CAC

ARMY CHEMICAL REVIEW

THE PROFESSIONAL BULLETIN
OF THE CHEMICAL CORPS







The Chemical Corps — Now More Than Ever

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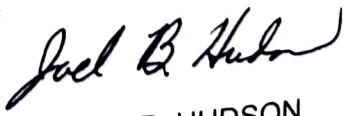
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Front cover: Scenes from Operation Iraqi Freedom: *top*, a truck driver drinks from his canteen while in his protective gear; *center*, a chemical officer does a chemical analysis of a captured vehicle (Photos, Sergeant Igor Paustovski, 55th Signal Company); *bottom*, a soldier dons his chemical mask (Photo, Sergeant Ronald Mitchell, Fort Meade, Maryland).

Back cover: *Top*, a soldier checks for nerve or blister agents in an abandoned building in Iraq (Photo, Specialist Kathy Jo Young, 982d Signal Company); *center*, soldiers remove their protective masks after completing a brisk morning run (Photo, Private First Class James Matise, U.S. Army); *bottom left*, soldiers on the perimeter around a convoy (Photo, Sergeant Igor Paustovski); *bottom right*, soldiers wear protective masks in a bunker during a drill (Photo, Captain Enrique T. Vasquez, 32d Army Air and Missile Defense Command Public Affairs Office).

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This will be my final opportunity to address you as the Chief of Chemical. I will be leaving shortly for an assignment as the Director, On-Site Inspection Agency, Defense Threat Reduction Agency, Fort Belvoir, Virginia. Although I am certain that my next assignment will be rewarding and challenging, I will never forget my time as Chief and Commandant and the opportunities and challenges that presented themselves to the Corps over the past four years.



BG Patricia L. Nilo

During my four-year tenure, sweeping changes impacted every facet of life in our nation, the Army, and our Chemical Corps. As a Corps and as individuals, we met each of these challenges with determination, innovation, and resolve—overcoming them with ostensible ease. Our Dragon leaders and soldiers never ceased to amaze me. They were able to accomplish miracles given limited time and resources.

Together, we successfully moved the U.S. Army Chemical School from its traditional home at Fort McClellan, Alabama, to Fort Leonard Wood, Missouri. Simultaneously, we integrated many of the school's functions into the U.S. Army Maneuver Support Center (MANSCEN). In what appeared to be an insurmountable mission challenge, our institution never faltered. Today, the Chemical School is a full partner in MANSCEN, contributing to the continued vitality of our Corps. Our Chemical School remains strong and continues to provide quality officers, soldiers, and noncommissioned officers to the field.

September 11, 2001, will always be remembered as one of the significant moments in our nation's history. Broad changes in our national security policy sprang from the attacks against Washington, D.C., and New York City. Our Chemical Corps remained in the forefront as we worked to overcome the damage to the Pentagon and the World Trade Center. Chemical soldiers immediately responded to these attacks and remained vigilant, guarding against further aggression and working to mitigate the effects of the subsequent Anthrax attacks. I cannot express the pride I felt seeing our chemical soldiers on the frontlines of these fledgling Homeland Defense activities.

As a Corps, we have remained engaged in every aspect of the War on Terrorism. Chemical units and soldiers performed vital missions at every echelon, such as at the Pentagon, in Afghanistan, and throughout the Gulf States during Operation Iraqi Freedom. In every one of these missions, chemical soldiers drew high praise wherever they served. Through all of these vital operational missions, I have endeavored to shape the continued transformation of the Chemical Corps. It is essential that our Corps remain relevant to the Army. This relevance can only be achieved through our transformational efforts.

I directed a number of initiatives that ensure the future vitality of our Corps, and some of you have participated in reshaping our path. Although some of these initiatives might have appeared drastic, changing threats drove the need for immediate action.

The continued threat of enemy use of toxic industrial materials (TIMs) demanded a change in our training strategy. While continuing to support the Warfighter, our Corps must work to become more technically adept.

At the Chemical School, we instituted Hazardous Materials (HAZMAT) Familiarization training in all of our leadership courses. We are working toward HAZMAT Operator and HAZMAT Supervisor training and certification as a part of our leader courses. Additionally, we are building new courses that will enable a full menu of civil support skills. My goal is to give the Chemical Corps crucial capability to respond to TIM attacks in the homeland or abroad.

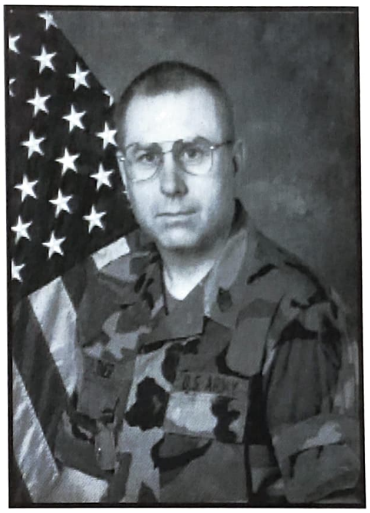
As part of the Total Army Analysis program, we reshaped Chemical Corps units, changing them from Cold War structure into organizations ready to support the unit of action and unit of employment. Future chemical companies will be multifunctional units, composed of single-function platoons. Companies will be built on a "plug-and-play" principal. Single-function platoons (heavy decontamination, medium decontamination, reconnaissance, mechanized smoke, wheeled smoke, and Biological Integrated Detection System) will form the building blocks yielding mission-focused companies targeted to specific operational missions and areas.

We have worked continually to protect our Army installations at home. Several new units are being activated to provide rapid response to chemical, biological, radiological, nuclear, and explosive (CBRNE) attacks against Army facilities. The CBRNE Operational Command (a flag officer headquarters) will combine the capabilities of Technical Escort and Explosive Ordnance and Demolition units into a full-spectrum response force. The CBRNE Operational Command will ultimately include an active duty chemical brigade, providing unprecedented support to our soldiers in missions ranging from homeland defense to contingency operations. Additionally, four Rapid Response Teams (company-sized elements) will stand up over the next two years, providing area response to CBRNE events at installations within the continental

(Continued on page 4)

CML

Backbone Development



CSM Peter Hiltner

"...I realize that I am a member of a time-honored corps, which is known as 'the Backbone of the Army.'" This sentence is from the first paragraph of the *Creed of the Noncommissioned Officer (NCO)*. There is no doubt that the NCO Corps is the backbone of the Army, and many say that this is the most quoted phrase in the Army today. I believe that the phrase *time-honored* corps is also significant. The NCO Corps is not something that just happened; it took years and vision to make it time-honored.

When you read about the history of the NCO Corps, you find that it originated with the Continental Army in 1775. These first "backbones" were a combination of the traditions and standards set by the armies of Prussia, France, and England. Over time, our NCO Corps took on its own structure and became that which all other countries try to emulate. In 1778, the NCO Corps began to develop clear duties and responsibilities.

General Friedrich von Steuben, the Inspector General of the Continental Army, wrote one of the first manuals of military training and procedures, *Regulations for the Order and Discipline of the Troops of the United States* (most commonly known as the "blue book"). Congress adopted the manual in 1779. A few pages of this book identified the duties of an NCO, including the responsibility for training, sick call, and discipline.

First sergeants of this period accounted for soldiers on the morning report and maintained the duty roster. They also kept books of information about their soldiers that were not unlike the leader books we now carry. During this time, the NCO ranks consisted of sergeant major, quartermaster sergeant, first sergeant, sergeant, and corporal. The blue book still exists as Field Manual 3-21.5, *Drill and Ceremonies,* and its legacy exists in many other Army publications.

By the outbreak of the Civil War, NCO duties and responsibilities were becoming more and more complex. NCOs carried the unit colors into battle. They were on every skirmish line, barking instructions and orders to keep the lines together. Commanders were able to tell where their units were located on the battlefield by observing the position and location of the unit colors. After the Civil War, NCOs were charged with maintaining good order and discipline among the troops. This was difficult at times; the Army was moving west and living in some very challenging locations. By the 1900s, the blue book had grown to several hundred pages, and the NCO Corps was firmly established.

When the United States entered World War I, the history of the Chemical NCO began. In James Thayer Addison's book (1919), *The Story of the First Gas Regiment,* Sergeant John T. William—from D Company, 1st Gas Regiment—told what happened on 30 July 1918:

> "Our own guns were firing over our heads. We heard the sputter of machine-guns distinctly, and there came an occasional distant whine of an enemy shell. ...All went well until a terrible thunderous crash sounded almost in our line. There was a rain of rocks, shell fragments, and clay ringing on steel helmets. ...No one was hurt, although I think each one of us pinched ourselves to make sure that we still lived. A few yards, and another shell burst near us, then a third and fourth. Now we turned, and the shells were singing harmlessly over our heads, and we breathed more freely, when there came a crash just above our heads, then another. Four men instantly went down, not to rise again. Two were instantly killed, the others died before they could be taken to the dressing station. ...We had our first experience of fallen comrades. ...We had had our baptism of fire."

This was just the beginning of the history of the Chemical NCO Corps. Another World War I soldier, Sergeant Robert Brantley from North Carolina, was awarded the Distinguished Service Cross for action in France. He, as is stated in his award citation, "remained at his location after his detachment had been ordered to the rear, administered first aid to a wounded comrade, and carried him through withering machine-gun fire to safety."

The 7 December 1941 attack on Pearl Harbor launched our nation into a second world war. The NCOs trained soldiers to deploy overseas, and chemical NCOs found themselves in battle once again. On 12 April 1942, Sergeant Doyle H. Knight, 7th Chemical Company, won the Silver Star for gallantry in action at Fort Mills, Corregidor, Philippines. His citation reads in part:

> "While in charge of a detail of five enlisted men engaged in the emergency field operation of a critical

(Continued on page 4)

("Chief of Chemical," continued from page 2)

United States. They will bring a Weapons of Mass Destruction Civil Support Team capability to the Army.

As you can see, while the emphasis on our roles at home and on the battlefield may change somewhat, the value of our role will never change. Our Corps's fundamental mission of protecting our comrades in arms from enemy use of CBRNE will never change. Today, as in World War One, we continue to "Rule the Battlefield Through the Elements!"

Military life mandates that each of us must at some point move on to a new assignment. I wish to leave you with just a few final words. I want to thank each of you for your support to the Corps during my term as Commandant and Chief of Chemical. It truly has been the highlight of my career—I cannot think of a more fulfilling assignment. Continue your great work; I wish you nothing more than complete success and fulfillment of all of your dreams. You are what makes the Chemical Corps the best in the Army. God bless you all.

("Regimental Command Sergeant Major," continued from page 3)

item of war material. Sergeant Knight…voluntarily remained in the immediate vicinity of the plant in the face of an alarm announcing an aerial bombardment by the enemy. A direct hit by a heavy enemy bomb killed this gallant noncommissioned officer and three of his associates. The example of heroic devotion to duty…served as an inspiration to the entire personnel of his unit."

The critical item of war material was sulfuric acid, which was needed to replenish the storage batteries used in the electric generator units, the radio sets, and the vehicle batteries that were essential to the defense of Corregidor. Sergeant Knight and his detail were manufacturing the sulfuric acid from the smoke filling of 4.2-inch chemical mortar shells.

Acts of heroism like this continue, but our past is not everything. We, the NCOs of today, are developing the future soldiers that will replace us. Sometimes I hear NCOs say that they are leaving the Army because the NCO Corps is not what it used to be. The NCO Corps can't remain the way it was; it has to change. The NCO Development Program and the NCO Education System (NCOES) are the cornerstones of this change.

The development of the NCOES began in 1947 with the establishment of the 2d Constabulary Brigade NCO School in Munich, Germany. Eight years later, Army standards for NCO academies were published, and by 1959, more than 180,000 soldiers were attending NCO academies. After the Vietnam War and the end of the draft, the Army began to transform the NCOES into what it is today. The system begins with the Primary Leadership Development Course and ends with the Sergeants Major Course.

Today, the NCOES is tied to promotion. Soldiers must complete each level of training successfully to maintain their promotion to the next higher grade. Our job as NCOs is to make sure that our soldiers are successful when they attend these courses. The process of backbone development begins when a soldier enters the Army. The NCO that you present to your soldiers is the NCO that your soldiers will become. NCO development is more than handing soldiers a study guide and telling them to get ready for the next promotion board. NCOs coach, teach, and mentor every day. Our soldiers observe us 24 hours a day. They see, know, and do what we demonstrate through our words and actions. When a soldier fails to meet the standard at an NCOES course, it tells me that an NCO has failed. Few soldiers fail an NCOES course because of academic difficulties. Soldiers routinely fail to pass the Army Physical Fitness Test or meet the height and weight standards. NCOs can prevent these failures if they take the time. You see the warning signs. You know the right thing to do.

As you look across your formation, what do you see? Do you see the next time-honored corps? You should, because those soldiers *are* our future. Those soldiers are the next Sergeant Brantley or Sergeant Knight. Those soldiers are the ones who need you to show them the way; it is time to get back to the basics. I remember a staff sergeant telling me that I would never make it in the Army. I also remember another sergeant taking the time to show me *how* to make it. I remember them both—one understood what it meant to be an NCO, the other didn't. As I read stories about the soldiers who are currently deployed, the comments always include credit to their NCOs for the training they received and that they were only reacting to the standards set in training. What a testimonial!

Remember, you are whom the future NCOs are going to talk about when they recite the Creed. You are responsible for the development and mentoring of the future backbones of the Army. I encourage you to take the time to coach, teach, and mentor. Take the time to demonstrate and teach your soldiers the importance and significance of the seven Army values. Get your soldiers ready today. Work with your soldiers. Show them what it means to be an NCO. Don't be their buddy; they want you to be their leader. Earn their respect.

First Place Winner, 2002

Chemical Corps Regimental Association Annual Writing Contest

Accounting for the Margin of Error—

Use of Standard Nuclear, Biological, and Chemical Attack and Toxic Material Release Hazard Area Templates by Tactical Forces

By Major James Demyanovich

This article was originally published in the spring/summer 2001 issue of *NBC Report.*

To help lessen the fog of war and reduce the risks from unknown factors, military commanders continually strive to improve their situational awareness. In the nuclear, biological, and chemical (NBC) defense field, risk reduction has focused primarily on preattack defensive measures. The risk-mitigating uses of individual protection and collective detection and monitoring equipment are very well understood. Once NBC events occur, however, there is much less clarity regarding the risks to—and the protection needed by—those forces that are primarily downwind of the NBC attack area. Following an NBC-type event, the much-dreaded yellow hazard template is applied to the commander's situation map. That template stirs visions of thousands of military members and emergency/essential civilians in full individual protection for an unknown (but most likely very long) period of time. This vision results from not exploiting the available battlefield information appropriately and using the hazard templates injudiciously.

Tactical Decision Aids and NATO Hazard Estimation Templates

For decades, the United States has worked with its North Atlantic Treaty Organization (NATO) allies to establish common sets of operational procedures, materiel standards, and techniques that address many aspects of military operations. Ensuring that the NATO members are as interoperable as is realistically possible within a multinational alliance has been an ongoing process. The NBC defense arena has well-established common procedures and techniques for estimating the effects of NBC agent releases/weapons and warning forces in the area. NATO Standardization Agreement (STANAG) 2103 covers hazard warning and estimation procedures. The full procedural explanation of STANAG 2103 is found in Allied Tactical Publication (ATP) 45B. In U.S. doctrine, the procedures found in ATP 45B translate directly into the following:

- U.S. standard NBC messages (NBC 1-6 reports from FM 3-3, *Chemical and Biological Contamination Avoidance*)
- NBC weather reports estimating nuclear events and templates for fallout
- Chemical and biological attack warning areas
- Toxic industrial material (TIM) release hazard estimation

Hazard Estimation Procedural Improvements

The procedures and templates from ATP 45B continue to be highly relevant and informative if they are used to their fullest extent. Over time, as with most areas of concern, there have been constant improvements in hazard estimation and warning procedures. In many ways, the historical chemical hazard and warning templates continue to be the standard basic plotting methods used to depict hazard and warning areas on tactical maps. In fact, the current version referenced here was only recently ratified by NATO for implementation in 2001. This most recent version includes templates for all forms of TIM releases, nuclear power or material storage facilities releases, biological agent releases, and nonweapon NBC or toxic material releases that are termed *releases other than attacks* (ROTA).

Hazard Estimation as an Art

The full use of the information available in the chemical attack warning and hazard template is important. It forms the basis of many of the same procedures that are used for other NBC or TIM releases for cloud travel and area warnings. The greatest difference between the templates is the different circular radii depicting the agent cloud initiation and the winds used to determine the expected downwind travel of clouds with the extent of hazard distances. The templates form the basis of the simple, effective use of battlefield information that is tailored to the event that is assumed to have occurred or, to use the worst case, when little is known. It allows users to visualize and therefore warn of the hazards as they develop following agent releases. The chemical template's construct and use forms the basis for maximizing the understanding of most forms of hazards that are dispersed downwind from release locations.

Estimating the Result of Complex Events

The NATO members have agreed to use standard procedures and templates when dealing with operational NBC warfare and TIM release warning, reporting, and hazard estimation requirements. The standard procedures for estimating hazards from NBC and release events have continued to be developed and implemented. Those procedures, if used with as much tactical information as is available, can account for many of the uncertainties related to hazard estimation and force protection. It is possible for tactical forces to have a clearer understanding of the nature of an NBC or TIM event than is obvious from the simplistic use of hazard and warning templates with no other information being provided. The standard procedures account for much of the uncertainty surrounding an NBC or TIM event. Those procedures use generalized attack or release estimates, tactical weather, terrain, and time to make hazard and warning area templates that will be applied to the common operational map. The templates provide an estimate of the very likely presence and occurrence of the vast majority of risks from the event that is present within the template outlines.

The template outlines should be envisioned as "fuzzy" with relative caution being exercised by units outside, but near, the template boundaries. No matter where a unit is located in or near the template area, judicious use of protection measures is necessary. Sensor information or additional NBC reports of contamination can and should allow the units to operate in less-than-full individual protection (that is, less than mission-oriented protective posture [MOPP] 4). Units must maintain a high state of vigilance and might need to assume high individual protection automatically due to their proximity to the attack or release area if they are located near template border areas (especially right after a release event). This explains the need for immediate attack warnings to local units. As always, tactical unit sensors and detectors allow all units to adjust their individual protection levels based on the assessed risks.

