ARMY CHEMICAL REVIEW

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What are these men looking for? See page 13.

Writing contest winners! Pages 3, 17, and 25

HEADQUARTERS, DEPARTMENT OF THE ARMY

Chief of Chemical

I take great pride in assuming the position of Commandant, U.S. Army Chemical School and being your Chief of Chemical. As Chief of Chemical, my responsibilities encompass both the Branch and Personnel Proponent aspect for Chemical Operations in the Total Army.

I have the responsibility to develop and document concepts, doctrine, tactics, procedures, organizational designs, materiel requirements, training programs, training support requirements, and manpower requirements for our branch.

Personnel life cycle functions management for the Corps is also within my charter. Further, I am obligated to instill in chemical soldiers a sense of history, professionalism, and esprit exemplified by past chemical soldiers in defending our country.

I look forward, with your help, to successfully executing these tasks. We in the Corps must work together to achieve consensus and move forward with a single vision as we continue service to our great nation. The way ahead will see numerous new concepts, such as the newly published Biological Defense Concept (TRADOC PAM 525-63) and the Draft Passive Defense Concept for Theater Missile Defense, and the impact of new technologies, such as stand-off detection, biological detection systems, automated warning and reporting, digitalization, bi-/multi-spectral smoke, and nonlethal systems.

Managing change while maintaining our traditional pillars of technical and tactical competence will require the integration of all our efforts if we are to succeed. Our plan is to focus on war-fighting (joint and combined) while responding to the "Operations Other than War" challenges of FM 100-5. I see the keys to success as adapting the Corps strengths to "National/International" initiatives while leveraging technology to improve capabilities and staying in step with the Army of tomorrow as delineated by Force XXI.

This publication serves a key role in my strategy. We will use this forum to provide focus on key issues and build the USACMLS as a Joint Service NBC Defense Center providing a regional training site with world class facilities. The chemical mission is to provide the Army with units, equipment, and experts focused on NBC defense operations and training, smoke/obscurants, and nonlethal systems. We monitor global and technological developments in NBC warfare to ensure NBC defense overwatch. The Corps will support the nation through security assistance, chemical arms control/verification, demilitarization, and hazardous material management.

Let us continue to work together to make the Corps of tomorrow as successful as the Corps of today. I am honored and gladly accept the mission of carrying forward our long-standing traditions of *ruling the battlefield by means of the elements*. My commitment to you, as your new Commandant and Chief of Chemical, is that I will devote all my skill, experience, and effort to ensuring we remain chemical trained and ready.

1st Place

Information Age Army

—the Chemical Corps' role

By CPT Mark Lee

Somewhere in Southwest Asia
26 Aug 2004
0100

Concern etched the face of the mobile strike force (MSF) commander. His MSF was rolling along the desert battle space toward enemy positions 25 kilometers distant.

The foe he faced today was far superior to the one he faced as a company commander in Operation Desert Storm. Equipped with advanced anti-tank guided missiles and up-armored T80 variants, the foe demonstrated his capability while blowing through the defense of his western-equipped neighbor in the weeks prior.

The dispersion of the MSF as it moved across the desert reflected the CO's concern. Spread out in a box 10 kilometers wide and 5 kilometers deep, the MSF presented no lucrative targets to the enemy.

Suddenly the message alert buzzer in the battle command vehicle brought the commander out of his current event's review and back to the task at hand. Unmanned aerial vehicles (UAVs) over the objective spotted a launch of enemy rocket artillery. The impact footprint of the volley appeared immediately on his tactical display. He ordered a change in the axis of advance for the MSF to avoid the area. The order, instantly transmitted to all vehicles, enabled the MSF to wheel as one.

Relieved to see the unit icons change direction in unison, the commander then adjusted the orders to reflect the changes in route.

Suddenly the hazard warning receivers alerted. One of the NBC reconnaissance vehicles in the battle formation had detected a thickened G-series nerve agent within the rocket impact area. All the remaining stand-off detectors in the MSF turned to the area. The size of the vapor cloud, along with its resulting downwind hazard area, quickly appeared on the commander's tactical display. Again the MSF pivoted as one to avoid the contamination.

As the MSF passed through the edge of the vapor hazard area, the icons for the company closest to the hazard area changed from green to amber. Their on-board detectors had detected enough vapor to alarm. Most of their vehicle detectors cleared once the MSF had emerged from the vapor cloud. One platoon did not clear. They were closest to the impact area.

As the MSF surged towards the objective, the formation closed. The contaminated platoon received a change in mission through its Inter-Vehicular Information System (IVIS). They would support the attack by fire, but would not participate in the initial breach.

