducted at Muroc AAF, May 1937.

⁴⁸⁷ Edwards Air Force Base, November 1950, SMAMA-November 30-3M, p. 22.

"ABM has approximate 100 square miles of desert bombing range area. Since the primary purpose is to obtain precision trajectory data, there are two (2) precision ranges and one (1) control range. The precision range impact areas are instrumented with sound microphones and geophones for detection of air and ground arrivals of functioning and impact events. Nearly all units dropped on the precision range are inert except that frequently a small explosive spotting charge is used for detecting time and position of the fuze functioning or other special events. Telemetry is also used to determine various in-flight characteristics. The control range is used for explosive units and special cluster units, where precise time of impact is not of prime importance."⁴⁸⁸

Tests. The ABM First Report on Ordnance Program No. 3635 listed the type and number of bombs dropped during the second half of 1944. Twelve bombs (chemical, 115 lb., M70) were dropped from an altitude of 25,000 feet. The impact points of 11 of the M70's were found, and one M70 was lost (no impact point). The M70 bombs were marked as filled with mustard.⁴⁸⁹ The impact area was approximately 2,000 feet perpendicular to the flight path by 1,000 feet parallel to the flight path. No other information was reported.

The weekly activity reports for the period January through December 1947 listed chemical bomb⁴⁹⁰ program activity for January only.⁴⁹¹ No chemical bombs were tested for the period February through December 1947. For the period January through December 1948 no chemical bombs were tested with the exception of some incendiary bombs and clusters during the period of March through July.⁴⁹²

A project was initiated in July 1950 with a December 1952 completion date to conduct B-45 high-speed bombing, high altitude drop tests of 500-pound, 750-pound, and 1,000-pound chemical cluster bombs. The test was to determine the operational and ballistic characteristics of the chemical cluster bombs when dropped from high altitudes at high speeds. By August

⁴⁸⁸ Pictorial Review of Aberdeen Bombing Mission Operations, ABM Engineering Report No. 4, Aberdeen Bombing Mission, Edwards AFB, California, 31 October 1955.

⁴⁸⁹ Ordnance Research and Development Center. High Altitude Range Bombing Conducted at Muroc Army Air Field, California and First Report on Ordnance Program No. 3635. Aberdeen Proving Ground, Maryland, 14 June 1945, pp. 9, 23.

⁴⁹⁰ Type not identified.

⁴⁹¹ ABM Weekly Activity Reports, 1947.

⁴⁹² ABM Weekly Activity Reports, 1948.

1952, 28 E-101R3 1,000-pound chemical cluster bombs and 39 E-108R3 750-pound chemical cluster bombs had been dropped with satisfactory results. Twenty E-101R1 and E-101R2 (chemical cluster bombs) remained to be tested to complete the program.⁴⁹³

Tests of 750 lb. clusters of aerosol generators were programmed with a starting date of March 1950. Approximately 70 bombs were to be dropped by a B-47 at the precision range at the Flight Test Center and at Holloman AFB, New Mexico. There were 22 each E-103 bombs, 10 each E-89 bombs, and 40 each E-115 bombs. Missions were alternated between Edwards and Holloman with four bombs being dropped per mission. The ABM was to provide Askania Camera coverage and data reduction.⁴⁹⁴ Since no special requirements (e.g., handling, personnel, etc.) other than security were needed, it is highly unlikely that live agent was used.

In May 1955, the ABM supported 25 total bombing missions, which were flown at altitudes of 1,200 feet to 40,000 feet. Six toxic bombs (not identified) were loaded and dropped.⁴⁹⁵ In March 1956, the completed projects included tests of the E-54 Chemical Bomblet Dispenser.⁴⁹⁶ No other information about this test was found.

Toxic Gas Yard

Toxic Gas Yard at Muroc (Edwards). The toxic gas yard at Muroc Field would not have been built until the latter part of 1942 and, if shipped, the bulk agent would probably not have arrived at Muroc Field until sometime in 1943. If the bulk agents had been shipped and not used for their intended purpose as stockpile items, they probably would have been returned to a Chemical Depot. No records were found of the bulk shipment of 273 tons of agent in one-ton containers or barrels either into or out of the toxic gas yard at Muroc Field. A search of the

⁴⁹³ History of the Air Force Flight Test Center, Edwards AFB, California, 1 July–31 December 1952, Vol. 4, p. 460.

⁴⁹⁴ History of the Air Force Flight Test Center, Edwards AFB, California, 1 July–31 December 1953, Vol. 6, App CC, Project Assignment Directive No. 53-25, Test of 750 lb. Clusters of Aerosol Generators.

⁴⁹⁵ History of the Air Force Flight Test Center, Edwards AFB, California, 1 June–30 June 1955, Vol 5, App AC, Projects Progress Report for May 1955, pp. 10-11.