The Downwind Area

Tactical forces have used simplified hazard estimation plots for decades, but what do they really depict? Clearly, the message transmitted by the templates has always been bleakly interpreted. Unfortunately, this is a misunderstanding of the breadth of the information that the templates provide and the failure to use additional information when applying the templates in risk assessments. Many individuals interpret the warning templates for chemical agents to mean that the forces present must be at the maximum protection levels available—MOPP 4—with all forces fully encapsulated in their individual chemical protective equipment. Further, templates are often used to estimate which forces should remain in MOPP 4 for the duration of the presence of the warning template posted on the tactical map. Driving the template presence are the agent contamination persistency tables that often indicate that contamination is present for many hours or days.

Optimal Use of the Hazard Template

In reality, the templates are reflections of where tactical forces must be highly vigilant. For units that are inside the hazard template area, the greater the distance that they are downwind from the attack and release area, the smaller the chance is that they will detect airborne contamination. Airborne contamination cannot be everywhere at once. Of course, units directly on the downwind line will be more likely to see contamination; however, this is not an absolute.

Areas Depicted in the Template

In a chemical attack template, the small *attack area*—where the agent originated—might remain as a liquid hazard for some time. This area might continue to be a potential obstacle to maneuver and must be avoided unless it is surveyed to determine the level of contamination. The forces in this area are clearly at the greatest risk. Departing from this area, the danger level decreases and follows a primarily downwind track as an agent cloud. The large downwind fan template is the *hazard warning area*, where units are warned that there is high likelihood that the initial release generated an airborne primary agent cloud (PAC) that may be present soon. The units are also told of the direction that the PAC is moving based on current wind conditions.

The gravest danger from the PAC is near the attack the cloud dissipates as it moves downwind. Meteorologists have long known that clouds of agent can move.

remain together, or break up with great variability due to the impacts of atmospheric stability, wind speed and direction, terrain, and ground cover. Even with a "constant" wind speed and direction, meteorologists know that small to large variances always occur. To use the template most effectively, it is critical that units visualize the movement of the PAC. The leading edge of the PAC can travel at 1½ times the wind speed; the trailing edge moves at half the wind speed. Hence, the PAC lengthens as it moves across the terrain, dispersing and breaking up over time and distance. Wind directional changes are accounted for in higher wind conditions by the template's large lateral "legs" that reflect the ability of the PAC to follow irregular terrain, breaking up and widening over distances and time.

The template indicates *atmospheric stability* or how much the PAC stays together—the more stable the conditions, the farther downwind the PAC remains a significant hazard, no matter what the terrain. As a result, the standard triangular templates for air-contaminating agents have the longest downwind areas under stable air conditions. Figure 1 is a standard template for a multiple rocket-delivered nerve agent GB (Sarin) attack. The figure depicts the 1-hour travel time of the PAC's leading edge (which has traveled downwind up to 20 kilometers) and the PAC's trailing edge (at around 6 kilometers). Units that are 6 kilometers from the attack may have detected the agent and already experienced a full cloud passage with subsequent negative detection. The units may not receive any more significant hazard from the attack depicted. A unit's higher headquarters can provide further information as it receives NBC reports of actual contamination detection based upon the movement of the hazard cloud. This is critical information that is needed to adapt and modify the hazard estimates in conjunction with the templates.

Computer Hazard Estimation Models

Over the past decade, there has been an ever-increasing availability of computer-based, hazard estimation models. To some, the existence of models has somewhat diminished the value of the simple hazard and warning templates shown in ATP 45B. This is primarily due to the large areas that are included in the ATP 45B templates and the belief that they do not accurately portray reasonable NBC hazard and warning areas. A significant misunderstanding held by tactical forces is that all the areas within the ATP 45B templates require units to be in high levels of personal protection for the entire duration of the hazard. Fortunately, this is clearly not the case when NBC defense staffs aggressively and fully exploit the template information and any additional tactical reporting that they have. Unfortunately, most tactical units do not use all of the hazard information that is available to modify the templated hazard and update commanders. These tactical units have long sought an automated hazard estimation system. As already shown, the primary area attacked suffers the highest danger, while the downwind units experience diminishing risk. Tactical sensors and detectors can warn those units so that they can take appropriate protective measures. All of this information processing appears, on the surface, to be easily resolved by using a hazard model at the tactical level.

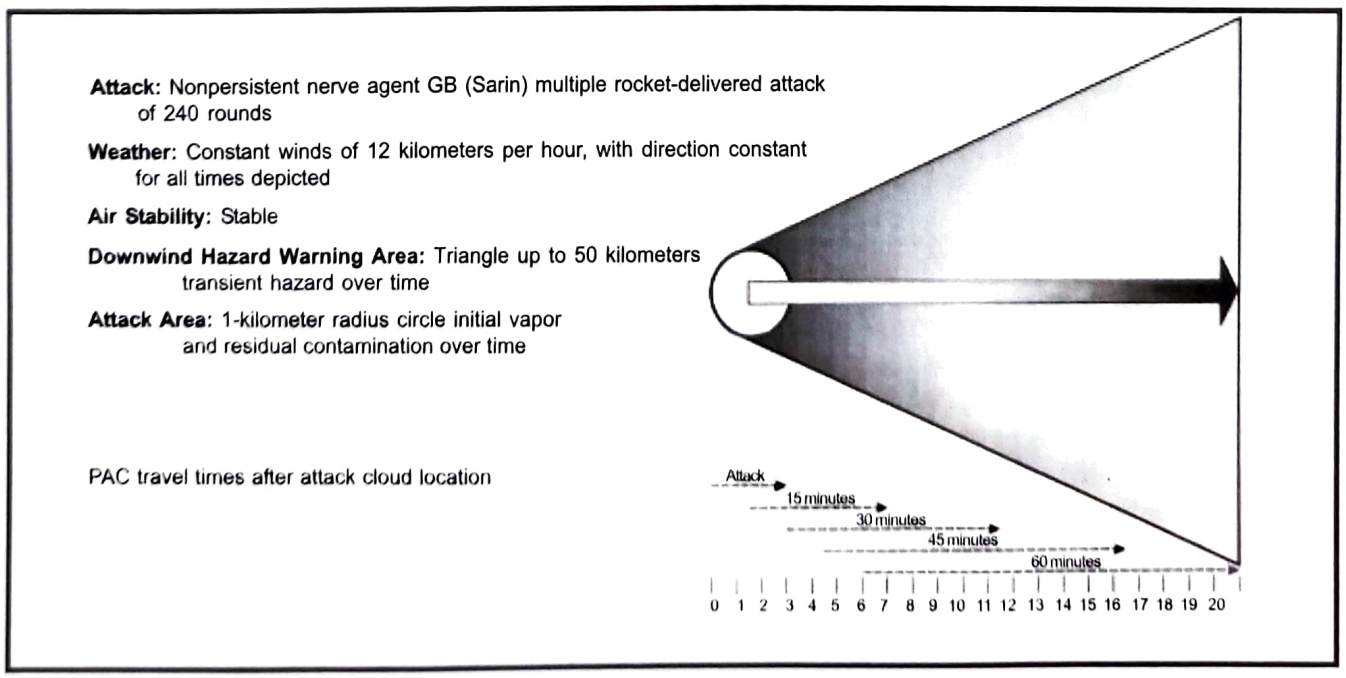


Figure 1. Chemical attack template with agent cloud movements

Model Input and Output

Figure 2 is a snapshot of a computer model output of an agent release similar to the one that is shown on the hazard template (Figure 1, page 7). The time depicted summarizes the doses of airborne agent that unprotected personnel received during the first hour after an initial agent strike. Most importantly, what the template does not show is the reasonable depiction of the vast uncertainties involved in modeling an adversary's agent attack. Those uncertainties result directly from not knowing about the following:

- Location or the true size of the rocket attack
- Properties of the agent
- Changes in the wind direction over time
- Effects of terrain on cloud travel

The highest dose that is shown on the template is greater than 95 percent of the lethal dose—to completely unprotected forces—for the hour and affects 1.8 square kilometers. The lowest dose to unprotected personnel that is shown on the template is 0.01 percent of a lethal dose over the entire hour. The total template area covered in 1 hour of cloud travel and agent exposures includes 21.76 square kilometers of terrain.

Accounting for Model Input Uncertainty

If it is overlaid on the hazard and warning area template, the depicted spread of contamination appears to be very narrow and relatively small (if the model input and output are totally accurate). However, input estimating enemy attacks will surely be derived from tactical NBC reports. As field units generate NBC reports, they will have very little information on the many details of the attack that they just experienced. These NBC reports contain few of the details that are needed to provide a model with a good basis of input, so there must be a lot of operator guesswork applied to create the model input data. Thus, any particular model output, including this model demonstration, can only be a rough estimate of the events that occurred. The rough estimate (or educated guess) used by the model operator can give a rough, but uncertain, estimate of the attack that an adversary may have launched. Some of the many unknowns estimated include how many munitions fell and where, the agent properties, the local weather, and the duration of the attack.

It is easy to imagine that there are some fairly significant errors or overgeneralizations in the input, leading to a need for including error in the model depiction somehow. The computer model user needs to address error when considering the risk assessment value of the hazard plot that is produced. Model error reduction requires significant operator training and skills. The attack location and weapons laydown—the start point of the plot—may be in error by hundreds of meters in any direction. So a circular area could be used to account for the error and dispersion of the impacting warheads (with a 1-kilometer radius used for good measure). This

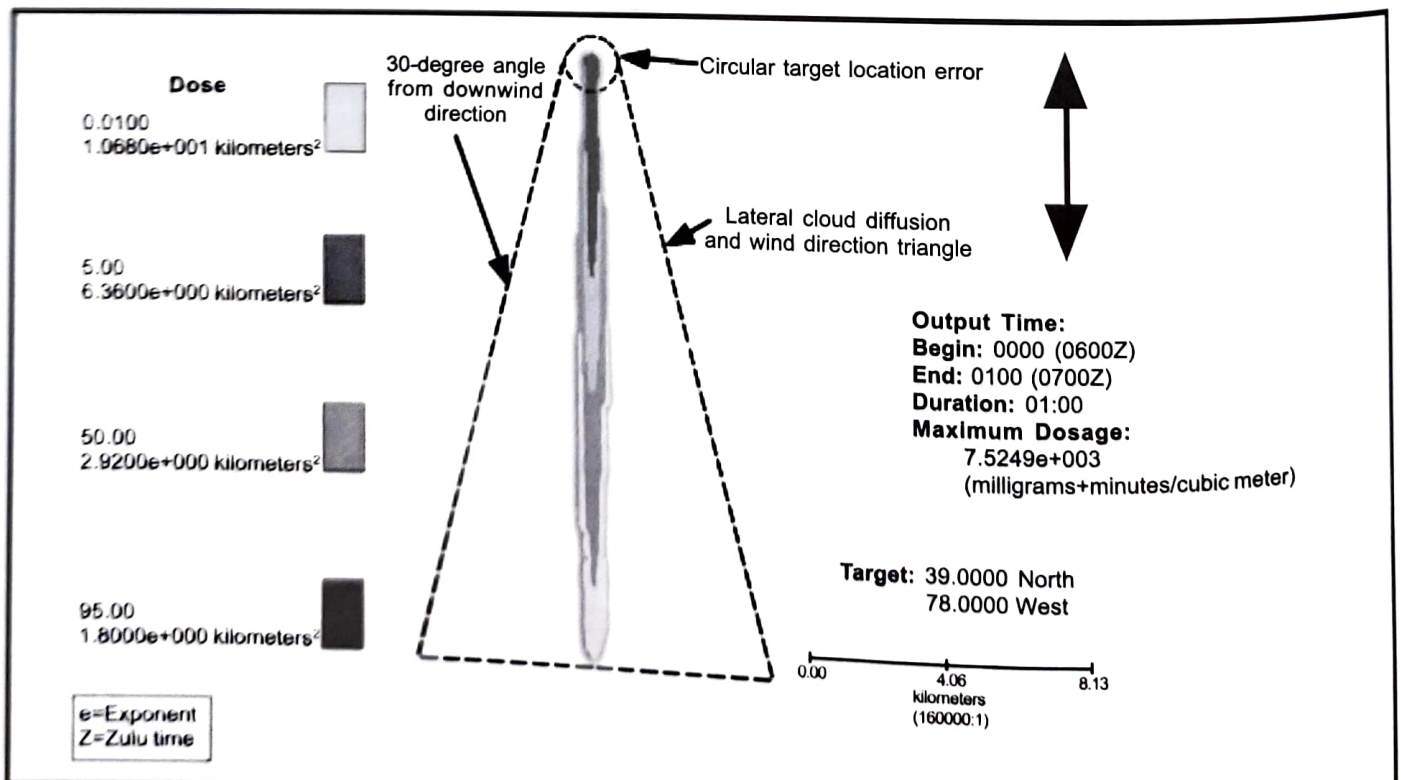


Figure 2. GB (Sarin) nerve agent multiple rocket-delivered attack 1-hour agent exposures

CML

adjustment can be applied as if it were a cigar-shaped cookie cutter, pointed downwind around the edges of the circle, broadening the areas of possible contamination.

The hazard model's downwind plot most likely needs adjustment to allow for wind direction variability and terrain effects on cloud dispersion. To account for this variability, the plume produced in the attack area could be anchored and the plot shifted laterally, plus or minus some number of degrees, from the downwind direction line. Very quickly, the computer model user will note that the template that is being constructed appears to be a standard chemical agent attack template that already exists in ATP 45B. This demonstrates simply the great value of using the attack templates fully from the start. Good hazard model use, in the hands of a highly trained operator, can provide additional (but not hazard template substitute) information on possible chemical attack hazards.

Hazard Template Modification

The tactical information and reports that follow any and all NBC or TIM events provide the additional information that must be used to better assess the impacts of the event. Ultimately, NBC defense staffs will assess the information and reports, resulting in hazard and warning template modification. Tactical unit NBC reports and/or NBC detection system alerts, in or near the downwind hazard template, provide a fair degree of confidence of the downwind travel of the hazard. The template's cloud passage calculations can be refined and appraised further. NBC detection and no-detection reports give the ability to better understand initial cloud travel and the hazards that can affect nearby forces. This full hazard tracking will ultimately result in the downwind hazard fan being reduced to a small area around the initial attack location. The hazards from the PAC will pass and disperse to a low, tactically undetectable level. Liquid agents evaporating at the attack or release location result in local hazards diminishing over time. Ultimately, reconnaissance of critical areas at or near previous attack areas allows for a full appraisal of the remaining hazards and the protection that the forces require.

Conclusion

Unit NBC reports that follow NBC-type events, along with the information provided by the full use of standard hazard and warning templates in ATP 45B, can allow commanders and their staffs to better understand and articulate the protection that soldiers need to be safe from likely downwind hazards. This hazard understanding provides improved force protection with fewer encumbrances from constant (and largely unnecessary) high states of individual protection for personnel in the very large template area. If computer models are used, they should be used at fully trained, fully manned, and fully equipped NBC centers that are operated by experienced NBC defense staffs at Army division, and higher, headquarters. Only at those higher command echelons is there the expertise and potential for providing additional credible, computer-based hazard information to commanders and units at all levels. This model-generated information can reasonably augment hazard warnings already provided by the standardized hazard and warning area templates updated with tactical NBC reports.

References

FM 3-3, *Chemical and Biological Contamination Avoidance*, 16 November 1992; Change 1, 29 September 1994.

NATO Allied Tactical Publication 45B, *Reporting Nuclear Detonations, Biological and Chemical Attacks, and Predicting and Warning of Associated Hazards and Hazard Areas*, July 2001.

Major Demyanovich is a Chemical Corps officer who is the operations research/systems analyst in the chemical division of the U.S. Army Nuclear and Chemical Agency. He serves as the head of the U.S. Multiservice Delegation to the NATO ATP 45B Panel for NBC Warning Reporting and Hazard Estimation. He is a Pennsylvania State University graduate and holds a bachelor's in mechanical engineering and a master's in operations research from the Naval Postgraduate School.

Directorate Update—Personnel Proponency

On 1 October 2003, Military Occupational Speciality (MOS) 54B (chemical operations specialist) will convert to MOS 74D. This is only a designation change and will not impact individual soldiers except for their MOS identification. Many other MOSs will change designations in the next few years. For a complete listing of designation changes, go to *<https://www.armyg1.army.mil/pamxxi/secured/mosstructure/mos-charts.asp>*.

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Second Place Winner, 2002
Chemical Corps Regimental Association Annual Writing Contest

A Relevant Chemical Corps in the Contemporary Operational Environment

Major Thomas A. Duncan II

Over the last 12 years, the U.S. military has been involved in a number of diverse missions. Operations in the first Gulf War, Haiti, Somalia, Bosnia, Kosovo, Afghanistan, the war against terrorism, and the Iraq War have taught us many lessons. Studying these missions and conflicts throughout the world has shown common trends. The U.S. Army Training and Doctrine Command (TRADOC) Deputy Chief of Staff for Intelligence summarizes these trends in a white paper, "Capturing the Operational Environment," published in 2000.[1] This white paper (that I refer to throughout this article) was aimed at capturing the current and future operational environment for U.S. military operations and was intended to inform military leaders about significant trends that would help them focus training.

The contemporary operational environment (COE)[2] has many implications for the U.S. Army Chemical Corps. While its doctrinal foundations are sound, to remain relevant, the Corps's leadership must change the way it thinks and trains soldiers. In this article, I discuss how the common trends and characteristics of military operations in the COE apply to the training of chemical soldiers.

Common Trends

Although the world today can appear chaotic, there are observable trends that will likely continue into the foreseeable future. Several of these trends were identified in the TRADOC white paper. In this article, I examine the five[3] that I believe are most relevant to the training of chemical soldiers:

- The dominant actors will still be nation states; however, some power will shift to nontraditional actors.
- The U.S. homeland will be increasingly exposed to attack.
- The world's environmental conditions (such as water shortages, pollution, and climate changes) will lead to increased intranational and international tensions.
- The socioeconomic gap between the haves and the have-nots will widen, leading to global tensions that force many groups to adopt terrorism and asymmetrical means to promote their agendas.
- The proliferation of advanced technologies/weapons (such as conventional weapons, weapons of mass destruction [WMD], and chemical/biological weapons) will continue.

Nontraditional Actors

Traditionally, the Army has been able to focus on defeating other nation states to achieve strategic goals, and it is important to remember that the United States must still be prepared to counter regional- or state-centered threats. However, over the last decade, transnational threats (such as terrorists, international crime, drug trafficking, and culturally or nationally motivated groups) have also become a concern.[4] These nontraditional actors now force the Chemical Corps to improve staff integration and create better nuclear, biological, and chemical (NBC) vulnerability analysis products.