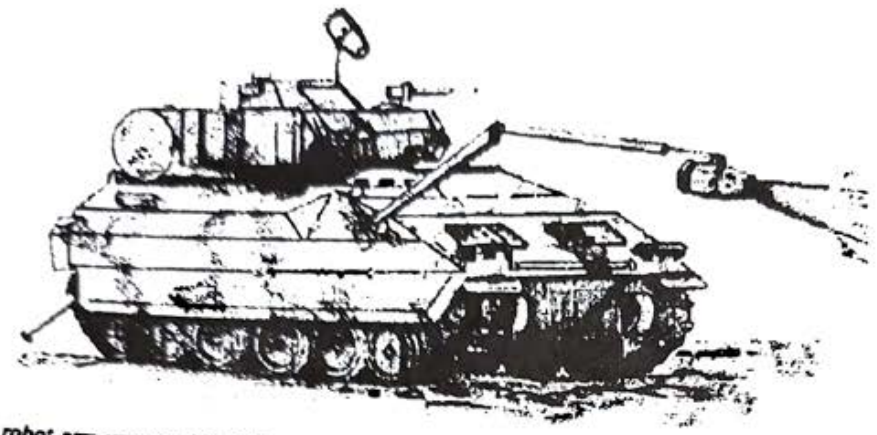
The movement, coordinated by the on-board navigation systems and the IVIS, took place quickly. Total situational awareness allowed the merging to take place smoothly.

Advanced field artillery systems, coupled with real time targeting from UAVs, began to place fire on the enemy positions just as the MSF rolled into direct fire range.

The artillery barrage, coupled with the devastating direct fire from the MSF, destroyed most of the enemy's direct fire capability with the first volley.

Approaching the obstacle belt, engineer assault vehicles, paired with third generation smoke vehicles, broke ahead of the fighting vehicles.

Just as they closed in on the engagement range of the remaining enemy positions, the smoke vehicles projected their multi-spectral obscurants over the breach area. The obscuration, tailored to blind enemy sensors only, was all but invisible to the MSF. They could still freely engage targets. For the enemy's gunner, it was as if someone pulled a window shade over their sights. They were unable to see anything beyond 100 meters in front of their positions.



A robot arm unwound itself from the top of the FDV and arched over to the contaminated tank.

Using liquid explosives, the engineers quickly breached the obstacle belt. The engineers transmitted data on the cleared lane to the task force. Computer-aided planning allowed the MSF vehicles to quickly flow through the breach and resume the attack formation.

Dismounted infantry, equipped with the Soldier Integrated Protective Ensemble (SIPE), quickly cleared and secured the objective. Meanwhile, the contaminated platoon moved to link up with the Forward Decon Vehicle (FDV). Notified of the platoon's impending arrival, the FDV operator quickly powered up the detection laser and activated his guidance system. The first vehicle, guided by digital cues from the FDV, pulled into position a few minutes later. A robot arm unwound itself from the top of the FDV and arched over to the contaminated tank. The arm began a pre-programmed, systematic search for contamination. The search took just under five minutes and detected no contamination.

As the decon specialist reset the robotic arm, the next vehicle moved into position. Halfway through the scan, the detector found several spots of contamination. After precisely outlining the extent of the contamination, the robotic arm rotated the decon head into position. Pinpoint applications of an ionic-resin decontaminant, coupled with a negative pressure return system ensured complete decontamination. The return system transferred the contaminated resin to the internal processing tank. Once inside, the agent was enzymatically removed from the resin and neutralized. The processed resin was returned to the dispersion tank, ready for future use.

Once spot decontamination was complete, the scan resumed. The detector found three more areas of contamination, removing them quickly. Total time for this vehicle was 15 minutes. One other vehicle had spots of contamination, the final one cleared. Total time for the entire platoon was 35 minutes. Consolidation on the objective was almost complete as the platoon returned to the objective.

The hazard alert warbled once again. The task force commander watched as the icon for an incoming tactical ballistic missile appeared on the edge of the tactical display. Switching to a larger scale, he saw that the predicted point of impact was in the corps rear area.

Two more tactical ballistic missile icons appeared, also targeted at the rear target. "Ought to keep those guys on their toes," thought the commander.

Just then, two of the icons disappeared, signifying a successful intercept by the Theater High Altitude Area Defense and third generation Patriot missiles over enemy territory.

Suddenly, the third icon changed in color and shape, signifying a partial intercept. The recalculated impact point centered on the MSF and its recently secured objective.

Minutes later, the remnants of the modified SCUD-E slammed into the ground almost five kilometers from the MSF position. The stand-off detectors immediately detected nerve agent and the MSF once again found itself in a downwind vapor hazard area.

Since the tactical display clearly showed the time of arrival of the vapor cloud, the task force was able to move to its alternate positions well before the cloud arrived. As the deadly cloud passed over the recently occupied position, the MSF was rolling toward its next objective...