⁴⁹⁶ History of the Air Force Flight Test Center, Edwards AFB, California, 1 January–30 June 1956, Vol 1, p. 16.

CBDCOM History Office (AMSCB-CIN) database⁴⁹⁷ did not list any shipments of chemical agents either to or from any of the four Air Force bases (Westover, MacDill, March [Muroc], and McChord) specified in the first indorsement dated 2 November 1940 for the years 1945 and beyond. No listings were available for the years prior to 1945.

Attempts to retrieve shipping records from the Atcheson Topeka and Santa Fe Railroad (AT&SF RR) for the period 1942 through 1945 were not successful. All records for the AT&SF RR were transferred to the Kansas State Historical Society where records for the Burlington Northern & Santa Fe RR are archived. The shipping records had been considered routine business records and not of any historical interest.⁴⁹⁸

Site. The site of the Toxic Gas Yard, constructed in 1942, is now occupied by the Main Base, Edwards AFB and is an open field adjacent to a military construction project. Four subsurface waste cells, approximately 150 feet long, 15 feet wide, and 20 feet deep, have been identified within the boundaries of the old Toxic Gas Yard site. The cells are bounded on the north side by Popson Avenue and on the west-side by North Muroc Drive and were located by a geophysical survey of the area, which detected metal in the four waste cells.

The geophysical survey was followed by a passive soil gas survey, conducted in October 1997, as a qualitative screening tool for organic compounds that were present in the waste cells. The contractor, Radian International, selected the passive soil gas survey as a qualitative screening tool for the exercise. The contractor stressed that passive soil technology is a qualitative tool and that results obtained from this survey are qualitative only. This was also the first opportunity to demonstrate the capability of the passive soil gas capability in the field--all prior work had occurred in the laboratory.⁴⁹⁹

⁴⁹⁷ Personal communication, CBDCOM History Office (AMSCB-CIN), Mr. Jeffery Smart, 30 December 1999.

⁴⁹⁸ Communication with the Kansas State Historical Society, 7 January 2000.

⁴⁹⁹ Ltr, 19 December 1997, from: Radian International, to: Mr. Fred Mueller, Sacramento District Corps of Engineers, Subj: Letter Report Summarizing Passive Soil Gas Analysis, Area 426, Edwards Air Force Base, California.

The soil gas samples were directed at determining the concentrations of 1,4-Thioxane (1,4-Oxathiane) and 1,4-Dithiane (Diethylene disulfide)⁵⁰⁰ as these compounds are known to be produced during the decomposition of mustard (HS). However, the presence of these two compounds is not specifically unique to mustard as they are also common to other organics; e.g., diesel fuel. Benzothiazole, an impurity of mustard carried over from the manufacturing process, is also a compound that is a good indicator that mustard may have been present at some time in the past. The sampling of the waste cells did not include analysis for the presence of benzothiazole.

Twenty-six samples were taken for each of the chemicals of interest: 1,4-Thioxane and 1,4-Dithiane. One sample was destroyed by vehicles working in the area, thus leaving 25 samples for analysis. Twenty sample results for 1,4-Thioxane and 16 sample results for 1,4-Dithiane were at or below the method detection limit of 0.5 ng/L. Twelve of the samples were between 0.8 to 1.5 ng/L, and nine of the samples were above 1.5 ng/L. One Thioxane sample (at location 426-3) registered 0.5 ng/L on the first analysis and registered 6.03 ng/L on the analysis of a replicate. The highest reading for Dithiane was 4.0 ng/L at one sampling location. Again, the values determined by the passive soil gas process are qualitative in nature and at this stage of survey development probably should not be used quantitatively.

Background: Handling and Storage of Toxic Chemicals. The CWS had 2.5 million square feet of depot storage in June 1942, 19.5 million square feet by the end of 1942, and 23 million square feet by June of 1943. By 1945, the CWS had 29.5 million square feet of depot storage with 20.6 million square feet of that being toxic gas yard. There were four CW depots: Eastern (Edgewood, Maryland), Gulf (Huntsville, Alabama), Midwest (Pine Bluff, Arkansas), and Deseret (Tooele, Utah). Deseret had 18 of the 20.6 million square feet. The primary mission of these depots was the handling of chemical ammunition and toxics for zone of interior distribution, shipment to Ports of Embarkation, and reserve storage.⁵⁰¹

⁵⁰⁰ 1,2 Dithiane is also closely related, the only difference being Sulfur in the 1,2 position rather than the 1,4 position. Chemical properties are somewhat different.

⁵⁰¹ Brophy, L. P., W. D. Miles, and R. C. Cochrane. United States Army in World War II, The Technical Services, The Chemical Warfare Service from Laboratory to Field. Washington, DC: Center of Military History, United States Army, 1988. Chapter XVI.