The three NBC attack checklists in Field Manual (FM) 3-14, *Nuclear, Biological, and Chemical (NBC) Vulnerability Analysis*, ask, "Are there known terrorist threat capabilities?"[5] However, these checklists focus on more traditional threats and provide us with an example of what the Chemical Corps must do to remain relevant in the COE. It must continue to refine its doctrine to arm soldiers with the tools they need to predict the enemy

threat accurately. Specifically, FM 3-14 needs to be updated. As an example, the NBC attack checklists could be expanded to ask additional questions about the likely terrorist targets in our area of operations and interest and the probable delivery means.

Our Corps must also continue to improve training at all levels. Institutional, operational, and self-directed learning need to include more elements of the COE. Every training plan should be balanced regarding conventional and nonconventional threats. For chemical units to remain relevant, they must be armed first with a vulnerability analysis that puts them on the battlefield in the right place at the right time to mitigate the threat. To accomplish this, the COE must be taken into consideration.

For instance, if U.S. forces are using an aerial port of debarkation (APOD) in a forward-deployed area, and the enemy has the capability to deliver persistent chemical munitions to deny us the use of that APOD, a decontamination company may be one of the highest-priority units in the deployment order.

Increasing Risk

Nontraditional actors also increase the risk to homeland security. The U.S. military currently has FM 3-11.21, *Multiservice Tactics, Techniques, and Procedures for Nuclear, Biological, and Chemical Aspects of Consequence Management*, as a doctrinal guide for dealing with the increased risk of NBC incidents in the United States. According to this manual, "U.S. forces may be required to support civil authorities in domestic or foreign situations/incidents due to the deliberate or unintentional use of NBC weapons or materials."[6]

While the Department of Defense is not likely to be the lead federal agency in the event of an NBC incident in the United States, it will continue preparing to serve in a supporting role. To achieve this, the Chemical Corps should expand its interaction and training with first responders and other federal agencies, such as the Federal Emergency Management Agency. Chemical units need to become more involved in annual training exercises with these agencies to ensure that they are ready to provide the NBC reconnaissance and decontamination support the agencies need. Remaining relevant today means allowing chemical units to have the resources (time, money, and increased training opportunities with other relevant agencies) to make them more flexible by participating in COE-focused training.

Environmental Conditions

How do environmental conditions affect the Chemical Corps? I believe that the Corps's role is to limit the impact of hazardous materials on friendly elements. The Chemical Corps is learning to deal with toxic industrial chemicals (TICs) and toxic industrial materials (TIMs). FM 3-14 has a short checklist that focuses on the possibility of a threat using TICs and TIMs as weapons.[7] This checklist can be applied to forces that are in foreign or domestic situations.

To demonstrate, a brigade priority intelligence requirement (PIR) might be finding where the industrial plants, storage sites, and shipping depots are located. Once the PIR is answered, the chemical staff analyzes the impact (or potential impact) of these TICs, TIMs, and sites on friendly operations. While the doctrinal foundation is present in FM 3-14, the Chemical Corps should continue to update this reference by expanding the checklists in order to provide more focus on battlefield TIC/TIM hazards. There are also civilian publications that help fill the gaps in this developing doctrine.

The Chemical Captain's Career Course (CMC3) is currently introducing students to the *National Institute of Occupational Health and Safety Guide* and the *North American Emergency Response Guidebook* to give them a better understanding of hazardous materials and how to respond to them. CMC3 has integrated practical exercises dealing with TICs and TIMs into their three Warfighter exercises. Additionally, both the CMC3 and the Chemical Officer Basic Course are certifying their students in hazardous material (HAZMAT) awareness and operations.

Institutionally, we are beginning to address TIC/TIM hazards on the battlefield. The Chemical Corps has a doctrinal base and school instruction in place. The next step in maintaining the Chemical Corps's relevancy in future operations is continuing to improve our doctrine, make relevant civilian publications more accessible to chemical staffs, and incorporate more TIC/TIM hazards at the combat training centers (CTCs) and corps/division Warfighters.

Asymmetrical Warfare

"Asymmetrical warfare focuses whatever may be one side's comparative advantage against an enemy's weakness."[8] In the foreseeable future, the United States expects to be dominant on conventional battlefields. This means that our enemies will attempt to exploit our vulnerabilities. So where is the United States vulnerable? The authors of the TRADOC white paper determined that, generally, the foreign perceptions of U.S. vulnerabilities are—

- An unwillingness to accept heavy losses and an aversion to risk.
- A leadership sensitivity to domestic and world opinion.
- A lack of commitment over time.
- A predictability to military operations that makes them easily modeled.[9]

The United States' enemies will attempt to use these perceived weaknesses against us. One way that they may attempt to keep the United States out of a conflict is to threaten to use chemical, biological, radiological, and nuclear (CBRN) weapons. If that threat can make the government or the people believe that an operation risks a large loss of life, an enemy may win a conflict before it begins.

So what is the role of the Chemical Corps in asymmetrical warfare? The Corps must continue to improve its NBC defense training, equipment, and doctrine. The best defense continues to be well-trained soldiers using the best NBC defense equipment in the world.

It is important to note that using CBRN weapons is a two-edged sword for the enemies of U.S. forces. While it can create mass casualties or delay actions, it can also galvanize world opinion against the user. Using NBC weapons against U.S. targets can also firm the resolve of the American people. Threat elements must understand that U.S. forces are capable of mitigating or eliminating the impact of CBRN weapons. U.S. training readiness should demonstrate that it is not in an enemy's best interest to use these weapons: the cost will far outweigh any potential benefit. This also applies to homeland security. The Chemical Corps needs to be ready to support the other agencies that are responding to terrorist threats. U.S. enemies must believe that there is an executable and comprehensive response in place that will mitigate the impact of an attack.

Weapons Proliferation

One of the reasons that the use of CBRN weapons is such a threat is the proliferation of this technology. The use of CBRN weapons may come from unexpected sources in the COE. Our military will never again go into an operation with no CBRN threat. There are too many states that have access to these weapons, and the likelihood of nontraditional actors obtaining these weapons is unprecedented.

In the past, our vulnerability analysis covered the immediate threat. Now, chemical staffs need to consider the impact of terrorists/nontraditional actors (who are not tied directly to whatever operation chemical soldiers are executing) using CBRN weapons. The key to addressing this issue at the division, brigade, and battalion level is the aggressive pursuit of current information about the adversary being faced and any other enemies that may have interests linked to the primary threat.

One way that the Chemical Corps can address this issue is by developing formal, quick, and easy techniques for reaching back to the U.S. Army Chemical School to request information. A better link between the collective knowledge of the schoolhouse and the field can provide critical and timely information to chemical soldiers.

Characteristics of Military Operations

The TRADOC white paper lists 13 characteristics of U.S. military operations in the COE. I will discuss three that I believe are relevant to the Chemical Corps:

- There is no homeland sanctuary.
- There will be operations in urban/complex terrain.
- There must be force protection.[10]

No Homeland Sanctuary

"With the threat of global terrorism and weapons of mass destruction (WMD), U.S. forces can no longer assume that the continental United States or overseas staging areas offer security. Future enemies will attempt to disrupt our power-projection capabilities by attacking installations, information systems, or transportation nodes."[11] Chemical staffs must consider the potential terrorist threat aimed at disrupting U.S. deployment. This may not mean terrorists smuggling CBRN weapons into the United States and releasing them. Terrorists may target or use local TICs/TIMs to disrupt deployments. War will not always mean deploying to a distant land; it can begin the minute our enemies know which units they have to delay.

Operations in Urban/Complex Terrain

Another relevant characteristic of military operations in the COE is complex/urban terrain. If the enemy is not successful in stopping our deployment, he will use difficult terrain to attempt to defeat U.S. forces. Operations on complex/urban terrain are unavoidable in future conflicts. Threat forces will use this ground in an attempt "to negate technological overmatches in intelligence and weapons systems."[12] I believe that this makes the use of CBRN weapons more likely. With our technological advantages taking away an enemy's ability to shoot the hundreds of rounds necessary to launch an effective chemical attack, complex/urban terrain allows a smaller number of rounds to be more effective in producing casualties and shaping the battlefield. One persistent round, detonated on a main city street or in a sewer line, can close a main axis of advance.

To remain relevant in the COE, chemical staffs need to ensure that technological advantages are taken into account when teaching and training NBC vulnerability analysis. This means changing the way we think about where, when, and how the enemy employs these weapons.

Force Protection

Everything we have discussed to this point relates to the primary mission of the Chemical Corps—force protection. This is a critical mission considering that the authors of the TRADOC white paper believe that "it is absolutely certain that our future opponents will focus entirely on our strategic center of gravity—mass

casualties."[13] They also believe that "WMD, rockets, and terrorism will be the weapons of choice."[14]

The Chemical Corps's mission is to protect the force and the nation from these weapons; that has not changed. The key to achieving this mission is chemical staffs conducting an accurate vulnerability analysis, taking the COE into consideration, and then creating a plan that focuses available resources on preventing or mitigating the effects of CBRN weapons, TICs, and TIMs on future operations.

Fundamentals Still Apply

It is important to note that the principles and fundamentals currently in chemical doctrine are still applicable. They just need to be applied with the COE in mind. I am using the principles of decontamination as an example:

- Decontaminate as soon as possible.
- Decontaminate only what is necessary.
- Decontaminate as far forward as possible.
- Decontaminate by priority.[15]

How does a chemical staff apply the principles of decontamination in the new COE? Let's briefly examine this scenario to find out:

A U.S. division is notified that it is deploying for combat operations. Entry into the theater is limited to one major APOD. The vulnerability analysis reveals that the enemy has persistent chemical agents that can be delivered to the APOD by rockets or terrorists. Additionally, the task force has an attached decontamination platoon.

In this situation, the chemical staff must ensure that the decontamination platoon is in theater in time to react to a chemical strike on the APOD. The staff has to be in position to decontaminate as soon as possible after a strike. The chemical staff ensures that the unit is trained to determine what needs to be decontaminated after a chemical attack. Additionally, chemical soldiers work with the commander to establish the priority of decontamination during predeployment planning. In this example, the priority might be the runway because it is needed to keep friendly elements moving into theater. The only change to how we apply these principles is in the way we think about threat capabilities and tactics.

Conclusion

While the doctrinal foundation is sound, the Chemical Corps must change with the times to remain relevant. The COE must be understood thoroughly. That knowledge must then be applied doctrinally to current and future operations in order to protect the force and our country.

Endnotes

[1]U.S. Army Training and Doctrine Command White Paper, Deputy Chief of Staff for Intelligence, *Capturing the Operational Environment,* Fort Leavenworth, Kansas, 2 February 2000.

[2]FM 7-100, *Opposing Force Doctrinal Framework and Strategy*, May 2003.

[3]Ibid., p. 5.

[4]Ibid., p. 7.

[5]FM 3-14, *Nuclear, Biological, and Chemical (NBC) Vulnerability Analysis*, November 1997, pp. A-0, B-1, C-0.

[6]FM 3-11.21, *Multiservice Tactics, Techniques, and Procedures for Nuclear, Biological, and Chemical Aspects of Consequence Management*, December 2001, p. I-1.

[7]FM 3-14, pp. 2-19.

[8]*Capturing the Operational Environment*, p. 8.

[9]Ibid., p. 7.

[10]Ibid., pp. 12-14.

[11]Ibid., p. 12.

[12]Ibid., p. 11.

[13]Ibid.

[14]Ibid.

[15]FM 3-5, *NBC Decontamination*, July 2000, p. 1-4.

Major Duncan is a small-group instructor/leader for the Chemical Captain's Career Course at the U.S. Army Chemical School, Fort Leonard Wood, Missouri. His previous assignments include numerous stateside and overseas leadership positions. He is a graduate of the Chemical Officer Basic and Advanced Courses; Combined Arms Services and Staff School; Ranger, Airborne, and Air Assault Schools; and the Army Total Instructor Training Course. Major Duncan holds a bachelor's in general studies with emphasis in business and communications from the University of Northern Iowa and a master's in environmental management from Webster University.

Third Place Winner, 2002

Chemical Corps Regimental Association Annual Writing Contest

Lieutenant Colonel Jon Pool's article, "The Chemical Corps and Its Emerging Role in Homeland Security," was published in the January 2003 issue of the *Army Chemical Review* (page 9).

Chemical Battalion Support in the CENTCOM Area of Operation

By Major Antonio Amos

Unit deployments are very demanding events that are stressful for both the units and family members. Planning ahead can alleviate stress and, more importantly, ensure that your unit is well prepared to perform its mission. Bottom line: Don't wait until a deployment to get your unit ready. Create a generic deployment timeline (X-hour sequence) that covers all critical events that lead up to a deployment. The timeline should include family support briefings, mandatory training, soldier readiness processing (SRP), deployment ceremonies, maintenance checks, vehicle and equipment loading, and family time.

This article describes some of the actions taken by the 83d Chemical Battalion, Fort Polk, Louisiana, for its deployment to the United States Central Command (CENTCOM) area of operation. It is intended to serve as a guide for future chemical unit deployments.

Predeployment Planning

Planning for the battalion's operations in Southwest Asia began in mid-December. The battalion staff had completed a three-day orders drill under the tutelage of the Joint Readiness Training Center's Leadership Training Program in November, so we were grounded in the fundamentals of the military decision-making process (MDMP). Although the battalion still had not received a deployment order, it was clear that it would deploy. The battalion had obtained Combined Forces Land Component Commander (CFLCC) planning documents, which indicated that we had a full spectrum of units to task-organize, including the Biological Integrated Detection System (BIDS), the M93A1 Fox NBC Reconnaissance System, heavy decontamination, and smoke units. The problem was that there was no brigade or other intermediate operations plan to guide our orders production process. After two days of considering different approaches to plan development, we decided that the classic MDMP framework was the best way to approach the tactical problem.

The battalion pursued two broad courses of action to support Operation Enduring Freedom (OEF) and eventually Operation Iraqi Freedom (OIF). These were assigning tasks to pure companies or task-organizing company teams. In developing the plan, there were no preconceived notions as to which course of action would be chosen. After analyzing the CFLCC's priorities of nuclear, biological, and chemical (NBC) support, force flow projections, and the assets already in theater, the S3 began to array forces. Units were broken into their lowest operational element, such as decontamination platoons, smoke platoons, BIDS teams, and Fox squads. Next, these elements were positioned at critical nodes based on stated priorities. Once this was complete, a Battlefield Operation System Simulator crosswalk was conducted to assess survivability, sustainability, and communication. From this analysis and the ensuing war games, it became clear that the best means to command and control the squads and platoons was as company teams. The battlefield geometry of the battalion's area of operation and mission indicated that to support the primary key nodes, we should build multifunctional teams composed of chemical surveillance/reconnaissance, biological surveillance, and decontamination assets.

Predeployment Preparation Checklist

- Identify deployable and nondeployable personnel.
- Report personnel shortfalls to your higher headquarters.
- Ensure that all deployable personnel have a viable family care plan.
- Remember that shifting personnel will alter your rating schemes.
- Identify a rear detachment that includes a competent chain of command that can effectively—
  - √ support rear-detachment soldiers and family members.
  - √ provide assistance to deployed soldiers.
- Identify equipment shortfalls.
- Ensure that all shortages are on order.
- Publish a packing list as soon as possible.
- Ensure that soldiers comply with the packing list.

Personnel Actions

Pending deployments always tend to bring personnel problems to the surface. Single-parent households without family care plans; sick family members; and pending divorces, weddings, and

childbirths are just some of the issues that bring into question a soldier's deployment status. The personnel section kept an updated by-name manifest of all deploying soldiers. However, this list kept changing due to the frequently changing status of many soldiers.

After developing a deployment roster and identifying the rear detachment, the battalion conducted a family readiness group predeployment briefing on topics such as health care, finance, wills, powers of attorney, and child care. The predeployment briefing was very helpful for soldiers and spouses prior to conducting SRP.

SRP gave soldiers an opportunity to take care of medical, dental, legal, administrative, and financial matters. Coordinating for SRP was easy. It was difficult, however, to keep track of immunization records when some soldiers missed the SRP date. The installation G1 also developed a new procedure to validate SRP packets that involved a lot of red tape. Unfortunately, the battalion wasn't aware of the new procedures and had to make late-night and last-minute adjustments. Also, many soldiers failed to take care of personal issues such as updating their records. And when the battalion arrived in country, we were surprised by the fact that all personnel actions had to go through the home station. Without updating records, soldiers run the risk of pay problems and promotion discrepancies because of poor connectivity between the deployed unit and the home station. Tracking and submitting personnel status (PERSTAT) reports went very well because the reports were set up early, making the status easy to track. Getting in touch with our higher headquarters before deploying and getting a copy of its PERSTAT format was a big help.

Unfortunately, some processes did not go very well. The battalion headquarters was ill-equipped to deliver mail to units that were spread out over vast distances. The rating chain for Officer Evaluation Reports (OERs) and Noncommissioned Officer Evaluation Reports (NCOERs) was also unclear. The deployment order never established whether the battalion's higher headquarters during deployment would take the place of our parent brigade to process awards, OERs, and NCOERs. The battalion personnel section also had to go through the Personnel Support Battalion at Fort Polk to process personnel actions. The S1 section had to rely heavily on fax, e-mail, and telephone calls to process personnel actions. Fortunately, the battalion rear detachment was extremely helpful in lending assistance and alleviating problems.

Advanced Echelon Operations

In mid-January, the first element deployed from the battalion. This advanced echelon (ADVON) was composed of the battalion S3, the assistant S3, the S4 noncommissioned officer in charge, a company executive officer (who had redeployed from Kuwait in August), a company supply sergeant, a driver, and a communications specialist. The overarching mission of the ADVON was to get movement on some key areas that were essential to the battalion's ability to quickly receive passengers and equipment, stage, and begin mission execution. Deployment of the ADVON proved valuable because many prerequisite tasks were handled before the arrival of the battalion main body:

- Obtaining maps and satellite imagery of mission areas
- Identifying and initiating coordination to obtain access to communications resources in theater
- Identifying procedures to initiate/continue required immunizations
- Reviewing recent planning documents and adjusting the battalion plan as necessary
- Initiating coordination with all supported units and conducting initial reconnaissance of the mission
- Obtaining approval of the battalion's operational concept
- Establishing supply accounts
- Identifying theater stockages of key NBC defense supplies
- Establishing maintenance support relationships

The ADVON arrived in theater just ahead of the "bow wave" of forces that began in early February. During this time, the ADVON established relationships with points of contact throughout Kuwait, which proved invaluable as the battalion conducted reception, staging, onward movement, and integration throughout the deployment. Execution of the ADVON tasks also allowed the battalion to focus its efforts on receiving and staging equipment with minimum friction associated with becoming established in a new area of operation. Additionally, since the battalion tactical plan had been staffed and approved already, the formal operations order briefing was given 24 hours after the main body arrived, providing maximum planning time to the companies.