The platoon leader of 2010 is in the first grade.

The dawning of the information age will fundamentally change the conduct of warfare. Information age technology, where information becomes a form of combat power, will change our doctrine, training, and operational style. We will no longer organize people around weapons systems, but will instead organize people around information. The force projection Army must execute any mission, any time, anywhere.

Doctrine drives change. It's our charter to ensure the Chemical Corps doctrine evolves alongside Army doctrine. Our fundamental mission will not change. We must ensure our forces are chemical trained and ready. We must prepare to fight in the future as a joint and possibly coalition force.

The ambiguous threat facing our future force creates a tremendous challenge. The proliferation of weapons of mass destruction propagates one of the fastest growing threats our nation faces today. Placing

these weapons and their delivery systems in the hands of rogue nations and other global gladiators represents a tremendous power shift from the bipolar world of the Cold War era.

Another fundamental shift in "things chemical" is our policy on the use of chemical weapons. The United States will no longer use chemical weapons to retaliate in kind. On the tactical level, the ability to equalize the battlefield was a strong deterrent. The asymmetrical battlefield we now face drives a major shift in the way we do business. A vigorous chemical training program that minimizes the impact of these weapons will be our best means of deterrence. Emerging technologies in target acquisition represent another threat to our future force. First generation night observation devices are readily available on the commercial market. The break-up of the Soviet Union unleashed a flood of these devices. It's only a matter of time before the next generation of these devices becomes readily available to anyone with a "gold card." Once highly classified satellite imagery is now for sale. Non-military satellites such as SPOT and LANDSAT now offer resolution down to 10 meters. We can't forget the intelligence provided to any potential foe by the ever-present media, providing a real time accounting of our every operation.

An Information Age Primer

Far from egg-headed future-speak, information age represents a logical progression of our society and military. The different sources may call them waves or ages, but the meaning is the same.

First Wave or the Agrarian Age states fit into our image of a pre-industrial age society. They make war at the operational level. Victory comes with the destruction of their armed forces.

Second Wave or Industrial Age states include the major forces of World War II and the Iraqi Army of 1990. Mass production of arms and men was the way of conducting operations. Victory over an industrial state requires the destruction of not only a large part of the armed forces, but also a large portion of its industrial base.

In *Third Wave* or Information Age states, productivity results not from mass but from precision. This type of organization is based more on a network model than a factory. Shared information leads to situation awareness. Militarily, this precision refers to target identification and engagement. Victory over an Information Age foe will require destruction of the armed forces and industrial bases, but also we must dominate its information system.

Using the network model, it's easy to make the next step and envision a battlefield without massed formations. In fact, one of the properties found in Information Age organizations is their de-massification. Precision replaces mass. The servicing of strategic targets in Iraq by precision-guided munitions represents a good example of the application of precision over mass.

To take the next step, consider what the Chief of Staff of the Army said in a recent paper on War in the Information Age. "Information age armies will develop a shared situational awareness. This awareness results from having common, up-to-date, nearly complete friendly and enemy information distributed among all elements of a task force...This shared situational awareness, coupled with the ability to conduct operations day and night, is what will allow information age armies to observe, decide, and act faster and more precisely than their enemies."

The velocity of weapons systems (both muzzle and ground velocities) has almost reached its limits. By leveraging information, an information age force can apply its combat power at the time and place of its choosing and decimate a numerically superior, industrial-based foe.

The road to the information age Chemical Corps will not be an easy one. Our evolution must be an information-based one. No longer can we afford to develop equipment and doctrine separately. The entire development and acquisition cycle, from factory to foxhole, will occur simultaneously. Our participation in the Louisiana Maneuvers and in the TRADOC battlelabs must ensure that America's Army remains chemical trained and ready.

Information Age Warfare and the Chemical Corps

A simply stated path to an information age fighting force addresses two Third Wave principles, "Digitalize and De-massify." These two concepts readily apply to Chemical Corps operations.

Digitalize (Chemical Information)

Digitalization represents the best way to create the shared situation

The ability to add value to the information is the key to digitalization.

awareness General Sullivan spoke about. The human ear/brain combination cannot process the volume of information needed for this task.

However, digitalization cannot be a simple passing of information from one source to another. Each processing station must be able to manipulate and add something to the data it passes along. The ability to add value to the information is the key to digitalization.

The power of the microprocessor will eliminate the NBC Warning and Reporting System messages as we now know them. NBC1 reports, processed on site, define a precise hazard alert area. The information age Army can calculate the precise hazard warning predictions that took two Cray super computers to execute in the Gulf War. The commander will no longer have to keep the GTA 3-6-3 in his pocket. Warnings, like those in the vignette, will appear on the tactical display as an overlay.