The primary packaging for the toxic agents was the one-ton container with a capacity of 170 gallons. With a density of 1.34-1.37 g/cc, 170 gallons of mustard (HS) would weigh approximately 1,900 lbs. These containers were kept in open storage on tracks (railroad ties) to keep them off the ground and provide for air circulation. Mustard amounted to over half of all toxics produced. Mustard (HS) contained over 30 percent of unstable impurities. When left in storage for any length of time, these impurities would cause high pressure within the containers and deposited tar-like sludge that could not be drained out of the containers. Sometimes, the combination of corrosion and high pressure would produce a spray of mustard through a leak.⁵⁰²

When toxics were stored in 55-gallon drums, problems of corrosion and leakage were serious. Standing on end, any rainwater accumulating in the tops would cause rust. Placed on their sides the bungs at the ends were likely to leak. The latter was preferred over the rust and corrosion.

Because of the possibility of leakage of the containers and the danger of personnel exposure to the toxic agents, it was necessary that shipments of toxics be accompanied by trained military escorts to handle the materials and to be able to attend to potential sources of trouble. When large-scale shipments of toxics and containers in and out of depots began in 1942, trained military personnel were used to act as guards and handlers. These personnel, selected by their units, were trained at Edgewood Arsenal as toxic gas handlers. The guard and security units were to escort rail shipments of toxics and CW munitions to and from depots, arsenals, and ports of embarkation. A guard detail took custody of each shipment at its point of departure, accompanied it via railroad caboose, maintained a continual alert for emergencies, checked for evidence of contamination at each stop, and made detailed inspections during major stopovers. All leaks found were repaired. Overseas shipments were accompanied to their destination by the unit.⁵⁰³

In January 1943, on recommendation of the Office of the Chief, CWS, a Chemical Warfare Service training center at Camp Sibert, Alabama, was set up to train a detachment of 20

⁵⁰² *ibid.*

⁵⁰³ *ibid.*

officers and 100 enlisted men for service as a guard and security unit for the shipment of toxics. In February 1944 the unit transferred to the Chemical Warfare Center at Edgewood, where it remained for the duration of the war. The unit strength rose to a wartime peak of about 350 officers and enlisted men.⁵⁰⁴ Records of shipments of toxics by these units have not been found. The TEU was formed in 1945 to serve as a guard and security unit for the shipment of toxics. TEU records of some of the toxic shipments are available; however, there is no record of shipments to the toxic gas yard of Muroc Field or the other three airfields designated for a toxic gas yard.

Biological Warfare Testing in the 1960's

Under Project Directives 67-32, 67-32A, and 67-32B, Midwest Research Institute conducted tests for the US Army on a portion of Rosamond Dry Lake to evaluate biological detection devices of the US Army Rapid Warning System project. The project approval was granted by AFFTC on 16 September 1966; the completion date was May 1968. The organisms used for the testing were the biological warfare simulant agents, *Serratia marcescens* (SM) and *Bacillus subtilis* var. *niger* (BG), a vegetative and a spore, respectively.⁵⁰⁵

Conclusions

- Maneuvers were conducted at Muroc AAF in May 1937. The maneuvers involved the use of smoke, tear gas, and simulated chemical agents. CW training was conducted during the maneuvers; however, no documentation was found on the training. CW training was conducted at Edwards in the 1940's and probably through the 1950's. However, little documentation was found of the numbers of individuals involved or the intensity of training.
- The Aberdeen Bombing Mission conducted a relatively large number of air drops of CW bombs and clusters. It cannot be determined if the bombs were filled with agent or a simulant. No documentation was found on the clean-up procedures used to remove the bomb debris from the bombing range nor the location of the disposal area.

⁵⁰⁴ *ibid.*

⁵⁰⁵ Midwest Research Institute, Evaluation of Detection Devices (Biological) Quarterly Report No. 8, 21 March 1968–20 June 1968. Quarterly Report, 19 July 1968.

- The Toxic Gas Yard information is inconclusive. No hard evidence exists that the bulk agents were ever delivered to the Gas Yard. The soil gas sampling was qualitative only and for the most part was inconclusive.
- The BW test conducted at Rosamond Dry Lake used vegetative and spore agents that are widely used as simulants.

Los Angeles Air Force Base, California

Background

General

In 1954 the Los Angeles Air Force Base (LAAFB) began as the Western Development Division (WDD) of the ARDC in a former private school building in Inglewood, California. The task assigned to the WDD was to attain an operational ballistic missile at the earliest date.⁵⁰⁶ ARDC transferred responsibility for a satellite reconnaissance program (weapon system 117L) from WADC to WDD in 1955.