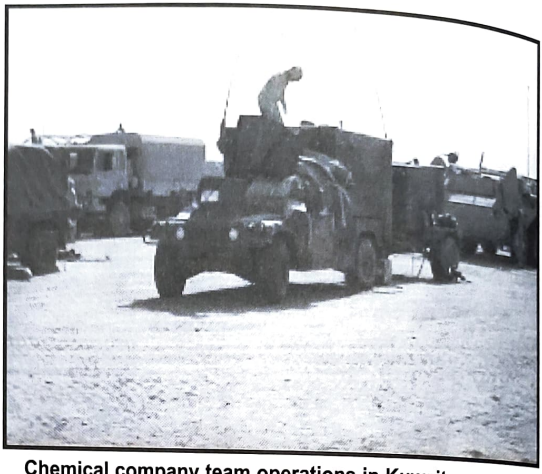
While ADVON operations were valuable, one significant improvement could have been made—the inclusion of two high-mobility, multipurpose wheeled vehicles (HMMWVs) in the ADVON flow to facilitate reconnaissance and supply operations.

Mission Execution/Task Organization

As discussed previously, war gaming and predeployment planning indicated that the company team was the best way to employ the battalion's assets during OEF/OIF. The success of this concept validated our concept of deploying multifunctional teams in chemical, biological, and radiological defense. The argument can be made that this is not a new concept, but the difference

here is the placement of Fox vehicles and BIDS under a non-like-type headquarters. Over the past year, the battalion had worked hard to sell the idea that BIDS platoons can be effectively commanded and controlled by something other than a BIDS company headquarters. This is probably attributable to the fact that biological surveillance technology is still relatively new and unfamiliar to most in the Chemical Corps, which may lead to a conservative approach to asset employment.

An additional benefit of this approach has been the tremendous development of leaders at all levels by forcing them out of their comfort zone of leading soldiers to execute their familiar lines of NBC operations. This was not easy. A great deal of training, back briefs, and rehearsals was required at every site to train soldiers and leaders to leverage the multiple capabilities available to them. Likewise, there were inevitable differences in tactics, techniques, and procedures and leadership styles. Simple personality conflicts sometimes arose from combining soldiers and leaders from as many as four different companies. In the end, these conflicts were worked through and resolved. Four months of continuous operations and dozens of fragmentary orders confirmed that the company team concept works. Simply put, it puts the right assets at the right place at the right time—with a clear chain of command.



Chemical company team operations in Kuwait

With the success of OIF ground operations, the battalion altered the task organization based on requirements to position forces farther north. Each shift required a new round of mini-war games and course-of-action comparisons. The difficulty of making these adjustments was eased somewhat by the arrival of additional decontamination assets in theater and the decreasing Iraqi capability to attack southern locations with weapons of mass destruction as the coalition advanced north and Patriot coverage proved impenetrable.

While the battalion's approach to unit task organization has proven successful, implementing sustainable command and support relationships was a significant challenge, particularly during offensive preparations and early in offensive operations. The austere structure of the chemical battalion headquarters and headquarters detachment, and the great distances that separated units, made logistics support an ongoing challenge. Although there are considerable advantages to chemical task organization structures, these advantages can be offset if unit readiness cannot be sustained. Doctrine provides the solution to this problem. Units can be placed in a direct support, general support, or operational control role and still receive some or all classes of supply from the supported unit. Too often, staff officers unnecessarily place themselves in a doctrinal box by limiting unit command and support relationships to those found in Figure F-1 of Field Manual 101-5, *Staff Organization and Operations*, when doctrine actually provides for much greater flexibility. Appendix F of this manual states that "definitions of command and support relationships do not always cover every situation.... Specific support tasks must be listed above the accepted doctrinal definition of a command and support relationship." Unfortunately, we found these specific support tasks to be rarely listed, and even when they were, they were often ignored. Fortunately, these relationships were worked out over time, and all units remained fully mission capable throughout the operation.

Chemical Battalion Viability

Based on the experiences of Operation Desert Storm, OEF, and OIF, arguments can be made for and against the efficacy of battalion and brigade chemical headquarters structures in combat. OIF force flow did not support inclusion of a brigade-level chemical headquarters until after organized resistance across Iraq was destroyed, so assessment of brigade command and control is not possible. Further, there is probably some bias as to the value of the chemical battalion headquarters structure. With that said, this battalion's experience and observations during OIF indicate that the chemical battalion headquarters remains a valuable command and control structure. The chemical battalion headquarters is focused on the command and control of chemical units, ensuring a holistic approach to chemical unit employment. This approach typically leads to the most efficient employment of scarce assets. In contrast, chemical staffs are primarily designed and resourced to advise commanders. While chemical staffs monitor the status and location of subordinate chemical units, they are simply

not manned or otherwise resourced to command and control multiple chemical units.

Once operations were under way, disposition of the assets under the battalion's control was routinely assessed, and adjustments were made as operations progressed. It was not always clear that this level of planning and consideration was involved in determining the employment of chemical units across the area of operation, and it appeared that there were instances when units task-organized elsewhere in theater were not used to their full potential. In one case, a Fox-equipped platoon remained in an assembly area 90 kilometers from Iraq as friendly forces attacked north into the infamous Baghdad "Red Zone," which was the suspected trigger area for Iraqi chemical weapons use. Similarly, a BIDS platoon was tasked to provide surveillance 40 kilometers to the rear of combat forces as they postured in tactical assembly areas along the Iraqi border awaiting line of departure. While the precise rationale for these employment decisions is unknown, it seems likely that better use would have been made of these units if they had been placed under a dedicated battalion headquarters.

Command and Control

Using a chemical battalion headquarters to command and control chemical assets as they spread across the battlefield was very challenging. The battalion's decision to employ assets using company teams presented monumental challenges to the battalion's ability to communicate with those assets. The standard company team was composed of decontamination, NBC reconnaissance, and biological surveillance assets. The mixture of communications assets and capabilities gave the battalion the flexibility to use redundant communications linkages. Each BIDS team was equipped with an AN/GRC-193 radio with a planning range of 300 to 500 kilometers, which allowed the battalion to communicate with company teams over great distances. Since the battalion headquarters was not equipped with an AN/GRC-193, the battalion acquired one for use in the tactical operations center.

The distribution and use of secure fills for the Single-Channel, Ground-to-Air Radio System (SINCGARS) was also a challenge. When a company team was assigned to another higher headquarters, it received the fill from that headquarters. That eliminated the battalion's ability to communicate via frequency modulated (FM) radios unless it switched to its fill. In any case, the amplitude modulated (AM) AN/GRC-193 radio was the battalion's best long-range asset.

AM versus TACSAT

Although the AM radio was the battalion's best long-range communications asset, tactical satellite (TACSAT) communications, because of its reliability and range, is always preferable to AM radios. Although AM communication has a planning range of 300 to 500 kilometers, distances of 3,000 kilometers-plus have been achieved. The frequency range of AM radios is from 1.6-29.999 megahertz. Each frequency in this range has an ideal transmission environment.

During OEF/OIF, the battalion was able to establish only intermittent AM communications with its units. Some frequencies work best during the day, others work best at night. Some that transmit well with heavy skies cannot be used with clear skies. To effectively use AM communications over long distances, you need a wide spread of frequencies to account for the changes in environmental conditions. However, frequency availability was a huge problem. During OEF/OIF, AM communications was heavily used by commercial and private venues because of the distances between unit locations. The battalion signal officer was eventually able to obtain a wide range of AM frequencies to ensure reliable AM communications through diverse weather conditions. The battalion learned that it is necessary to coordinate with local frequency managers well before deployment to get a good spread of frequencies.

TACSATs such as Spitfires can be used with greater ease in changing environments. Once the antenna is pointed to the right azimuth and the equipment locates the necessary satellite, you have a virtually unlimited communication range.



BIDS operations in Iraq

Mountainous terrain, which can block your view of satellites, and stormy weather are the only factors that may interfere with transmissions.

Although TACSAT communication is far more reliable, it is also harder to acquire. Satellites have a limited number of signals that can transmit at any one time. Getting satellite time keeps many units from using TACSAT. With the high value placed on satellite time, only extremely high-priority units with a need for long-range communication can usually gain access. Tactical commanders must realize that during a time of high chemical and biological threat, the mission of chemical units is a high-priority mission that requires the allotment of TACSAT equipment and satellite time accordingly.

Multiple Net Requirements

The ideal operational environment has several nets assigned to the battalion—one command net for each company, and one net per platoon. This breakout limits unnecessary traffic on each net and provides for clear lines of communication from commanders to their subordinate units. During OEF/OIF, FM frequencies were hard to get. As a result, each company and the battalion headquarters had only one net available to them, which required following strict radio discipline. Strict radio procedures were developed at the company level to ensure that lines were free for operational traffic.

Communications Zone Operations

The mission of chemical units in any communications zone is planned around a need for reconnaissance in those areas and not on the range of their communication. This can pose a serious problem for both chemical and biological detection units. BIDS platoons have AN/GRC-193s in all of their vehicles, so their effective range of communication (taking environmental factors into account) is about 300 kilometers. But as mentioned before, this range can vary greatly. Even Fox units are equipped with only SINCGARS, giving them an effective range of 35 kilometers.

Fox units are often put at a disadvantage on reconnaissance patrols that skate on the edge of their FM range. Unless they are provided with retransmit capability by the unit they've been attached to, they must often find alternate means to talk back to their command posts. The need for NBC Fox reconnaissance assets to report the timely confirmation or denial of chemical agents employed on the battlefield magnifies the need for long-range communications.

To remedy this situation, alternate long-range communication assets must be acquired or allotted to these units. Ideal secondary sources of long-range communications are secure cell phones or secure Iridium satellite phones. During OEF/OIF, many units used Smart Phone zone radios as an effective form of secure, redundant communication. Repeaters spread throughout Kuwait gave these Smart Phones border-to-border range, which proved useful for in-country operations. Since there is currently no mobile subscriber equipment in southern Kuwait, Smart Phones are not only an effective means of reconnaissance reporting but also of reporting from companies to higher headquarters. The battalion also installed the Force XXI Battlefield Command—Brigade and Below (FBCB2) System in five Fox vehicles and a command HMMWV during the deployment. This gave the battalion the ability to track assets real time and allowed units to view the common operational picture.

Predeployment/Deployment Logistics Considerations

Once the 83d Chemical Battalion received notification of deployment, a preplanned timeline immediately went into effect, which was critical in keeping units on track during equipment uploading, pallet building, Unit-Level Alert Control Center (ULACC) operations, and household goods and privately owned vehicle (POV) storage. Simultaneously, automated unit equipment lists were turned in to the installation transportation office (ITO) to build deployment equipment lists, which in turn were used to initiate Level 4 time-phased force deployment data for air and sea transportation.

Equipment Uploading

It was important to ensure that each company deployed with specified classes of supply. If we were deploying to an immature theater, it would be necessary to plus up (120 days) Class II office supplies, Class IX prescribed load list and repair parts, and Class XI personal hygiene items. Since the battalion used commercial equipment, such as lamps and printers that take commercial bulbs and ink, the battalion S4 attempted to acquire a four-month supply of these items. However, they were hard to come by in country, and shipment time from the states took several weeks.

The S4 coordinated with personnel at the seaport of debarkation (SPOD) to brief unit movement officers on the specifics of SPOD operations, uploading containers, and support and dunnage requirements of containers. Coordination was also made with the ITO to brief the unit movement officers on the specifics of aerial port of debarkation (APOD) operations and uploading ammunition, supplies, baggage, equipment, and weapons, that would accompany the troops.

Pallet Building

Units were stocked with a consolidated list of pallet-building materials from the ITO. The following materials were needed for one pallet:

- 1 463L pallet
- 8 cardboard deployment systems with covers
- 1 roll of bubble-wrap
- 1 roll of shrink-wrap
- 1 cargo net
- 2 rolls of tape

ULACC Operations

This process validated equipment for air and sea transportation before convoy operations to the SPOD. There are four areas within the ULACC that must be checked—maintenance, secondary load, weighing and taping vehicles, and hazardous material (HAZMAT)—before a vehicle is validated and certified as fit for transportation overseas.

The process started with organizational maintenance. The maintenance team validated each piece of rolling stock and major end item. If 10/20-level faults were found, deficiencies were fixed on-site. The battalion also coordinated for direct-support-level maintenance. If deficiencies were found, they were corrected on-site as well.

We coordinated with the ITO for secondary load verification and weighing and taping vehicles for deployment equipment list validation. During the secondary load verification process, the ITO ensured that all secondary loads were properly loaded, with dunnage and shoring materials securing the load. All rolling stock was weighed and taped to ensure that the equipment was within height and weight specifications for the type of airframe or ship.

The ITO verified all HAZMAT paperwork for correctness before posting the documents and warning placards to the respective container. The unit HAZMAT personnel carried a complete set of documents during movement in case the SPOD operations had any questions concerning the contents of containers. Once HAZMAT was verified, the validation process for that container or rolling stock was complete.

Household Goods Storage

The S4 coordinated with the ITO for a unit consolidated household goods brief. The battalion scheduled packing and pickup dates, by unit, a couple of days before validated airflow time of movement through the APOD.

POV Storage

The S4 also coordinated with the point of contact for the installation consolidated POV storage lot point for proper paperwork for storing vehicles. A date was scheduled one day before validated airflow time of movement through the APOD. If your installation does not have a consolidated POV storage lot, contact the installation military police/physical security department for details on how to construct a unit-level storage lot.

Husbanding Chemical Assets

It is critical that chemical leaders at all levels take responsibility for chemical units operating in the battlespace. Too many times during our deployment, there was a "hands-off" approach to husbanding resources coming to this area of operation. For example, this headquarters provided vehicles and other assets to our war-traced units because it was the right thing to do, regardless of whether the units were task-organized to the 83d Chemical Battalion or not. Until we as a Corps start to look out for all our assets, we will continue to allow chemical units to wander around the battlefield without the proper guidance or mentorship. Additionally, we should not become so wedded to the execution of the operation plan. In my view, our chemical staffs at all levels—from the chemical battalion up to the CENTCOM levels—were tied into fighting the plan, not fighting the conditions or the enemy. While my view may be jaded as a chemical battalion commander, we did not do many things that would ensure our success. Examples of some of the things I would change are listed below:

- Chemical staffs and commanders should have conducted back briefs and rock drills to ensure that we met the CFLCC's intent for employment of chemical units. This was even more critical because we did not have a chemical brigade to interface with the higher-level command headquarters.
- Higher-level staffs tended to micromanage commanders instead of providing a task and purpose for each mission. This was also tied to the lack of a higher-level command and control headquarters. But in my view, it was tied to the continued execution of OEF and deployment of assets for that operation.

Even with the operational challenges, the NBC architecture worked. We know what we need to do to improve in our respective staffs and commands. Our requirement as leaders is to take this organization as a "way forward" to improve our systems and capabilities.

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Confront Any Mission!

Major Amos is the deputy Chemical Branch Chief, U.S. Central Command.

Improved Marking of Contaminated Areas



By Mr. James M. Cress

Throughout the 1980s, the Chemical Corps sought a nuclear, biological, and chemical (NBC) reconnaissance capability that would prevent the possibility of an unwarned encounter with contaminated terrain. With the type classification of the German Transportpanzer 1 Fuchs vehicle as the standard NBC reconnaissance asset, the U.S. Army first became capable of rapidly detecting terrain contaminated with chemical agents. The U.S. variant of this vehicle was designated as the M93A1 Fox Nuclear, Biological, and Chemical Reconnaissance System. The system includes a marker set which consists of a weighted base, a wire mast, and pennants for each class of NBC hazard. Enough components to assemble 175 markers are stored inside the crew compartment of the vehicle. There is a marker chute at the rear of the vehicle which allows assembled markers to be dropped outside without compromising the collective protection of the vehicle.

Starting with World War I (1914-1918), various methods of marking contaminated areas have been used. All have shared the same goal—preventing an unwarned encounter with a chemically contaminated area. The protocol for annotating the pennant or marker has remained relatively unchanged over the years. When emplaced, the unit, the date-time group, and the hazard are written on the marker, typically using a grease pencil. The identification of these markers is a common task at Skill Level 1 for all soldiers (found in Soldier Training Publication [STP] 21-1-SMCT, *Soldier's Manual of Common Tasks Skill Level 1*, task number 031-503-1019, *React to Chemical or Biological Hazard/Attack*).

The adequacy of the Fox marker system was an issue during the field-testing of the system before its type classification. With the limited number of markers on board, it was clear that placing them around a typical contaminated area would immediately consume the entire basic load of markers. Soldiers also raised issues concerning the visibility of the markers during periods of darkness and the limited amount of information available at the marker. Following the type classification, field units began to report that the markers were difficult to see and tended to tip over in rough terrain.

In 1997, the U.S. Army Chemical School's Directorate of Combat Developments at Fort McClellan, Alabama, drafted a concept for the digital marking of contaminated areas. An evaluation of a concept entitled Smart Marker was proposed. In 1998, the U.S. Army Maneuver Support Battle Lab, Fort Leonard Wood, Missouri, managed a limited-scale in-house project designed to demonstrate a long-duration infrared (IR) beacon. A circuit was then assembled based upon an LM3909 integrated circuit and other components purchased at a local electronics store.

The goal of this early experiment was to determine if a small, thumbnail-sized (1 centimeter by 1 centimeter) IR beacon could be used to improve the visibility of a Fox NBC marker for a period of two weeks without a battery change. This experiment was a success: the beacon worked for 87 days (on one AAA battery) without a failure.

The success of the beacon project prompted an investigation into the scope of the capabilities that could be included in a marking system product improvement. The Maneuver Support Center Battle Lab was sponsoring an Army advanced technology demonstration that looked at the development of decision tool software for NBC personnel. The prototype software was installed on a commercially available Windows® CE-based personal data assistant (PDA). The PDA mirrored the capabilities of laptop computers with the same graphics, text files, database utilities, and IR port. When the software contractor delivered the products, they were demonstrated on a PDA that also had a personal computer radio frequency (RF) modem card for Internet access. This allowed the user to obtain online maps via a Web site. Further investigation revealed small Global Positioning System integrated circuits that could be used inside a Smart Marker.

A demonstration to transfer a field survey form and a graphic hazard from a laptop to a PDA was conducted. This caused further interest in the concept. The Smart Marker concept was revised and improved based on the combination of technology demonstrations, market surveys, and collateral readings resulting in development of a U.S. Army Training and Doctrine Command Concept Evaluation Program (CEP) proposal.

The funding needed to conduct the Smart Marker CEP was approved in 1999. The goals of the program were to improve the visibility of the marker and increase

the amount of information it makes available. A statement of work was then prepared and a solicitation for bid issued. The University of Missouri-Rolla was selected for the contract, and work began. Government personnel provided the background information on the concept and its goals for the experiment. The one government-specified constraint for the design team was to use commercial off-the-shelf (COTS) technology or components whenever possible.

The project was partitioned into four phases, and transitioning from one phase to the next was contingent upon the results of an in-progress review (IPR). Phase I was a front-end analysis that examined the varying methods of addressing the problems of the existing markers. Phase II was the fabrication of breadboards (alpha prototypes) that demonstrated function and potential and resolved any shortcomings of the existing system within the constraints specified. Phase III involved fabricating and demonstrating functioning prototypes for field demonstration. Phase IV was the demonstration of a working prototype in a limited-objective experiment.

There were three senior design teams assigned to develop three different designs. Each team consisted of one electronics/computer engineering student and two mechanical engineering students. Two of the teams also had one engineering management student each. The three teams arrived at two design approaches. Two of the groups elected to repackage a PDA to take advantage of its built-in functionality. The other team opted for the use of COTS electronic components that were coordinated by a microcontroller. Some time after the work had begun, the teams were reorganized to partition the effort. The three mechanical teams remained, but the electronics development team was consolidated.

The researchers used computer-assisted design and manufacture to create the marker prototypes. Each team had a different solution to the problem of marker stability. One team decided upon a multipod approach using multiple short legs that provided at least three points of contact regardless of its directional orientation. The multipod approach was the closest to the design of the existing marker, but the approach did not demonstrate well during the field trials. An alternative design approach used a counterweighted cylinder with a self-orienting antenna/mast. This technique had the advantage of simplicity of design but was difficult to deploy from the Fox and suffered from durability problems. The most successful mechanical design had articulated legs and was self-righting. When cost was considered, it was decided that this approach, however elegant, was not practical.

The electronics module was the most successful element of the design approach. Initially the design teams had two different approaches to the electronic functions. As the teams reviewed the requirements, it became obvious that most of the requirements could be met with a PDA. The battery well, keyboard, and visual display are the biggest parts of the PDA. These parts are unnecessary to the marker function. Two of the teams concluded that a PDA could be repackaged to meet the need. The third team thought that this approach was inefficient and that a fresh breadboard should be developed using miniature COTS electronic components. This approach was selected at a midpoint IPR.

With this decision, the teams were reorganized, and a composite team was created to design an electronics module that was compatible with all three mechanical designs. In response to the reorganization, the scope of work statement was adjusted. This team was given a size constraint for the marker and was instructed to conduct a design-to-fit study. The idea was that the actual device could be larger than the design constraint if standard design practices could configure the electronics to fit the constraint. The engineers took a modular approach, placing the components inside a clear plastic enclosure. The use of a miniature frequency-hopping transceiver ensured that it would be possible to download the marker's data from standoff distances.

A standard graphic interface was designed so that service members who are familiar with Windows products could use the supporting software easily. This approach was an unqualified success, because personnel who were familiar with Windows applications had no difficulty using the prototype software. The terminal used in the field was a standard military contract laptop computer with a Windows NT® operating system. Accordingly, soldiers with experience using these tools had no challenges with the Smart Marker and its supporting software.

The field experimentation was very successful. The Smart Marker concept evaluation demonstrated that by leveraging commercially available technology, it is possible to improve the Fox's marking of hazard areas dramatically. Simply adding different flags and a commercially available stick-on beacon makes a significant difference in the ability to detect the marker during periods of limited visibility. Leveraging available technology allows the standoff download of detailed hazard information via RF modem or digital download via the IR or the hardwire communication port. In the case of the RF mode, detailed hazard data was visible in the cab of a truck 300 meters before the marker was encountered. While this project focused upon the Fox, its findings could be useful for a number of different applications, such as minefield, hazard, and traffic-control marking.

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Managing Sensitive Site Exploitation — *Notes from Operation Iraqi Freedom*

By Major Pete Lofy

The hunt for weapons of mass destruction (WMD) and the related documentation was a focal point during Operation Enduring Freedom and Operation Iraqi Freedom. U.S. Central Command designated sites that were associated with WMD or other war atrocities as sensitive sites. During the conduct of Operation Iraqi Freedom, Task Force Iron Horse—built around the 4th Infantry Division, Fort Hood, Texas—was given the task of securing and exploiting many of these sites. This article outlines the management process that was used to identify, target, and exploit those sites; it will not elaborate on techniques used or detail findings.

Weapons for the Dragon Hunt

A sensitive site—as defined by Special Text (ST) 3-90.15, *Tactics, Techniques, and Procedures for Tactical Operations Involving Sensitive Sites*—is "... a geographically limited area with special diplomatic, informational, military, or economic sensitivity to the United States."[1] For our purposes, sensitive sites were separated into two types: those that potentially contained WMD and those that did not. The focus of the former was to locate stores of nuclear, biological, and chemical (NBC) weapons or the facilities that produced them. The focus of the latter was to exploit the documentation that supported the former Iraqi regime's atrocities and/or gave information regarding its structure.

In order to conduct sensitive site exploitation operations, Task Force Iron Horse was augmented by two specialized sensitive site exploitation teams: Mobile Exploitation Team (MET)–Delta (MET-D) focused on non-WMD, while Site Survey Team #4 (SST #4) focused on WMD exploitation. These teams were placed under the operational control of the task force. While the composition of a MET or SST varies among different teams, those teams assigned to Task Force Iron Horse had typical composition and capability. The two teams had some overlap in capabilities and could internally task-organize to accomplish specific missions or prosecute multiple missions simultaneously.

Redefining the Targeting Process

The process by which sensitive sites are identified, targeted, and exploited is analogous to—and can be imbedded in—the process used by an effects coordination cell (ECC) in planning and executing an air tasking order (ATO) cycle. An ECC is generally found at division and higher levels, but its targeting processes can be used at almost any level. The division ECC's purpose is to—

- Plan, prepare, and execute the synchronization of lethal and nonlethal effects at the decisive point on the battlefield.



Photo courtesy of MET-D

MET-D poses in front of a picture of Saddam Hussein as it prepares for yet another mission in support of Task Force Iron Horse.

- Synchronize and integrate the division's collection and target efforts for shaping operations.
- Integrate information operations (IO), civil affairs (CA), and public affairs themes into the shaping operations.
- Coordinate and synchronize organic echelon-above-division and joint assets.
- Develop and disseminate targeting products.

The ECC is generally built around the unit's fire support element. For those not familiar with the ATO cycle or the targeting process, they are deliberate, coordinated processes by which persons or areas of interest are identified and targeted using information from a number of sources. Once targeted, members of the ECC determine how to attack or render effects on a target. This group then continually provides updated information (or refinement) on the target. After the effects (lethal and or nonlethal) have been delivered, battle damage assessments feed back into the ECC for refinement of the target and possible reservicing of that target. This is a very rough description of a complex process.

It is easy to dismiss the importance of the chemical officer in this process. The operational danger is that everyone knows a little about WMD. The danger manifests itself when that "little" knowledge is applied. This is not a job for part-timers; it requires a chemical officer to assess and inject WMD smarts into the process. "Enthusiasm does not equal capability" was the constant mantra of this mission. (To read more about the chemical staff officer's part in the targeting process, see "The Chemical Officer's Critical Role in the Targeting Process" in the January 2003 issue of the *Army Chemical Review*.)

For the purposes of security and stability and support operations, Task Force Iron Horse transformed the ECC from a group that primarily targeted high-value assets (HVAs) kinetically (lethal) to a group that used nonkinetic (nonlethal) effects to target HVAs. Examples of nonkinetic effects include psychological operations (PSYOP), CA operations, and IO. As the task force transitioned to stability and support operations, the composition of the ECC changed from artillerymen, aviators, and Air Force representatives to a group dominated by PSYOP, CA, and IO planners. This paradigm shift resulted from the need for the armed U.S. forces to adapt to an ever-changing battlefield in which simultaneous, full-spectrum operations were the norm.

The sensitive site exploitation management process nests itself within the ECC's targeting or ATO cycle. The process begins with identifying the threat — in this case, the sensitive sites. Sites are identified by two primary means. The first is based on the findings of our national-level intelligence assets: the deliberate planning process identifies preplanned sites. These sites translate easily to specified tasks for the units. The second means involves serendipity: units identifying a site during the conduct of operations. More often than not, these sites are discovered as a result of contact with the local populace (human intelligence [HUMINT]).

SST #4

Primary Mission: Exploit sites that may contain evidence of Iraqi WMD-related materials and/or actual NBC agents.

Team Composition and Functions:

- Site Assessment Team: Five Defense Threat Reduction Agency soldiers providing technical expertise and equipment
- Support Element: Ten soldiers providing logistical support and tactical linkages
- Explosive Ordnance Disposal: Two soldiers securing the team from explosive hazards
- NBC Reconnaissance Section: (Composition varies) providing NBC survey and monitoring

MET–D

Primary Mission: Exploit documentation and other information supporting Iraqi WMD programs and/or supply information regarding the structure, personnel, or atrocities of the former Iraqi regime.

Team Composition and Functions:

- Site Assessment Team: Five Defense Threat Reduction Agency soldiers providing technical expertise and equipment
- Support Element: Ten soldiers providing logistical support and tactical linkages
- Criminal Investigation Element: Two investigators providing crime scene support
- Explosive Ordnance Disposal: Two soldiers securing the team from explosive hazards
- Security Detachment: Five soldiers providing physical security for the exploitation team

In Iraq, farmers, merchants, and local civilian authorities approached soldiers stating that something had been buried in their backyards, fields, or playgrounds. These types of reports were so numerous that it was often difficult to corroborate the information with other sources. Often, these HUMINT reports were not immediately prioritized and matched up with the sites from higher headquarters unless they posed an immediate danger. Nevertheless, these ad hoc sites required the same level of attention and effort as the preplanned sites. Part of the growing pains in identifying these ad hoc sites was the

initially limited skill set for missile identification. Many missiles larger than a soldier's arm were incorrectly identified as Scuds (enemy missile systems) or other surface-to-surface missiles. It took a concerted effort to educate the force and grow beyond the "big missile" identification. A description of how these ad hoc sensitive sites were processed is at the end of this article.

Assigning Priorities

Once all of the possible sensitive sites were identified, the systematic process of site prioritization began. Prioritization was a deliberate, dynamic process based on many factors, which included (but were not limited to) the—

- Priority assigned by higher headquarters.
- Perceived geographical/political significance.
- Amount of combat power required to secure the site.
- Reliability and recency of on-site intelligence.

The priority assigned to these sites could change based on updated information. For example, a clue discovered at site "X" could cause site "Z" to leap to the top of the list.

At the task force (division) level, the most critical factor in determining prioritization was often how much combat power was required to secure the site. Our higher headquarters tasked us to secure the designated sites until they were properly exploited and reported. Only then were we relieved from the task. Those who understand the tactical task of security realize that physically securing a fixed site can require from two soldiers to two battalions of infantry. The amount of combat power and time required to secure a facility gains the commanders' attention quickly.

Next, the planner must balance the priority of the site against the tactical reality of the unit. Often, the task force's prioritization of sites was not in line with those of our higher headquarters. The sites were prioritized by importance while maintaining the scheme of maneuver. For example, if site "Z" was at our limit of advance, it would not be secured initially despite its high priority, whereas lower-priority site "W" was secured simply because it was encountered earlier in our advance.

Injecting Sensitive Site Exploitation

Once initial prioritization of sites was complete, it was time to feed the sensitive site into the targeting cycle. The injection of the site was the duty of the NBC plans officer on the division plans team. He took the site with the highest priority and placed it in the targeting list. This was done 96 to 120 hours before the site was to be exploited. This list was staffed throughout the division plans team and examined for feasibility. If approved, the target list was passed to the ECC for further refinement and assignment of supporting resources.

At the 72- to 96-hour ECC meeting, resources—such as security personnel, engineers, and the Fox M93A1 Nuclear, Biological, and Chemical Reconnaissance System—were allocated to support the exploitation effort. Members of the ECC analyzed sensitive sites and other missions to ensure that all targets got the required assets during the timeframe of interest. During the 48- to 72-hour meeting, the commanding general reviewed and approved the target list. Approximately 48 hours before the execution of the exploitation, a division fragmentary order (FRAGO) detailing the operation and its support requirements was produced.

The FRAGO was not the first time that the supporting unit was aware of the requirement. The target sheet listing the task and purpose for each 24-hour time period was circulated to the units after approval by the commanding general. This allowed the units some lead time to plan. This target sheet also translated into a troop-to-task list, which the leadership of the division used to manage assets and ensure no unit was overtaxed.

Target Refinement

While the targeting process continued, the NBC staff (assisted by the intelligence section) continued to refine



Photo courtesy of SST #4

SST #4 exploits a suspected WMD storage site.

intelligence on each target. Priority intelligence requirements (PIRs) for the exploitation were also refined. PIRs focused the teams in their exploitation efforts. Some of the secure sites were rather large, and without PIRs the teams would have taken days (if not weeks) to exploit some of the sites.

Before the day of execution, MET-D and SST #4 coordinated with the supporting unit. The supporting unit can be tasked with providing security, engineer assets, and other needs. The mission was completed on the day of execution, and the teams out-briefed the supporting unit, the ECC, and the division chemical section. This form of feedback allowed the division staff to decide if the mission was complete or if the target would have to be revisited.

Release from the task of securing the site required that the teams exploit the site and submit a formal report detailing what, if anything, was found at the site. If the site required a large amount of force to secure, the drain on combat power crippled other operations in the task force area of operation (AO). Therefore, the reports to higher headquarters were normally submitted within 24 hours of mission completion.

Lessons Learned

The process used to exploit ad hoc sites is important to know and pass on. If a unit received a report regarding a possible sensitive site within its AO, it would process the site at its level before engaging the SST. For example, if the unit reported a possible WMD site, it would first exploit the site with organic NBC monitoring and survey teams. If these teams found positive evidence of chemical or biological agents, then the unit dispatched a Fox to the site. If the Fox also found positive evidence of WMD, then the unit would request support from the division Chemical Section and the SST. The SST was tasked by the ECC (using the targeting process) and dispatched only after credible evidence of WMD was found and proper analysis conducted. This use of organic assets was critical to the process of managing the ad hoc sites, ensuring that the crucial asset of the SST was not squandered.

Conclusion

The salient points of sensitive site exploitation management within the realm of the targeting process may be summarized as follows:

- Targets must be prioritized based on predetermined factors, but this prioritization remains flexible to allow for ad hoc site exploitation.
- Targets must be injected into the unit's targeting process early. This allows members of the ECC to allocate resources and gives subordinate units ample time to plan.
- Written orders must be specific about sensitive site exploitation task accomplishment and the unit's requirements for supporting the effort.
- PIRs must be defined for each sensitive site.
- Intelligence preparation of the battlefield must continue on the target as the date of execution nears. Detailed targeting folders must be delivered to the team well in advance of conducting the exploitation.
- Detailed coordination must be complete before executing the exploitation.
- Detailed feedback about the exploitation must be briefed after its completion. This will determine if the target must be reserviced or if the mission is complete.

Managing sensitive site exploitation is a new and complicated process. This process can be simplified, however, when it is nested in the already-existing system of the ATO or targeting process. This established method makes the task more manageable for the staff officer and gives the unit actionable tasks. Correct and efficient management of this process will ensure minimum strain on unit combat power because of sensitive site security missions.

Acknowledgements: I would like to recognize the diligent work of MET-D and SST #4, commanded by First Lieutenant Thomas D. Jagielski and Lieutenant Colonel James K. Johnson, respectively. I also want to recognize the hard work of the Task Force Iron Horse team, especially the division Chemical Section's officers and noncommissioned officers. Finally, I thank Major Mark Lee for his help in editing this article and keeping me sane for months in Iraq.

Endnote

[1]ST 3-90.15, December 2002, was an excellent and timely guide for sensitive site exploitation operations. Though it focuses on combat operations, most of the principles can be applied across full-spectrum operations. This was extremely important, as the task force was often involved in combat and stability and support operations in an extended battlespace.

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Task Force Environmental Cleanup

By Major Brian Lynch

The 101st Airborne Division (Air Assault) Chemical Section from Fort Campbell, Kentucky, performed the first chemical hazard mitigation and terrain decontamination of Operation Iraqi Freedom. The project required the alleviation of more than 11,000 gallons of assorted chemicals that were deliberately poured on the ground and the streets of a neighborhood in Mosul, Iraq. Timely action was required to reduce the health risk because civilians and military personnel were living and working in the area. At the time, the Chemical Section's technical training and expertise in this area was limited, but the hazard had to be reduced immediately.

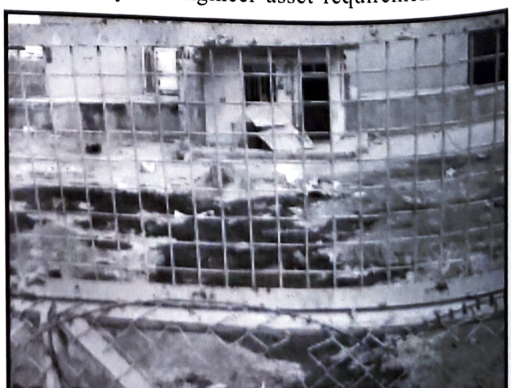
Before the cleanup, coalition forces had liberated southern Iraq and Baghdad, and the 3d Infantry Division had relieved the 101st, which had occupied the area for nearly two weeks. As the 101st finalized the routing information protocol, it prepared to jump its main command post north to conduct combat operations in Mosul. Two days before, the 101st's jump command post (a small structured section of the assault command post) and the 2d Brigade Combat Team (BCT) air-assaulted into the Mosul airport. In a ground assault convoy, the remaining portion of the assault command post linked up with the jump command post, established communications, and assumed command and control of the 101st, allowing the main command post to break down and move forward.

At approximately 0600 on 25 April 2003, the 2d BCT reported that it found heavy looting at the agricultural storage facility in central Mosul and heard that the populace might have been exposed to chemicals. Iraqi civilians in the area were complaining about an irritating smell and their burning eyes and skin. The 2d BCT secured the area and reported the incident to the Chemical Section.