The Space Technology Laboratories (STL)⁵⁰⁷ of Ramo-Wooldridge Corporation purchased approximately 41 acres on the southeast corner of Aviation Boulevard and El Segundo Boulevard and constructed the area now known as Area A in the fall of 1955. The center was purchased by the Air Force in December 1960.⁵⁰⁸

In 1957, WDD was redesignated as the AF Ballistic Missile Division (AFBMD). The AFBMD facility was moved to El Segundo in 1960. In April 1961 the AFBMD was inactivated and replaced by the Ballistic Systems Division (BSD) and the Space Systems Division (SSD). After the 1961 reorganization, the BSD moved to Norton AFB, California (October 62). SSD remained at the El Segundo location.⁵⁰⁹ In 1964 the site--Area A--was renamed Los Angeles Air Force Station (LAAFS). In 1967 LAAFS was designated as headquarters for Space and Missile Systems Organization (SAMSO). SAMSO was created by the merger of the BSD and the SSD in the interest of economy.

⁵⁰⁶ The Space Systems Div--Background (1957-62), Vol. 1, History of Space Systems Div., January-June 1962, p viii.

⁵⁰⁷ Space Technology Laboratories (STL) were a subsidiary of the Ramo-Wooldridge Corporation (later known as TRW). STL was later spun off and renamed the Aerospace Corporation. The Aerospace Corporation is a federally funded, research, and development center (FFRDC).

⁵⁰⁸ IRP Phase 1: Records Search, LAAFS, California, SD-TR-85-29, Environmental Science and Engineering, Inc, July 1985, pp. 2-6.

⁵⁰⁹ *ibid.*, p. 89.

In the early 1970s LAAFS primary missions were the Atlas and Titan missile and satellite programs. The DoD involvement in NASA operations was also headquartered at LAAFS with prime responsibility for the Inertial Upper Stage booster for the Space Shuttle.

The current Los Angeles AFB includes Area A, Area B, the Lawndale Annex, and the Fort MacArthur military family housing (MFH) areas. Areas A and B are on approximately 95 acres in the City of El Segundo within the metropolitan area of Los Angeles, California, and are located at the intersection of El Segundo Boulevard and Aviation Boulevard, west of Interstate 405.

Area A

During WW II, 41.45 acres of land, now Area A, were converted to light industrial use. None of the WW II buildings remain in Area A. In 1955 STL, of Ramo-Wooldridge Corporation, previously located at Inglewood, built and relocated to the Aviation-El Segundo complex (now Area A). In December 1960 the USAF purchased the complex from the STL for use by the Aerospace Corporation that would provide systems engineering and technical direction for future space programs. In 1964 the facility was transferred to USAF from the Aerospace Corporation and redesignated the Los Angeles Air Force Station.⁵¹⁰ The structures currently in Area A are principally missile and space research and engineering facilities, including laboratories and offices built from 1957 through 1959. Ancillary buildings were constructed in Area A during this period with small amounts of construction from the 1960s to present.

Area B

In 1963 the US Navy transferred 52.3 acres of land, northwest of Area A, to the Air Force. In 1968 the Air Force added 1.4 acres to site, and the total acreage was designated as Area B.

During WW II, the Area B land had been acquired by the Navy and developed for military aircraft production by the Douglas Aircraft Company. Two maintenance shop buildings built in 1942 remain in Area B. The majority of the structures currently in Area B are office, shop,

⁵¹⁰ Preliminary Draft, Vol. 1, Introduction and Area A, Phase I, Environmental Baseline Survey Utility Privatization and Real Property Transfer, Los Angeles AFB, Los Angeles, California. White Plains, New York: Malcom Pirnie, Inc., November 1999.

warehouse, and ancillary buildings built from 1953 through 1959 with some construction through the mid-1990s.

Lawndale Annex

The Lawndale Annex site, one mile south of Area A, was developed in 1958 by the Douglas Aircraft Company for the production of aluminum parts and later for the Douglas Publications Department (Bldg. 81) and a DC-8 flight simulator for pilot training (Bldg 80). The plant consisted of two major buildings (Bldgs. 80 and 81) and 22.7 acres of land.

The site was purchased by the US Army Corps of Engineers in 1964 and designated as the Lawndale Army Missile Plant. Fabrication and initial assembly of the Shillelagh anti-tank guided missiles, excluding propellant and warhead, were conducted there until March 1971. In 1973 GSA transferred 9.4 acres, including Bldg. 81, to the State of California. Bldg. 81 has been demolished and the site is a Metrorail facility.