The source of the hazard was a series of warehouses that once contained more than 230 barrels of pesticides, acids, herbicides, and organic phosphates. The looters stole 55-gallon barrels to use for benzene (gasoline) storage and had no need for the chemicals inside. To make the barrels lighter and easier to move, the looters opened them and dumped their contents onto the ground inside the facility and the streets of the surrounding neighborhoods. Some of the looters simply opened the barrels and rolled them down the streets, splashing the contents out onto the pavement.

When the initial site survey team from the Chemical Section arrived, it saw several children vomiting and found many dead animals, and more than 20 pigeons. To make matters worse, the affected civilians in the immediate area refused to leave their homes because they feared that their property would be looted. Based on these indicators, the Chemical Section personnel determined that they needed to mitigate the vapor and contact hazards quickly, so they developed and organized Task Force Environmental Cleanup. The task force included engineers, public affairs and psychological operations personnel, interpreters, medics, and the 2d Platoon of the 63d Chemical Company (Smoke/Decontamination).

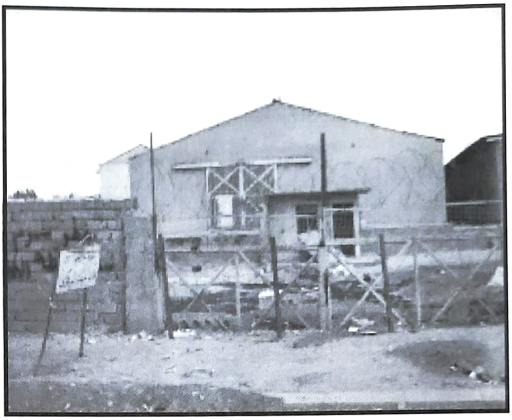
The team drew a site layout, and the deputy division chemical officer briefed the task force. The task force was to move along a semipermissive route and set up a secure staging area within 500 meters of the agricultural facility. Once the staging area was established, a smaller security element was to move forward to clear and secure the buildings within the facility. A decontamination point—between the staging area and the entrance to the agricultural facility—was designated. After the facility was cleared and secured, the 2d Platoon was to move forward and conduct a chemical reconnaissance (under the control of the Chemical Section). The 2d Platoon was to determine what key areas within the facility required mitigation or decontamination and identify the engineer asset requirements. When



The looted agricultural facility in Mosul, Iraq, where pesticides, herbicides, and other chemicals were dumped

completed, the team was to clear the site and return the next day for an assessment.

Upon arrival at the staging area, the security element established a perimeter, went to mission-oriented protective posture (MOPP) 4, and began to clear and secure buildings systematically. After the site was secured, 2d Platoon conducted a nuclear, biological, and chemical (NBC) reconnaissance, and the Improved Chemical Agent Monitor (ICAM) showed four bars positive for G-series nerve agent at 30 meters downwind of the warehouses. We knew this was a false positive because we saw people walking in the chemicals earlier that day. The M256 Chemical Detection Kit also displayed positive results, verifying that an organophosphate vapor hazard was also present. It was estimated that the looters dumped more than 200 of the 55-gallon barrels (11,000 gallons) directly into the storage yard.



The agricultural warehouse, decontaminated and secured

Although a large portion of the 230 barrels had been removed, the Preventive Medicine Section of the 801st Main Support Battalion, Fort Campbell, Kentucky, recorded the labels of the remaining barrels and identified their solutions. The barrels contained herbicides, pesticides, and acids. EasyDECON™200 foam was brought forward in an attempt to neutralize the pesticides. Soldiers were required to go to MOPP 4 before entering the hazard area and were checked for contamination with the ICAM upon exiting. Contaminated suits, boots, and gloves were removed and transported to a location outside the city, where they were destroyed.

Under the direction of the Chemical Section, the 2d Platoon decontaminated the entire area using more than sixty 5-gallon containers of EasyDECON200 foam, which was applied using the M17 Lightweight Decontamination System (known as the M17). The siphon hose attachment of the M17 was used to draw solution directly from the buckets. The solution was also applied to the floors and interior walls of two storage buildings that contained standing pools of raw liquid chemicals. The 326th Engineer Battalion (Combat) (Air Assault), Fort Campbell, Kentucky; and the 37th Engineer Battalion (Combat) (Airborne), Fort Bragg, North Carolina, brought in more than 14 dump trucks of dirt—an estimated 120 tons—to cap the sites. During the operation, the trucks were secured at the staging area several blocks away and called forward, one at a time, to off-load. This method minimized the soldiers' time in MOPP 4, reduced their exposure time, and limited site congestion.

Actions on-site took approximately six hours. The operation was completed at night, when the temperature was in the high 80s. Finally, the gates of the agricultural storage facility were closed, and two dump trucks of dirt were placed at the front of the entrance to deter access to the site. This terrain decontamination operation was the first (and possibly the only) terrain decontamination done during the Operation Iraqi Freedom combat operations.

The next day, the task force revisited the site, conducted a follow-up survey, and inspected the dirt seal. No vapor hazard was detected. The EasyDECON 200 foam that was applied to the ground and the inside of the two storage buildings appeared to be effective in drying and neutralizing the chemical mix. The storage building floors, which were once covered in pools of chemicals, were dry. The preventive medicine staff stated that the immediate threat was gone and conducted interviews with the local civilians. The civilians appreciated the quick response, and we gained their respect for our efforts. The Chemical Section exhausted its organic capabilities but eliminated the immediate threat and recommended to V Corps that more assets and actions were required to fully alleviate the conditions at this toxic site, including the removal and disposal of contaminated soil.

The 926th Engineer Battalion from Montgomery, Alabama, is currently assigned to the 101st and is evaluating the site for additional remediation.

Major Lynch is the division chemical officer, 101st Airborne Division (Air Assault), Fort Campbell, Kentucky. During previous assignments, he was the chief of experimentation and the concepts officer of the Directorate of Combat Developments, U.S. Army Chemical School, Fort McClellan, Alabama, and served two tours in Germany.

Battlefield Decontamination Using Aircraft

By Captain David Bergman

The Australian Defence Force (ADF) has never had the luxury of a dedicated Chemical Corps or the decontamination battalions that are available to our allies in the United States and Britain and our nonallies such as the former Soviet Union. The ability of the ADF to decontaminate in a chemical, biological, radiological, and nuclear (CBRN) warlike environment at the tactical level is based on limited equipment and personnel at the brigade level. The decontamination capability currently consists of combat engineer regiments and a troop from the Emergency Response Squadron, Incident Response Regiment. Because decontamination is only one of a range of tasks for each, the priority for training, experience, and preparation for brigade decontamination tasks is at a low level. The employment of decontamination assets is based on post-World War II developments.

Ways to increase the effectiveness of the limited resources that we have at the brigade level for decontaminating large numbers of vehicles and personnel in a tactical warlike environment needs to be looked at from as many different perspectives as possible. In this time of change, we need to look to battle cunning[1] to provide an edge in a difficult task and look laterally to apply techniques used by other organizations.

This article explores the "outside-the-box" concept of using aircraft on the battlefield to assist engineers in mass chemical and biological decontamination of vehicles, personnel, and ground. It also suggests the possibility of sharing this resource with other Australian national stakeholders.

Outside the Box

When you think outside the box,
The problem's always greater.
The reality is often such
That the others just don't get it.

It's often hard to visualize
And harder to explain,
But what's as plain as your nose
Can be someone else's game.[2]

Background

"*Land warfare represents the most comprehensive form of conflict and, until recently, victory or defeat on land has been synonymous with victory or defeat for the state.*"[3] With the increase in world tension in respect to the proliferation of chemical and biological weapons, the ADF needs to be able to better support units on the battlefield. Currently, engineers provide this support in the form of mobility/survivability at the tactical level of operations, which includes decontamination.

"*Decontamination is a progressive operation that removes residue contamination from personnel and material with the aim of restoring combat power by allowing a reduction in protection levels.*"[4] Decontamination is traditionally a labor-intensive task. The Soviet Union, prior to its loss in the Cold War, employed thousands of troops dedicated to decontaminating its forces en masse on the battlefield. As a small force, the ADF needs to have a knowledge edge over potential adversaries.[5] For example, to decontaminate a brigade on the battlefield, we may be able to look to technology to overcome labor and other resource requirements.

Technological Advances

There have been advances both in aircraft and in additives to water to increase the fire retardant effectiveness of water. One advance in technology that has a relevance to decontamination on the battlefield is firebombing aircraft.

Foam

Foam is used as an additive to water for firebombing tasks. An example of this is the Bombardier CL-415 amphibious aircraft where the foam chemical is carried in one or two 300-litre (80-gallon) reservoirs. "*When used, it is injected into the water load at a ratio of 0.3 percent to 0.6 percent by volume. Using a 0.4 percent concentration, which is typically used in fire fighting, a 6,000-litre (1,585-gallon) water load requires only 24 litres (6.4 gallons) of foam concentrate.*"[6] "*Class 'A' fire fighting foam, as it is more commonly known, is*

designed to be mixed with water to produce a very effective fire suppressant. Foam has the following characteristics:

- *It improves the drop pattern.*
- *The mixture of foam and water expands and doubles the drop area.*
- *It protects unburned vegetation and structures.*
- *It increases moisture penetration, creates an air barrier, and reflects radiant heat.*
- *It also clings to tree and structure surfaces providing additional protection.*
- *The foam drop can easily be seen from the air, enabling pilots to maximize coverage."*[7]

The characteristics outlined above appear similar to those desired in the use of Canadian Aqueous System for Chemical-Biological Agent Decontamination (CASCAD) or similar decontamination agents. One of the reasons sited for moving to foam over other fire-suppressant additives is that *"foam is inexpensive compared to the cost of dropping an equivalent quantity of long-term retardant (red slush commonly used as a fire barrier)."*[8] The benefits to the ADF are not necessarily the cost but the capability of providing large amounts of decontamination foam over a large number of equipment and it stores quickly and efficiently.

The suitability of the firebombing aircraft to be utilized in battlefield decontamination depends on the performance of decontamination foam when dispensed from aircraft. The crux of the issue is whether decontamination foam has the same or similar properties that allow it to be dispersed from aircraft, just as fire retardant foam is now. Defence Science and Technology Organisation (DSTO) specialist support and trials are required to qualify the suitability of this method of decontamination.

Quick and efficient decontamination of contaminated personnel and equipment on the battlefield is a significant goal. As stated in ADF Publication (ADFP) 15, *"The need for decontamination will significantly affect any operational plan. A commander must decide on the degree of decontamination necessary and the control measures to be adopted. Decontamination will impose delay to operations and may render the force less capable of defeating a follow-up attack."*[9] A method that sees the decontamination process commenced in a comparatively short time is worth exploring.

Fire Fighting and Aircraft

In fighting bushfires, as in most other areas of life, the issue comes down to one of cost. In respect to the ADF, cost does play a part, but it could be argued that it is the capability that takes priority. The Australian Fire Authorities Council found that ground suppression is the most cost-effective means of fire suppression where access is good.

The council also found that *"the operating cost of medium helicopters is higher than fixed-wing aircraft carrying similar loads, but their accuracy and ability to pick up retardant close to the fire can make them more cost effective."*[10]

The council investigated the option of investing in large aircraft and found that *"the investment required for the operation of large air tankers or water scoopers is not justified."*[11] This appears to be due to the costs involved. The current line of thinking supports this with a recent report in the news media stating that *"the federal government will spend as much as $5 million—up to half the cost—to bring three helitankers to Australia for the bushfire season."*[12]

Successful aircraft decontamination foam dispersal trials would open up possibilities of asset sharing between the ADF and other state and federal agencies. This would provide a combat capability for the ADF, while providing potential cost savings for other government agencies.

Chemical, Biological, and Radiological Weapons

Indirect fire support weapons capable of delivering chemical, biological, and radiological (CBR) warheads for use in the tactical battlefield environment and their chemical/biological effect on the battlefield is questionable. *"Even missiles with chemical and biological warheads, however, may be more terror weapons than true weapons of mass destruction."*[13] In his book, Cordesman's reason for this is that *"under optimal conditions such as exposed personnel, a flat plane, and optimal delivery conditions, the VX chemical warhead used on a Soviet version of the Scud missile indicates a 50 percent casualty rate for exposed personnel as opposed to a real lethality rate estimated at between 5 and 20 percent."*[14] Given that the use of CBR weapons on the battlefield may not produce as many physical casualties as desired, these weapons have the potential to produce results out of all proportion to their size.

Without effective and efficient decontamination methods, the combat effectiveness of a brigade could be removed for a considerable time. As ADFP 15 outlines, *"Priorities for decontamination must be clearly directed by the commander and initial measures should be limited*

to those necessary to allow operations to continue. The following principles of decontamination should be considered in order of priority:

- ***As soon as possible.*** *The sooner the contamination is removed, the sooner the protective clothing levels can be reduced and combat power restored.*
- ***Only where necessary.*** *To survive and win in a contaminated environment, precious resources and time cannot be wasted. Thus, decontamination should only be carried out where it is necessary to continue the mission.*
- ***As far forward as possible.*** *Contaminated personnel and equipment should not be moved rearward if decontamination assets can be moved forward safely. This allows assets to be where they are needed and decontamination to begin earlier and limits the spread of decontamination to other areas.*
- ***By priority.*** *Items of equipment should be cleaned in their order of importance to the mission."*[15]

If the methods used by firebombing aircraft to dispense firefighting foam on fires can be applied to dispensing decontamination foam by similar aircraft, then the four principles of decontamination can be enhanced. The end result is that having a quick and efficient method of providing large amounts of decontamination foam to where it is most needed can reduce the effectiveness of CBR weapons.

Trials

Upon concurrence with DSTO on the feasibility of decontamination foam theoretically being able to be delivered effectively from aircraft, there are several ways for trials to be conducted. The first, with the blessing of fire brigades, is to conduct limited trials with medium helicopters hired by the federal government during their time in Australia later this year.

Another option would be to conduct limited trials in Canada. This could take many forms, one of which could be joint trials with the Canadian Defence Force. These trials could make use of the CL-415, which is fitted for foam dispersal.

Using current ADF aircraft and modifying them to dispense foam is a third option. All current ADF aircraft that provide a lift capability could be modified to allow them to undertake decontamination tasks. This includes Black Hawk, Chinook, and Hercules aircraft. The question of providing this capability for fire fighting would need to be addressed in a different forum. However, it is worth noting that by participating in firebombing activities, aircraft crews would be maintaining skills similar to those needed to carry out a decontamination task on the battlefield. If required, during bushfires these assets could be available to state governments as part of the Defence Force Aid to Civilian Authority. This would combine with the ADF chief's philosophy when he was land commander: "*Our skills must be second to none, honed for combat but adapted for peace.*"[16]

Bombardier CL-415 Aircraft

It is worth looking at the CL-415 as a decontamination-dispensing platform because its versatility may add to decontamination tasks it could potentially be used upon. One example would be large oil spills at sea. "*The multipurpose CL-415MP [multipurpose] is designed to help governments manage a wide range of state responsibilities with a unique aircraft. The CL-415 was designed from the outset for daily operations in very demanding conditions: very short response times, short take-off and landing distances, high maneuverability, and the ability to operate from land or from the sea.*"[17]

"*Other fixed-wing aircraft simply don't have the structural integrity—especially the corrosion resistance—the configuration, nor the performance to accomplish what the Bombardier [CL-415] is able to do. Helicopters approach the versatility of the CL-415MP but offer less speed, range, and endurance and have substantially higher acquisition and life cycle costs.*"[18]

The benefits of sharing a purpose-built aircraft such as the Bombardier CL-415 is outlined in their information. "*A Ministry of Interior will perform police operations against drug smuggling, infiltrations, and illegal immigration. Civil protection departments will use the aircraft for disaster relief, carrying equipment, supplies, and technicians to short airstrips or to isolated areas. Environment and forestry departments will benefit from its unsurpassed aerial firefighting capabilities but also be able to detect and monitor pollution at sea, contain oil slicks, and gather samples from the water surface for analysis, treatment, and evidence. Agricultural entities will perform pest control on large areas with the recently developed spray system. Fisheries and customs defence agencies will do discrete surveillance and identification of vessels [and] their activities but also be able to land and intervene. Coast Guard and*

defence agencies will have the benefits of an aircraft that is also a fast boat, patrolling at 120 knots and 500 feet, and able to deploy Bombardier's Jet Boat to reach ship or shore or to perform direct search and rescue."[19]

Summary

There have been no significant improvements in battlefield decontamination delivery methods over the past fifty years. Battlefield decontamination still relies on vehicles, held in reserve of maneuver units, being brought forward to deliver equipment, water, and personnel to the contaminated unit, with the aim of restoring combat power by using standard techniques. By looking at developments in fire-fighting techniques and, in particular, advances in foam dispensing from aircraft, an opportunity exists to modernize and enhance battlefield combat decontamination delivery methods.

The vision of seeing firebombing aircraft laying decontamination foam over a contaminated mechanized brigade—allowing the decontamination process of vehicles and equipment to be sped up and therefore more quickly continuing the maneuver warfare battle—has many benefits. Not only does it allow combat power to be restored more quickly, but it also reduces the effectiveness of CBR weapons and reduces the use of significant resources such as manpower, time, and equipment.

Endnotes

[1] Land Warfare Doctrine 1: Fundamentals of Land Warfare, (LWD 1), 2002.

Note: Battle cunning is the basis of "bottom-up" innovation in the conduct of tactical land force operations. Battle cunning is the use of initiative to best adapt to, and take advantage of, the prevailing circumstances. It creates surprise and confusion in combat that undermines the enemy's cohesion and effectiveness.

[2] D.A. Bergman, September 2001.

[3] Land Warfare Doctrine 1.

[4] ADFP 15, *Operations in a Nuclear, Biological and Chemical Environment.*

[5] Land Warfare Doctrine 1: *Fundamentals of Land Warfare*, (LWD 1), 2002.

[6] *<http://www.aerospace.bombardier.com/en/3_0/3_3/3_3_9.html>*

[7] Ibid.

[8] Ibid.

[9] ADFP 15.

[10] A. Victoria Hodgson, Department of Conservation Forest and Lands, *Firebombing*, 1987.

[12] Use of aircraft for firebombing in Australia, The Australian Fire Authorities Council, 1996.

[12] *The Sunday Telegraph*, September 15, 2002, p.96.

[13] A. H. Cordesman, *Weapons of Mass Destruction in the Middle East*, 2000, Brassey's UK, p.56.

[14] Ibid., p.58

[15] ADFP 15.

[16] ADFP 15.

[17] *<http://www.aerospace.bombardier.com/en/3_0/3_3/3_3_7_61.html>*.

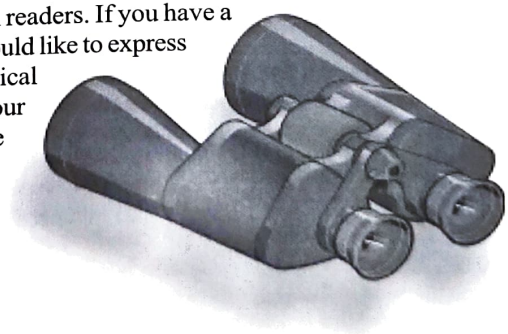
[18] Ibid.

[19] Ibid.

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When You Only Have *Two Days*

By First Lieutenant Alexander L. Carter

The mission of the U.S. Army Civil Affairs and Psychological Operations Command (Airborne) (USACAPOC[A]) is to train, validate, and monitor the readiness of assigned Active Component, Reserve Component, and civil affairs/psychological operations (CA/PSYOP) forces to accomplish assigned missions in support of the warfighting combatant commanders.

About 96 percent of the command's approximately 10,000 soldiers are with the Reserve Component, located in 26 states and the District of Columbia. USACAPOC(A) is headquartered at Fort Bragg, North Carolina, and is one of the three major subordinate commands that comprise the U.S. Army Special Operations Command. As Army special operations forces (ARSOF), they maintain high standards of training and physical readiness so that they can deploy anywhere in the world on short notice. This standard of training, which includes proficiency in nuclear, biological, and chemical (NBC) defense readiness, was tested commandwide when the command's reserve units were mobilized to support the global war on terrorism.

Premobilization Preparations

Like the other Army commands, USACAPOC(A) historians will record and document the monumental effort that reserve units put forth to be fully mission capable and ready to deploy to support combat operations in Southwest Asia. As part of its premobilization and mobilization activities, USACAPOC(A)'s CA/PSYOP units completed weeks of logistical, administrative, and readiness training and tasks so that they could be validated at an Army installation's mobilization station (MS). At the MS, the installation commander is responsible for validating whether the unit is able to accomplish its wartime mission.[1] It is not the intent of the MS commander to provide training time and resources for units to train up on tasks that should have been performed at the home station, since this can slow mobilization processing and cause a unit to be delayed.

Unfortunately, many units arrived at Fort Bragg without having conducted a satisfactory level of premobilization NBC training. Clearly, NBC training had not been planned in their training schedules. For example, several units had not been trained to standard on critical NBC tasks such as administering the Nerve Agent Antidote Kit (NAAK), drinking water from a canteen in mission-oriented protective posture (MOPP) 4, and reporting an NBC attack over the radio using the NBC reporting standard. General George C. Marshall once said, "We cannot train without planning, and we cannot teach without preparation."[2]

Additionally, many units had not purchased enough NBC training equipment to support the NBC training goals during the fiscal year; therefore, it can be argued that some units had not treated NBC as another battlefield condition within which to train on their mission-essential task list. "NBC warfare is not a separate, special form of war, but instead a *battlefield condition* [emphasis added] just like rain, snow, darkness, electronic warfare, heat, and so on. Units must train to accomplish their wartime missions under all battlefield conditions. Whenever NBC is separated from other training events, we condition our soldiers to regard operations under NBC conditions as a separate form of warfare."[3]

Training Concerns

What was clear to the command leadership was that a premobilization NBC training program meeting the requirements for the fiscal year 2003 common task list had to be implemented quickly. The program also had to incorporate additional NBC tasks that, in my judgment, were especially suited to the ARSOF community. The command's NBC training program also had to be developed with these operating constraints in mind:

- Limited time
- Insufficient NBC training supplies
- Outdated NBC lane-training experience

Let me expand on each of these limitations. The units had, at most, two days of NBC training time allotted at the MS. Many units arrived at the MS without their training MOPP/Joint Service Lightweight Integrated Suit Technology (JSLIST) suits, M291 Personal Decontamination Kits, M295 Equipment Decontamination Kits, M256A1 Trainer Kits, and NAAK Trainer Sets. Several units had not conducted lane training in an NBC environment within the past 24 months. According to

Training Circular (TC) 25-10, *A Leader's Guide to Lane Training*,[4] lane training is an important part of the training evaluation and unit assessment process. Lane training is "a systematic, battle-focused, performance-oriented training process used to plan, execute, and assess unit training to achieve maximum training results with limited time and resources."[5] Based on these constraints, the NBC mobilization training was built as a two-day program with the second day devoted to lane training. The plan was to break the units into operational elements/teams and run through an evaluated battle-focused scenario (reacting to a chemical/biological attack). USACAPOC(A) provided the training supplies, decreasing the reliance on the units to provide them.

NBC Training

The training program was staffed by the primary instructors (the command chemical officer and the command NBC noncommissioned officer [NCO]) and a number of 54B-qualified personnel from other subordinate commands and units. In this manner, many NBC NCOs helped to train their own soldiers so that they could, in turn, take the training and deliver it throughout their own command structure, ensuring consistency of content and quality.

Each block of instruction followed the crawl-walk-run approach that is discussed in Field Manual (FM) 7-0, *Training the Force*.[6] During the *crawl* phase, the instructor taught the program of instruction using a demonstrator. The *walk* phase involved group practice and individual validation on each task. The *run* phase was designed exclusively for the second training day.

Day One: Crawl and Walk

Day One was primarily Skill Level 1 NBC tasks from the fiscal year 2003 Common Task Test (CTT).[7] Table 1 shows the training sequence.

Day Two: Run

The lane training was organized to incorporate many of the individual NBC tasks (see Table 1). The lane was organized into a five-step process:

Assembly Area: At the beginning of the day, the group was briefed on its mission and then task-organized into tactical teams or detachments that usually consisted of 4 to 12 soldiers each.

Rehearsal: Teams were allowed to practice team drills such as performing mask drills, administering the NAAK, radioing in an NBC 1 report, and identifying alternate team leaders.

Lane Execution: Each team began at a start point in MOPP 0 and moved through two phase lines (PLs) and a release point. At a location determined by the observer-controller (PL 1), the team came under a chemical/biological attack; their performance was then evaluated. Part of the exercise at PL 1 included a set of CTT tasks conducted both individually (individual decontamination, for example) and collectively (administering the NAAK to a casualty and transporting the casualty out of the area). Teams were then required to move the chemical/biological agent casualties back to a rally point (PL 2). This was clearly the most physically demanding part of the lane training, since team members had to move simulated casualties across wooded terrain as efficiently and effectively as possible under mental and physical duress.

Table 1. NBC Training Sequence

1	Maintain your assigned protective mask.
2	React to chemical/biological hazard/attack—mounted and dismounted.
3	Conduct immediate decontamination using M291 and M295 Decontamination Kits.
4	Protect yourself from injury by assuming correct MOPP.
5	Provide JSLIST suit demonstration and instruction.
6	Detect/identify chemical agents using M9 and M8 detector papers.
7	Identify chemical agents using M256 detector paper.
8	Submit NBC 1 report.
9	Protect yourself from contamination while drinking from canteen in MOPP 4.
10	Conduct unmasking procedures with and without an M256A1 Chemical Agent Detector Kit.
11	Administer nerve agent antidote to self, and administer first aid to a nerve agent casualty, and then transport casualty.
12	Use latrine in MOPP 4.

After-Action Review: Once back at a rally point, the teams conducted additional NBC tasks as part of PL 2. The observer-controller then gave the all-clear signal, signifying the end of the exercise, and had an informal after-action review.[8]

Retraining: Units were advised to conduct retraining based on the lessons learned.

Lessons Learned

A number of valuable lessons in implementing a simple, effective NBC training program were learned. Table 2 on page 34 lists some of the important characteristics to remember. First and foremost, the

program must be developed with the intent to model it down to subordinate units. A "universal" command NBC training program, in terms of content and delivery, will motivate units to acquire and procure appropriate NBC training supplies and possibly share NBC trainers. Additionally, training consistency is beneficial for any organizational inspection program. For example, many of the inspectable areas relating to NBC are linked to whether or not a unit has conducted specific types of training.



Moving a casualty back to a rally point over varied terrain

Second, it takes a strong coordinated effort among a command's operations, logistics, and resource managers. These managers must coordinate with the individual unit commanders so that the instructors, equipment, and funding converge at the right time and place. Remember, a mobilization station will not release a unit to deploy unless that unit is 100 percent validated on its mobilization tasks/stations. All USACAPOC(A) active and reserve units were validated and met their ship-out dates due to the concerted efforts of several support functions at the command.

Third, as with other training areas, physical fitness was a contributing factor. Carrying a casualty while in MOPP 4 for an extended period of time across uneven terrain is no small task. During our lane training, soldiers commonly hyperventilated while wearing their protective masks. Soldiers were taught how to combat and mitigate the psychological and physical effects of duress while wearing a protective mask.

Fourth, a reserve unit's training time is very limited. The NBC battlefield condition must be incorporated into a unit's training time. After all, if **N**o**B**ody **C**ares, there will be **N**othing **B**ut **C**orpses.

Table 2. NBC Lane-Training Characteristics

- Scenarios are mission-oriented (battle-focused).
- Tasks—individual and collective—are performance-demonstrated.
- Lane-training exercise has start point/line of departure, phase lines/testing stations, and after-action review location.
- Soldiers are trained to standard, not time.
- Exercise results help develop and refine unit standard operating procedures.
- Formal and informal after-action assessments are given, recorded, and distributed to relevant personnel and commands.

Endnotes

[1]Army Regulation 600-8-101, *Personnel Processing (In-and-Out and Mobilization Processing)*, 1 March 1997, pp. 6-9.

[2]FM 7-0, *Training the Force,* October 2002.

[3]Walter Polley, Michael Dlugopolski, and William Hartzell, "40,000 Train in Chemical Environment," *Army Chemical Review,* January 1988, p. 31.

[4]TC 25-10, *A Leader's Guide to Lane Training*, August 1996, p. 1-1(d).

[5]Ibid.

[6]FM 7-0, *Training the Force*, October 2002, pp. 5-8.

[7]ArmyStudyGuide.Com, Common Task Test description, September 2002, online at <*http://www.armystudyguide.com resources/CTT_FY03/*>.

[8]TC 25-20, *A Leader's Guide to After-Action Reviews*, pp. 4-7.

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The 42d Chemical Laboratory Company in World War II: *A Chemical Reminiscence*

By Mr. Norman Fine

A version of this article originally appeared in the Winter 2002 (Volume 20, Number 4, page 13) issue of *Chemical Heritage*.

World War II was one of the grimmest events in history. Yet to a fortunate few, "it was a good war," as the phrase goes. I was one of those few who were selected, by chance, for a military assignment in which I could use my professional training as a chemist and chemical engineer.

In 1942, I graduated from the Cooper Union in Manhattan, where I attended night school classes while working during the day for the then well-known consulting firm of Foster D. Snell in the old *Brooklyn Eagle* building, with a bachelor's in chemical engineering. After my draft number was selected in August 1943, I was sent to Camp Sibert in Alabama for basic training in the Chemical Warfare Service (CWS).

Basic training had a bad name. Yet to a kid from Brooklyn whose only previous experience with firearms was Coney Island pellet guns, it was fascinating. Like most basic training courses, CWS basic included the elements of infantry training: how to crawl under barbed wire (on your back), fire small arms, and do close-order drill—which I regarded as a sort of mass square dance.

The heart of our training was chemical warfare (CW). We learned to identify CW agents: phosgene smelled of new-mown hay; lewisite of geraniums; and mustard gas of, well, mustard. The principal method for laying down poison gas was the 4.2-inch chemical mortar. This rifle-bore mortar, equivalent to a 105-millimeter artillery piece, could accurately shoot shells loaded with either a chemical warfare agent or a high explosive. The 4.2 mortars were organized in military units that were designated as chemical mortar battalions. In both the European and the Southern Pacific campaigns, the 4.2 mortars, firing high explosives, were used against the enemy with great effectiveness.

Smoke generation and napalm were also the responsibility of the CWS. Before this time, smoke had been generated from hazardous materials such as titanium tetrachloride and chlorsulfonic acid. During my time with the CWS, there was a method for generating smoke as a petroleum aerosol, a system developed by V. K. LaMer, a physical chemist at Columbia University. Oil-tank trucks equipped with the aerosol-generating equipment were used to make smoke in the field. Napalm, at that time, was an aluminum soap of **na**phthenic and **palm**itic acids (thus **na** plus **palm**). Making jelled gasoline for flamethrowers and bombs was a matter of stirring the correct proportion of napalm into gasoline.

Defense against poison gas had three prongs: gas masks, impregnated protective uniforms, and decontamination. Protective uniforms were prepared (in modified commercial dry-cleaning machines) by drenching the garments in a kerosene solution of a wax binder and an organic compound containing free chlorine (such as Halazone). The chlorine trapped in the fabric would oxidize and neutralize any liquid vesicants—blistering agents—that came into contact with the uniforms. Treated uniforms in storage were monitored periodically for available chlorine by iodometric titration. Bleaching powder—calcium hypochlorite—was used to decontaminate nonvolatile liquid vesicants on the ground.

After basic training, I was sent (with a small group of other Camp Sibert graduates) to a military embarkation port in California. While conversing in our private Pullman car, we discovered that most of us were chemists. After a stay in California, our little group boarded a military transport to zigzag across the South Pacific to Milne Bay at the southeastern tip of New Guinea. Following a month's stay in rain-soaked tents under the palm trees of a Lever Brothers coconut oil plantation, our group shipped out again in the empty hold of a Liberty Ship (U.S. cargo ships designed to be built quickly and economically for the war effort) to Brisbane, Australia.

En route on the Coral Sea, we heard of the Allied invasion of Europe—D Day—on 6 June 1944. After a night in an Army reception center on the grounds of a former Brisbane racetrack, we were welcomed to the antipodes by the shrill scream of a kookaburra, the down under equivalent of a rooster crowing at dawn. Soon, a truck pulled up and took us to our ultimate destination: the 42d Chemical Laboratory Company.

The CWS of World War II had its origins in World War I. The German use of chlorine on the Western Front led the United States to form the American Gas Service, which trained the American expeditionary force in the use of and defense against poison gas. In 1920, Congress authorized creation of the CWS as a permanent branch of the Army with the mission of preparing effective offensive poison gas and defensive methods.

In World War II, the CWS commissioned a new type of unit, the chemical laboratory company (CLC). In all, three CLCs were organized and designated as the 41st, 42d, and 43d.[1] These companies were staffed mainly with graduate and postgraduate chemists and biologists. The CLCs trained in the identification of CW agents and tested the effectiveness of defensive equipment. The ancillary staff maintained a machine shop, the glassblowing equipment, and the experimental animals employed to test the effectiveness of new CW agents. It was intended that a field CLC would be a self-sustaining unit able to function independently for long periods. A CLC's operating base was a semimobile laboratory with close access to the front. In the event of an enemy poison gas attack, its principal mission was to get poison gas samples from the field for rapid identification and evaluation. The CLC also analyzed and evaluated captured enemy CW protective equipment and related materiel and furnished general scientific assistance to the local command.

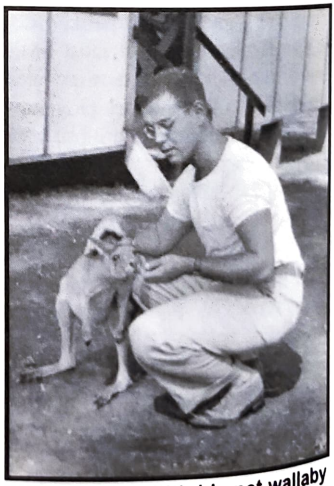


Ingarfield **Lab of the 42d CLC in Brisbane. Living quarters and lab buildings had no numbers, just names.**

From today's perspective, it is fascinating to pick up the CWS operating manual and read the official list of equipment that a CLC had to work with in 1942: chemicals, flasks, beakers, burettes, condensers, graduates, balances, various tubings, burners, and furnaces. There is no mention of pH meters, spectrometers, chromatographs, microprocessors, or any of the other high-tech equipment found in today's laboratories. Yet, using classical methods of analysis, the CLCs managed to get some useful results.

The 42d CLC came into being in May 1941 at Edgewood Arsenal, Maryland. After a training period, the original 42d embarked from the West Coast on 21 November 1941 for "PLUM," a code name for the Philippines. Still at sea when the Japanese bombed Pearl Harbor and the Philippines, the convoy diverted course to Brisbane, Australia, where it docked on 22 December 1941. The 42d was not to reach the Philippines until June 1945—3½ years later.

By June 1944 when I arrived, the 42d had been in Brisbane more than 2½ years. Some of the men had married Sheilas (a common local term for Australian women), had children, and lived off base. The base of the 42d was actually two large, formerly private, homes in Clayton, an upscale



The author with his pet wallaby in Brisbane

Brisbane neighborhood where many homes had private tennis courts. One building was for living quarters and mess hall, while the other housed the laboratory and animal quarters. Wallabies and cockatoos were common pets.

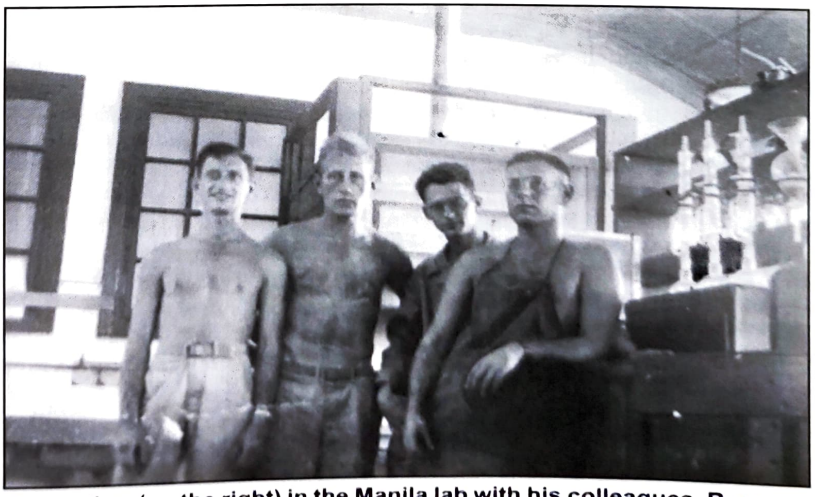
When the 42d first arrived unexpectedly in Brisbane in December 1941, no facilities had been prepared for their work. Nevertheless, the company soon organized itself into a working unit and produced useful results. Most, but not all, of the work required expertise in gas warfare. One early assignment from the Quartermaster Corps was to turn 100,000 pounds of fatigue uniforms into camouflage suits for the soldiers fighting on the islands. Using local materials, the 42d produced a dye and a procedure for a quick process to do the job. Another project studied the physical properties of CWS agents at high altitudes and low temperatures. Problems of water purification, rust inhibitors, skin dye for personal camouflage, and improved methods for using napalm are but a few examples of the developmental projects undertaken. In the analytical department, analyses of defective ordnance components, captured enemy explosives, soap and solder flux, and many other materials helped smooth our Pacific war effort.