In 1985 the 13.3-acre Lawndale Annex, including Bldg. 80 was purchased by the LAAFB for construction of administrative offices. (These offices were never constructed.) The building constructed in 1958 by Douglas Aircraft (Bldg. 80) is used as administrative offices for LAAFB. Lawndale Annex is a subinstallation of LAAFS.⁵¹¹

Fort MacArthur Reservation

Fort MacArthur, originally established to defend the Port of Los Angeles in WW I and II, was composed of three discontinuous areas: the adjacent Lower and Middle Reservations, Upper Reservation, and Whites Point Reservation. In 1982, the Air Force assumed control of the Middle and Upper Reservations of Fort MacArthur from the U.S. Army.

The Lower Reservation no longer exists. Portions of it were excavated to enlarge the harbor and construct a marina, and the Army buildings were destroyed. The area is controlled by the City of Los Angeles, Department of Harbors and Beaches.

⁵¹¹ Installation Restoration Program Phase I: Records Search, August 1985.

Following WW II, the Middle Reservation was used by the Regular Army, Army Reserve, and Reserve Officer Training Corps. The buildings were maintained by the Army on a caretaker basis. The Middle Reservation became a sub-post of Fort Ord, California, in 1975. The post was transferred to the Air Force in 1982. Extensive two-story MFH was constructed on the Middle Reservation for LAAFB military personnel.

The Upper Reservation was deeded to the City of Los Angeles in 1976. A portion of the Upper Reservation is administered by the Los Angeles Department of Parks and Recreation. Many of the buildings are used by the Los Angeles Unified School District and a Skills Center for vocational education.

Whites Point Reservation is currently the site of the Pacific Heights Housing Area, which is part of the LAAFB. The Pacific Heights Housing Area contains 79 Air Force MFH units constructed on a western parcel of Pacific Heights during the 1980s. A new tract of Air Force MFH units are currently being built on the eastern-most parcel of Pacific Heights. The remainder of Whites Point Reservation is owned by the Los Angeles Department of Parks and Recreation. The park area contains two IRP sites that are still under the management of LAAFB.

The Pacific Crest housing area is located on the northern side of 25th street. The Pacific Crest housing area contains 91 AF MFH units built in 1988 and 1989.

Discussion

Area A

The 41.45 acres of land, now Area A, were converted to light industrial use during WW II. None of the WW II buildings remain in Area A.

In 1955, STL of Ramo-Wooldridge Corporation, built and relocated to the Aviation-El Segundo complex. In December 1960 The USAF purchased the facility for use by the Aerospace Corporation. The USAF took over the property in 1964. The structures in Area A were principally missile and space research and engineering facilities, including laboratories and offices built from 1957 through 1959. Ancillary buildings were constructed in Area A during this period with small amounts of construction from the 1960s to present.

The mission for missile and space research and extensive engineering facilities, coupled with the lack of any training being conducted in the field of BW/CW, would mitigate against the presence of any BW/CW materiel at the Area A complex.

Area B

From 1942 to 1954 the Area B facilities were oriented toward the production of aircraft by the Douglas Aircraft Company. At the site, Douglas manufactured aircraft, conducted engine testing and runup, and sighted-in wing guns.⁵¹² After that time, the Area B facilities were converted to offices, shops, warehouses, and some ancillary buildings were constructed.

Considering the lack of BW/CW training on the LAAFB, and the type of work conducted at Area B, there is little reason to expect the presence of BW/CW materials.

Auto Hobby Shop. Building 215,⁵¹³ Area B, was constructed in 1942 and used as a Modification Building by Douglas Aircraft Company. Aircraft coming off the assembly lines were inspected for conformance to specifications. Those aircraft requiring modifications to meet specifications were processed in Building 215. The building is currently used as for personal vehicle repair and restoration, motor pool maintenance, car wash, and office space for the AF Material Command.

The Modification Building is a one-story, concrete slab-on-grade, wood frame building with wooden/built-up asphalt roof, 40 feet by 410 feet. A second-story storage loft is located in storage area south of the Material Command offices. A hazardous waste accumulation area is located in the northwest corner of the Auto Hobby Shop compound. The waste area is equipped with secondary containment and consists of a corrugated metal shed. A 500-gallon waste oil storage tank is located adjacent to Building 213. Generated wastes from Building 215 are accumulated and stored in 55-gallon drums and then moved to Building 213. The waste drums are labeled for used engine oil, spent antifreeze, waste transmission fluid,

⁵¹² Hendry, C. D., D. F. McNeill, A. P. Hubbard, J. J. Kosik, L. D. Tournade, and M. D. Stewart. Installation Restoration Program Phase I: Records Search, Los Angeles Air Force Station, California. SD-TR-85-29, Gainesville, Florida: Environmental Science and Engineering, Inc., July 1985.

⁵¹³ The HQ AFMC/CEVR specifically requested an evaluation of the Auto Hobby Shop.

crushed/drained used oil filters, waste oil from filters, contaminated spill absorbents and rags, and aerosol spray cans. An automotive paint spray booth was present at the site from 1986–1995.⁵¹⁴

Any contaminant found in or around Bldg. 215 would be attributed to the automotive wastes. There is no evidence that any BW/CW materials were ever in or around the Automotive Hobby Shop (Building 215).