My initial assignments were analyses of captured Japanese materiel. On one Pacific island, there was a cache of 55-gallon drums containing a watery, purplish liquid with a smell reminiscent of Teaberry chewing gum. Analysis found methyl salicylate and traces of a soluble iron salt in aqueous dispersion. The iron and salicylate reacted to form a purple compound. No literature was found with the drums, and the purpose of the liquid remained a mystery (perhaps it was a liniment). On another island, drums of a viscous, inflammable liquid were discovered. Distillation and qualitative tests (remembered from my course in organic qualitative analysis) showed that the liquid was benzene thickened with a methacrylate polymer. The liquid was probably intended for flamethrowers.

A problem of mineral analysis was that it required liquids of varying density for physical separation by flotation. One dense liquid needed was methylene iodide, which was not available in Australia. It was synthesized by first preparing a large batch of iodoform which was then reduced to methylene iodide. Obtaining chemical reagents was a constant problem. Those requisitioned from the United States involved many delivery uncertainties and delays. One time, we ordered 10 grams of dithizone, a reagent used for trace analysis of heavy metals. Dithizone is a very fluffy substance: 10 grams would fill a large jar. Several months later, a truck pulled up and began unloading 5-gallon, widemouthed carboys, each filled with dithizone; 100 *pounds* had been ordered owing to a clerical error. We distributed dithizone to every laboratory in Australia.

The CWS had a large cache of CW agents stored in 2-ton tanks in the Australian outback. The 42d had the task of inspecting and maintaining the tanks. This was a very desirable mission, although it was somewhat hazardous. A convoy of trucks and jeeps loaded with C rations and apparatus set out for a two-day trek to the dump. Using protective suits that encased the entire body, the team inspected the tanks and took samples for later quality-control analysis in the laboratory back at Brisbane.

Meanwhile, there was fierce fighting up north. On 20 October 1944, U.S. forces landed in the Philippines, and by 3 March, Manila was occupied. It was time for the 42d to move back to its original destination. Laboratory equipment and reagents were packed in crates. Somehow we had acquired a large supply of 1-pound cubes of metallic sodium in hermetically sealed tins; these were not to be taken to Manila. There was too much sodium to employ the laboratory method of disposal: dissolving sodium shavings in alcohol. Fortunately, Brisbane is near the sea. Getting the use of a fast boat, we sped

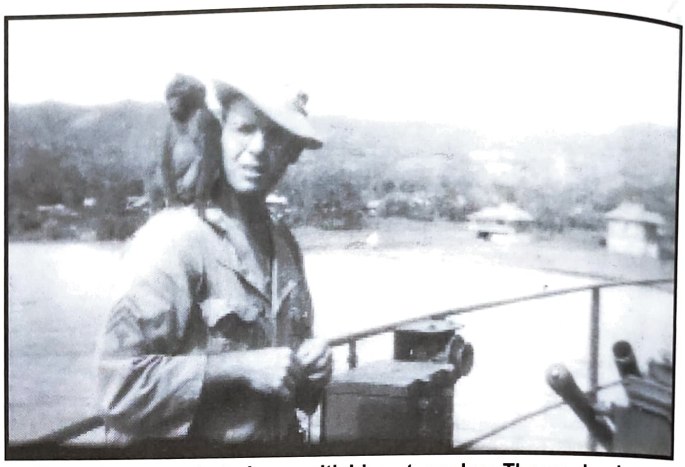


The author (on the right) in the Manila lab with his colleagues. Because of the heat and humidity, the scientists are wearing typical "lab dress."

over the Pacific Ocean, hurling punctured sodium cans over the stern. The huge eruptions of yellow flame and the sodium cans skimming over the surface made an impressive display.

In June 1945, exactly one year after I reached Australia, the 42d sailed to Manila—3½ years late. Manila was a devastated city, destroyed by heavy artillery fire. The beautiful palms that lined broad boulevards were gone. Our new laboratory occupied the former U.S. Department of Agriculture Bureau of Animal Research Station on the banks of the Pasig River that flowed through the center of Manila. The building was more or less intact, but all apparatus and equipment were gone; only the benches and tiled walls and floors remained.

By this time the war was almost over, and the supply of captured Japanese materiel dried up. However, some local technical problems were presented to the 42d. One problem was some suspected counterfeit coins. In anticipation of liberation, the government had minted a large quantity of Filipino specie, including silver coins equivalent to quarters and half-dollars. Many of the new silver coins did not ring true, suggesting that they were counterfeit. Samples of the suspect coins were submitted to the 42d for examination. Quantitative analysis for silver by both gravimetric and volumetric methods using silver chloride precipitation and the Volhard titration method with potassium thiocyanate showed the correct 90 percent of silver. Electrolytic and volumetric analysis for copper also found the correct 10 percent. However, close physical examination of the coins showed a thin sandwich layer of slag in each "counterfeit" coin. Apparently, the alloying process had been faulty, and it was the layer of impurity that deadened the ring rather than counterfeiting.



The author en route to Japan with his pet monkey. The monkey jumped ship and was last seen swimming back toward the Philippines.

For this and other efforts, the Philippine government later awarded the 42d the Philippine Presidential Unit Citation Badge "for exceptionally meritorious conduct in the performance of outstanding service."

Victory Over Japan (VJ) Day was 6 August 1945. With no more official work, the 42d cadre was told that they could undertake any research project they wished. The local Army command organized an Armed Forces Institute to give academic courses to the troops. I helped organize the institute and taught math courses, for which I received a commendation.

One day, I heard that soldiers were needed in Japan. Replacements were required for the 82d Chemical Mortar Battalion that was assigned to occupation duty in Japan. This battalion, unlike the 42d, saw heavy fighting in the jungles of the South Pacific and suffered many casualties. With the war over, I felt that I might as well complete my tour in Japan. For the first time in my Army career, I volunteered and was joined by several friends from the 42d. After several months of occupying Japan in the pleasant seaside town of Mito (only lightly bombed) with weekend trips to Tokyo and nearby hot spring spas in the mountains, I boarded a final transport for return to the United States. This time there was no zigzagging; we took the great circle route to California. I was discharged in February 1946 at Fort Dix, New Jersey, and headed home to Brooklyn.

Endnote

[1]Poison gas was used extensively in World War I, and it is believed that Japan used it in China in World War II. The three Chemical Laboratory Companies were commissioned with the expectation that poison gas might be used and that the United States must be prepared to counter it scientifically. Fortunately (if that word can be applied to any aspect of World War II) poison gas was not used. But if it had been, the CLCs were ready.

Mr. Fine lives in Sewell, New Jersey.

Transforming Training Through the Increased Use of Distance Learning

By Ms. Sandra Gibson and Mr. Larry Helms

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"The delivery of standardized individual, collective, and self-development training to soldiers and units anywhere and anytime through the application of information technologies."

—The U.S. Army definition of distributed learning

The Strategic Plan for Transforming DOD Training, 1 March 2002, recognizes that "transformed training" is the key enabler to transforming the Department of Defense. An essential component for transforming training is the increased use of distance learning methodologies.

In some form or other, distance learning has been an alternative to the traditional classroom for many years. The term *distance learning* was coined by Otto Peters and other practitioners at the University of Tubingen in the 1960s.[1] The term has evolved to *distance education* and most recently *distributed learning* (DL). As early as the 1940s, the U.S. military began employing print-based correspondence courses. Other media delivery used by the military through the years included television; "teleteaching," which used commercial dial-up telephones; electronic blackboards; and more recently, personal computers. In November 1997, the Distance Learning/Training Technology Applications Subcommittee of the Secretary of the Army's Education Committee was established to review and evaluate the status of DL within Army training. In a June 1999 briefing to the Secretary of the Army,[2] the subcommittee recommended that the U.S. Army Training and Doctrine Command (TRADOC) adopt the Internet as The Army Distributed Learning Program (TADLP) distribution backbone, enabling training to be Web-centric in the long term. The subcommittee also added that the Army must use CD-ROMs as a convenient, necessary interim measure while transitioning to the Web. This article provides an update on the status of DL development at the U.S. Army Maneuver Support Center (MANSCEN) Directorate of Training Development (DOTD), Fort Leonard Wood, Missouri, and more specifically, near-term plans for implementing the DL courseware being developed.

During the stand-up of MANSCEN, senior leaders recognized that DL would play a major role in future Army Transformation processes and opted to establish a Multimedia Development Team (MDT) within DOTD. The DOTD MDT has the responsibility to conduct MANSCEN DL contract oversight for contractor-developed courseware, develop selected in-house multimedia products, and upgrade legacy MANSCEN school courseware. The MDT staff is comprised of instructional designers, training technicians, a visual information specialist, and a computer scientist specifically trained to facilitate courseware development at MANSCEN.

To establish the MDT workload, the MANSCEN schools' courseware redesign and development requests are reviewed by MDT and approved by DOTD. Course priorities are determined, based on a careful review of the TRADOC TADLP courseware redesign list published each fiscal year. TRADOC schools may at any time nominate courses to be added to the redesign list. Course nominations are reviewed at TRADOC and prioritized reflecting the Army's strategic needs. Courses accepted on the list are the Army's top priority for DL course redesign. TRADOC allocates DL funds on a priority basis to redesign about forty courses per year. Once the DOTD MDT annual course redesign and development requirements are established, a decision is made whether to conduct some of the funded courseware development work in-house (by requesting a waiver from TRADOC) or to proceed with contracting the work to one of the TRADOC courseware



development contractors. In any case, MDT personnel work closely with MANSCEN DOTD Warrior and school training developers throughout each phase of the development.



Early MANSCEN courseware development efforts were primarily targeted for CD-ROM-based delivery. In 2002, the emphasis changed to developing Web-based courseware. The time required to complete an average forty-hour DL course redesign project in TRADOC is 24-30 months.[3] In an attempt to reduce the overall time required to create courseware at MANSCEN, DOTD has implemented a Rapid Courseware Development Model (RCDM). This model is a new approach not currently used by other TRADOC schools. We requested and received approval to augment the in-house MDT with personnel contracted to develop Instructional Media Design Packages and storyboards on-site under the close watch of MDT. This approach uses highly skilled contracted instructional designers and writers working alongside the in-house MDT, allowing them to be able to redesign and develop 100 hours of interactive courseware this fiscal year. We believe the DOTD RCDM will prove to be a very successful initiative to reduce interactive courseware development time.

Having a reliable, proven avenue for DL implementation is just as important as courseware development. We must have a method and procedures for delivering the completed courseware and providing the essential support that students require in order to have a successful experience with DL. To that end, we developed what we are calling the MANSCEN Advanced Distributed Learning University (ADLU), a three-phased (crawl-walk-run) implementation plan for DL. The overall mission of the ADLU includes—

- Providing the infrastructure and support to facilitate individual, collective, and self-development training anywhere and any time.
- Leveraging cutting-edge DL technologies and methodologies to provide soldiers a lifelong learning experience in a positive, effective, cost-efficient, stimulating, and motivating environment that supports Army Transformation.
- Improving individual and unit readiness.
- Supporting Army DL initiatives.
- Seamlessly integrating the MANSCEN infrastructure with the Army Knowledge Online as the primary gateway to MANSCEN DL.

Major General R.L. Van Antwerp, MANSCEN commander, approved the MANSCEN ADLU Implementation Plan in October 2002, with the first phase of the plan being a test of our student support infrastructure, as well as establishment of the MANSCEN help desk, staffing roles, responsibilities, requirements, and operating procedures.

One of the key components of the MANSCEN ADLU student support interim infrastructure is the DOTD Aspen Learning Management System (LMS). The LMS will allow MANSCEN ADLU students a means to access MANSCEN courseware online. TRADOC is in the process of establishing an objective learning management system (OLMS). When it is fully functional, we will transition to the OLMS. Courses developed to TRADOC's established standards will be compatible with either system. An LMS/OLMS allows us to track such things as student enrollment, student progress, course completion, and student success (test scores).

The MANSCEN ADLU pilot is not only designed for success, but our intent is to harvest valuable experiential data on how best to implement an ADLU at Fort Leonard Wood. To that end, an operations council and a strategic council (council of colonels) will be used to develop, execute, monitor, and review the ADLU pilot. The strategic council, chaired by the DOTD, will—

- Identify the goals and the overall direction for the pilot and subsequent phases.
- Establish and staff the operations council.
- Represent the interests of the MANSCEN schools' commandants (to be represented by the Directors of Training from the Chemical, Engineer, and Military Police Schools) and the Noncommissioned Officers Academy commandant.
- Provide resource recommendations for the ADLU follow-on phases.

The operations council, chaired by the Chief of the Multimedia Development Division, DOTD, will—

- Monitor and manage the ADLU pilot and subsequent phases.
- Actively review and examine the post-pilot results to harvest lessons learned and incorporate them into the subsequent ADLU phases.

CML



- Coordinate student participation for courses identified in the ADLU pilot plan.
- Recommend ADLU improvements and changes to the strategic council.

The first "window of opportunity" for the test or pilot phase of the ADLU Plan is the April-June 2003 time frame. Courseware scheduled for testing includes the—

- 12B10 (Reclass) Combat Engineer Training.
- Nuclear, Biological, Chemical Defense Course.
- Military Police Total Army Training System Advanced Noncommissioned Officers Course.

Our plan is to fully test the infrastructure by including courses for all three proponent schools and students from a variety of locations using various technology levels of automation equipment (varying bandwidths and computer configurations). Such a plan requires a considerable amount of coordination and decision-making. We are currently coordinating with the proponent schools to provide e-mentors/instructors, the National Guard Bureau to provide students for the pilot, the Directorate of Information Management to establish help telephone lines, the Directorate of Common Leader Training to develop a one-day e-mentor instruction class, and Army Training Requirements and Resources System personnel to ensure that students receive the appropriate credit for the courses they complete. During the pilot phase, a help desk will be manned 12 hours a day, 7 days a week to provide course assistance. The e-mentors/instructors will be trained to provide basic technical assistance to the students in addition to their subject matter expertise.

At the conclusion of the ADLU pilot phase, the strategic council and the operations council will analyze data collected, based on preestablished goals and success metrics, and formulate lessons learned and ADLU resource requirements from the experience. These lessons learned and recommended improvements and changes will be carried forward to the next MANSCEN ADLU implementation phase.

Endnotes

[1] M. Moore and G. Kearsley, *Distance Education: A Systems View.* Belmont, California: Wadsworth Publishing Company, 1996.

[2] A. Chute and H. Mehlinger, *Reportout of the Distance Learning /Training Technology Applications Subcommittee to the Secretary of the Army.* Washington, D.C., June 1999.

[3] U.S. Army Audit Agency, Audit Report: A:2002-XXX-FFF. *Courseware Development for Distance Learning*, 18 July 2002, p.1.

References

Abell, M. (2000). *Soldiers as Distance Learners: What Army Trainers Need to Know.* Paper presented at the Interservice/Industry Training, Simulations, and Education Conference (I/ITSEC), 2000.

U.S. Army Maneuver Support Center. *Advanced Distributed Learning University Plan (Phase I) for MANSCEN.* Fort Leonard Wood, Missouri, 2000.

U.S. Army Training and Doctrine Command. *Army Distance Learning Plan.* Fort Monroe, Virginia, 1996.

Wisher, R., Sabol, M., and Moses, F. *Distance Learning: The Soldier's Perspective.* U.S. Army Research Institute Special Report 49, 2002.

Ms. Gibson is the chief, Development Support Department, Directorate of Training Development, U.S. Army MANSCEN, Fort Leonard Wood, Missouri. She has worked in the training development arena for about 15 years and also has a background in resource management. Ms. Gibson holds a bachelor's in business administration.

Mr. Helms is the chief, Multimedia Development Division, Development Support Department, Directorate of Training Development, U.S. Army MANSCEN, Fort Leonard Wood, Missouri. He is the point of contact for coordination and installation-level management of The Army Distance Learning Program (TADLP) courseware development initiative for Engineer, Military Police, and Chemical School products. Mr. Helms holds a bachelor's in psychology and sociology and a master's in education from Drury University, Springfield, Missouri.

UPDATE: *The pilot phase of the ADLU Plan was conducted as scheduled with some success. The establishment of a student base was challenging because of the ongoing Operation Iraqi Freedom. We ended up with a much smaller number of students than we envisioned, but we still gained invaluable experience and collected data to guide the follow-on phases of the MANSCEN ADLU program. During the pilot, we were able to fully test our LMS and identify associated problems, and we got a much more realistic concept of the resources required to implement DL. The after-action report for the pilot is currently being finalized.*

Following completion of the pilot phase, a decision was made to transition responsibility for the execution of the ADLU Implementation Plan from DOTD to the Directorate of Common Leader Training (DCLT). The handover date for that action was 15 July 2003, and DCLT is in the process of developing a strategy for conducting the follow-on phases.

Happy 85th, Dragon Soldiers!

The period from 25 June through 27 June 2003 marked the Chemical Corps's 85th birthday. For the second consecutive year since moving to Fort Leonard Wood, Missouri, the Chemical School celebrated with exuberance! The week began with athletic competitions between units within the school, and on Wednesday, the Regiment gathered at 0500 for a 3-mile run around the installation. Thursday was the regimental golf tournament, and on Friday, the celebration was capped off with the regimental picnic and athletic championship matches. Many thanks go out to the staff of the 3d Chemical Brigade, particularly MAJ Jeff Stolz, SGM Robert Davis, and MSG William Satterwhite and to CPT Robert Paul of the Chemical School staff.



Looks like Regimental Command Sergeant Major Hiltner is planning to take the rest of the afternoon off... No shoes in the pool there, Sergeant Major!



Food, games, and athletic competitions were part of the regimental picnic celebration.





Command Sergeant Major Burns of the 84th Chemical Battalion knows what's coming. Look at him—undaunted, defiant even, and yet so vulnerable. Note, too, Sergeant First Class Stokes' smile of anticipation.

CML