Lawndale Annex

As part of the Installation Restoration Program, Phase I, past waste handling and disposal practices were evaluated. It was determined that no waste was disposed of on the facility. Solid wastes were collected for pickup for disposal, generally by a subcontractor at municipal landfills. Water soluble liquids were discharged to the sanitary sewer system. Waste POL was stored in two 500-gallon USTs until picked up by the POL contractor. All concentrated industrial wastes were hauled from the plant site for disposal by contract waste disposal companies. No sanitary or debris landfills were identified on Lawndale Annex.

Two past waste disposal sites were identified. Both sites were found to have no potential for contaminant migrations or endangerment of human health or environmental quality. No Phase II actions were considered necessary.⁵¹⁵

Considering the type of operations and the large proportion of civilian workers at the Lawndale Annex, there is little or no risk that CW items would have been used at the site.

Fort MacArthur

Middle Reservation. In 1974, all of Fort MacArthur was excessed except the Middle Reservation, a 96-acre parcel. In October of 1982 Middle Reservation was transferred from the

⁵¹⁴ Preliminary Draft, Vol. II, Area B, Phase I, Environmental Baseline Survey Utility Privatization and Real Property Transfer, Los Angeles AFB, Los Angeles, California. White Plains, New York: Malcolm Pirnie, Inc., November 1999.

⁵¹⁵ Hendry, C. D., D. F. McNeill, A. P. Hubbard, J. J. Kosik, L. D. Tournade, and M. D. Stewart. Installation Restoration Program Phase I: Records Search, Los Angeles Air Force Station, California. SD-TR-85-29, Gainesville, Florida: Environmental Science and Engineering, Inc., July 1985.

US Army to the USAF. The mission of the Middle Reservation, also referred to as Fort MacArthur, was to provide multi-family housing, administrative offices, warehouses, civil engineering shops, and recreational areas in support of LAAFB.

A number of Army buildings were demolished to provide for military family housing units: (1) Oil Pumping Station and Asphalt Paving Company 1920s–1930's; (2) Battery Shop 1934–1982; (3) Furniture Repair Shop 1934–1982; (4) Motor Repair Unit 1935-1945; (5) Vehicle Washracks 1945-1965; (6) Paint Shop 1948-1982; (7) Post Exchange Service Station 1951-1979; (8) Guided Missile Maintenance Shop 1954-1974; (9) Oil/Water Clarifiers (on washracks) 1965-1982; and (10) Entomology Section 1970-1982.

The activities involving handling, storage, and disposal of toxic or hazardous materials were part of the maintenance support function for facilities, missiles, shore batteries, and ground vehicles. The toxic or hazardous materials would include pesticides, polychlorinated biphenyls, petrochemicals, and explosives. There is no evidence that indicates the presence of BW/CW materials in the Middle Reservation.

There is some indication of gas chamber training,⁵¹⁶ however, location of the chamber is not known. The Army often used tents for a gas chamber due to their availability and portability. At the most, tear gas candles and perhaps chlorine would have been used in the chambers. Colored smoke grenades may have been used in training and spotting rounds may have been used by the Artillery. These munitions are often labeled as Chemical Warfare items, primarily because they were produced by the US Army Chemical Corps.

Whites Point Reservation. The Air Force Pacific Heights Housing Annex is located in the northern area of Whites Point Reservation, bordering on the southern side of Western Avenue

⁵¹⁶ Tear gas instruction was performed in two different buildings during WWI and WWII on the Upper Reservation. Approximately 100 empty tear gas canisters were the only waste produced. The 12th Special Forces Group operated a tear gas instruction building on an annual basis from 1949 to 1974. Less than 20 empty canisters were generated annually and were disposed in the normal post refuse. (Hendry, C. D., D. F. McNeill, J. J. Kosik, W. Pandorf, and K. J. Tribbey. Installation Restoration Program Phase I: Records Search, Upper Reservation of Ft. MacArthur, California. SD-TR-87-, Gainesville, Florida: Environmental Science and Engineering, Inc., January, 1988, pp. 4-9 to 4-11.) Per Rowenna Andress, 61st ABG/CEZV, since the USAF no longer owns this property, it is of no concern to this study.

and western side of 25th Street. Seventy-nine MFH units were constructed in the western parcel of Pacific Heights in the late 1980s. When acquired by the Air Force, the eastern-most parcel of Pacific Heights contained 1960s Navy family housing units which were removed in 1997. A new tract of Air Force MFH units are currently under construction to expand the total housing within Pacific Heights.

Construction debris, mineral spirits, oils and lubricants were disposed of at the site. All drums and contaminated soil have been removed from the site. The site has been designated "Completed" and a "No Further Response Action Planned Decision Document" has been submitted to the regulatory agencies for approval and site closeout.

A construction debris landfill is located in a ravine traversing the site just south of Building 1008 and east of the roadway leading to the coastal battery. Building 1008 is approximately 500 feet south of the southern boundary of the Pacific Heights Housing Annex, and therefore the landfill is not on Air Force property. Further south of the landfill is the site of a former trap and skeet range. Investigation of the debris in the skeet range included fragments of clay pigeon, cans and drums used in target practice, lead shot, and a rusted drum with a label indicating that it had at one time contained chemical munitions. The original contents of the drum of chemical munitions is only conjecture. It is known that gas chambers were used in training on Fort MacArthur. Therefore the original contents of the drum could range from tear-gas grenades to smoke grenades. Further interest is not warranted since the area is owned by the Los Angeles Parks and Recreation Department.

The Pacific Crest Housing Annex is across 25th street and north of Pacific Heights. It does not contain any historic or architecturally significant resources. The site was originally known as the Portsmouth Naval Housing Area. In 1988 and 1989 the Air Force built 91 MFH at Pacific Crest.

Military Training

The 6592nd Support Group Operations Division of SSD was, in 1962, among other things, responsible for the SSD military training requirement and the full or partial implementation of the SSD Disaster Control Plan. The Division recommended the following: that a Military Training Branch be required to insure compliance with the training requirements established by AF and

AFSC regulations, and that a Disaster Control Branch be formed within the 6592nd Support Wing to insure adequate preparations for SSQ responsibilities in coping with continuation of essential programs or execution of emergency or was plans. Fourteen training requirements were listed and referenced to AF regulations. None of the listed requirements included BW/CW training.⁵¹⁷

Conclusions

- There is no evidence that BW/CW training was ever conducted at the Los Angeles Air Force Base.
- There is no evidence that BW/CW materiel was ever present on Area A or Area B. There is no evidence that BW/CW materiel was ever present at Building 215, the Auto Hobby Shop.
- There is no evidence that BW/CW materiel was ever present on the Lawndale Annex site.
- There is no evidence that BW/CW materiel was ever present on the housing areas of Middle Reservation, Pacific Crest, and Pacific Heights areas of Fort MacArthur.

⁵¹⁷ Letter, 6592nd Support Group/SSQO, Subject: SSQO Responsibilities, 1 November 1962.

OVERALL CONCLUSIONS

Research and Development

The BW/CW program's research and development work was conducted primarily from Wright-Patterson, Hill, Kirtland, Eglin, and Edwards Air Force Bases. No evidence was found of the involvement of other AFMC bases in the CW/BW R&D program. This program dealt with the development of the munition and how it functioned with the weapon system; i.e., how it worked with the aircraft.

At Wright-Patterson AFB, the Air Materiel Command (forerunner of AFMC) was responsible for the management of the BW/CW program during the 1950's. The Chemical Office of AMC did not perform R&D or tests on CW munitions and equipment. It is not expected that any residual items would be found at WPAFB from this program. The Special Weapons Branch of WADC (forerunner to ASC at WPAFB) managed the BW/CW Vulnerability Program during the 1950's. Any R&D tests conducted at WADC may have had either live agents with inert explosives or simulants with live explosives. Other than the munitions found in MBS1, it is not expected that any residual items from this program would be found at WPAFB. Other than MBS1, there is no indication that any of the WPAFB landfills or burial sites received any CW/BW agents. Some industrial chemicals, which may have CW applications--i.e., phosgene, have been found.

Ogden Air Materiel Area (OOAMA), Hill AFB, Utah, was assigned the prime maintenance responsibilities of the Federal Supply Category to include CW/BW agents and weapons in 1956. In 1965, OOAMA was the AFLC program manager for the AF CW/BW program. There is no indication that OOAMA ever received BW munitions for storage and shipment.

The Special Weapons Command at Kirtland AFB, New Mexico, provided a significant amount of support to the CBR testing program. The Command provided the aircraft for ferrying chemical, biological, and radiological (CBR) weapons to test sites (mainly, at Dugway Proving Ground, Utah) and for the delivery of CBR weapons on target grids during test trials. The majority of the drops were simulant-filled weapons. No evidence was found that indicated any agent-filled weapons were ever present at Kirtland.

Various tests of CW related hardware were conducted at Eglin AFB, Florida. Records from one test conducted in 1943 indicated the use of live agent; however, all other testing used simulant. All known CW live agent testing of hardware was conducted at other locations such as Dugway Proving Ground, Utah. The only BW test using live agent was Operation Green, conducted in 1951. The agent posed no hazard to humans or animal life, other than the test animals. All other known BW testing used simulants.

The testing conducted at Edwards AFB, California, was much the same as at Eglin. Ballistic tables for various munitions, including chemical bombs, were computed by the Aberdeen Bombing Mission. However, it is believed that these munitions contained inert fill. The munition drops were done to compute the trajectory, not the agent dispersion patterns of the bombs. A toxic gas yard was built in the 1940's for the proposed storage of bulk CW agents. It could not be determined if the bulk CW agents were ever shipped to or stored at Edwards. In 1967, testing was conducted on Rosamund Lake using the BW simulant BG to evaluate biological detection devices for the Department of the Army.

Training

Considerable CW/BW training occurred at most air bases during the 1940's and early 1950's. Gas chambers were found on most base maps during that time frame. These chambers were either tear gas or chlorine and have long since been destroyed or dismantled. Evidence of the use of CAIS was found at most bases; however, these sets were disposed of in accordance with the accepted disposal procedures of the time.

RECOMMENDATIONS

- Review the BW/CW activities of Air Force bases in the other major commands.
- Review the previous Army/Air Force locations that have transitioned to the Air Guard and the AF Reserve.
- Review bases that were on land that have reverted to civilian ownership.
- Review training records to define what was included in the BW/CW training courses conducted by the Army Air Corps in the 1940's and the Air Force in the 1950's and 1960's.

APPENDIX A

CHEMICAL AGENT IDENTIFICATION SETS

CAIS⁵¹⁸ were developed to aid in the training of soldiers, airmen, and sailors. Training consisted of teaching the proper procedures for identifying chemical agents and taking proper actions in case of a chemical attack. The CAIS contain small amounts of chemical agents and industrial chemicals that simulate chemical agents. Three major varieties including 17 different types of CAIS were produced over the years.

One major variety of CAIS was an instructional "sniff set" that contained very small amounts of agent impregnated in charcoal. It was intended for use indoors to instruct military personnel in recognizing the odors of chemical agent. The agent-impregnated charcoal was contained in round, four-ounce, heavy-walled, wide-mouth bottles. The bottles were stored and shipped in wooden boxes.

A second major variety designed for use outdoors, consisted of sealed Pyrex ampoules containing the chemical agent. The chemical agent was filled either diluted or not depending on the type of agent. The glass ampoules were placed in small holes on the ground and detonated to create a small cloud of agent. The test subjects approached the agent cloud from downwind and identified the agent by its odor or other characteristics. The glass ampoules of agent were packaged in mailing tubes and then overpacked in metal cans. The metal cans were stored and shipped in steel shipping containers, also referred to as "pigs."

A third major variety of CAIS were those containing bulk mustard (H). These CAIS were used in decontamination training. The mustard would be spread about on the ground or equipment, particularly vehicles. The test subjects donned protective clothing and then proceeded to decontaminate the agent. The CAIS contained relatively large quantities of mustard (H). The

⁵¹⁸ Appendix E, Survey and Analysis Report--Second Edition, Chemical Agent Identification Sets, Hazards and Precautions, Project Manager for Non-Stockpile Materiel, US Army Program Manager for Chemical Demilitarization, December 1996. (The US Army Chemical Demilitarization Office may be contacted through Public Affairs Office (PMNSCM) at Aberdeen Proving Ground, Aberdeen, Maryland 21010-5401. The Public Affairs Office phone number is 1-800-436-3629.)

mustard was filled in bottles, overpacked in metal cans that were in turn stored and shipped in "pigs."

Approximately 110,000 CAIS were produced between 1928 and 1969. They were widely distributed to military organizations in the conduct of their chemical warfare training. Approximately 21,500 CAIS were recovered and destroyed in the early 1980's. The balance is not accounted for--some were consumed in the training process, some were disposed of in landfills or other disposal sites, and some were perhaps retained by various personnel as souvenirs. The CAIS were extensively used by all military services. The sets were expendable items and records as to their disposition were not required.

As many as eight chemical agents were contained in the various CAIS:

Mustard (H)--plant-run mustard, very dark liquid w/ odor of garlic or horseradish

Nitrogen mustard (HN-1)--dark liquid w/ fishy odor

Lewisite (L)--dark oily liquid with odor of geraniums

Chloropicrin--pungent and stinging odor

Phosgene (CG)--colorless gas with odor of new mown hay or green corn

Chloroacetophenone (CN)--solid with fragrant odor

Cyanogen Chloride (CK)--colorless gas with odor somewhat like peach kernels

Adamsite (DM)--yellow/green solid with no odor.

Exposure to these chemical agents can cause coughing, nausea, vomiting, irritation, burning sensation, swelling of the eyes, itching, redness and blisters on the skin, and acute pain and tightness in the chest.