Digitalization will reach far beyond the turret of the future fighting vehicles. Logistical plans and data will also move across the digital battlefield. Moving information to the combat supporter will allow them to use real-time data to plan and execute their sustainment operations.

De-massify (Chemical Operations)

Precision replaces mass. With chemical operations, mass refers to far more than numbers. The application of de-massification, as it applies to our major battlefield mission, follows.

Smoke Operations. De-massification in smoke operations refers to the type and way we use obscurants on the battlefield. Sensor proliferation will drive us to the development of the next generation of multi-spectral obscurants. We will develop the capability to tailor these obscurants to blind specific wavelengths used by the enemy while ours will be unaffected. The "dial-a-smoke" capability will allow us to still enjoy the advantage provided by our current family of obscurants.

Smoke delivery systems will become more maneuverable, survivable, and effective. They can place these tailored obscurants anywhere within the immediate battle space at a moment's notice.

Contamination Avoidance. Stand-off detection, accelerated (digital) alert procedures, and precision vapor modeling will act together to take some of the mass out of weapons of mass destruction. De-massification will let us break the ATP-45 hazard prediction model. While these weapons will still impact over a large area of the battlefield, a precise definition of the hazard will give the maneuver commander more options than he enjoys today. In future cases the commander will be able to define the operational risks that he will accept in contamination avoidance. Considering the chemical officers' recommendation, he could accept some risk in passing through a vapor hazard area in order to meet the mission requirements.

Decontamination. De-massification of decontamination operations is an extension of the principles of decontamination.

Decontaminate as soon as possible, as far forward as possible. Moving as an integral part of the maneuver element, the FDV will give the commander a quick response decontamination asset. New technologies in decontaminants will break our water dependency. Again, robotics will enhance their capability by allowing for precise application and removal. Removal and regeneration of decontaminants will stretch our capability and reduce the hazards on the battlefield. Imagine a decon site without sumps!

Another principle is decontaminate only what is necessary. Robotics, executing a precision search for contamination, coupled with new detection technologies, will allow the FDV to quickly process potentially contaminated vehicles. On-board detectors will speed up the screening process for all tactical vehicles.

Our Challenge

The change we initiate today will determine whether the mobile strike force commander will benefit from the chemical systems described. The superstar weapon systems of *Operation Desert Storm* began in the late 1970's and represent the vision of leaders of that time. Our challenge is to display that same vision.

The Chemical Corps is stepping out toward the 21st Century. The spread of nuclear, biological, and chemical weapons across the globe gives us one of the few growth threats our forces face. Chemical trained and ready is a journey, not a destination. We know where we are going and are moving out.

At the time this article was written, CPT Mark Lee was attending the Chemical Officer Advance Course. His previous assignments include battalion chemical officer, 4th Battalion, 325th Airborne Infantry Regiment, 82d Airborne Division; platoon leader, 21st Chemical Company (Airborne), 82d Airborne Division; NBC staff officer, 82d Airborne Division Chemical Section, and aide-de-camp to the Chief of Chemical. CPT Lee is a graduate of the Chemical Officer Basic Course, Airborne, Air Movement Operations, and Jumpmaster Schools.

The Very Beginning
—genesis of a chemical agent

By Eugene J. McDevitt

One of the goals of research in chemistry is to explain how molecules react with one another to form new substances. Modern chemists attempt to justify these reactions on an atomic scale by speaking in terms of the breaking and forming of electron bonds between atoms. It is then often possible to generalize a type of reaction for many particular chemicals of the same classes. For example: Carboxylic acids react with alcohols to form esters and water.

To prove a reaction's mechanism, chemists will select known chemicals and predict how they will react by carefully controlling the circumstances of their interaction. In organic chemistry, it is the custom of the profession to title specific chemical reactions after the author who first examined and reported them.

In the 1920's two American chemists synthesized a series of new compounds whose formation was predictable based on a generalized reaction that had been first described by a German chemist in 1896.[1,2] They did so, not so much to ape the known procedure, but to provide themselves with a new series of compounds whose chemical structure was of interest to them. They carefully reported their results to the chemistry community where they would lay dormant for over 20 years. Here is their story and the strange result of their work.

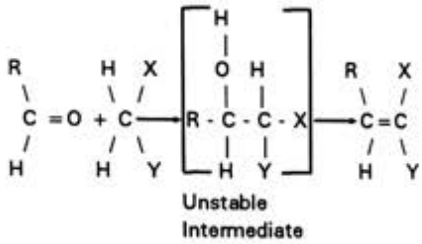
Ben B. Corson was born in Bridgeton, Maine, on August 12, 1896. After serving in the Army from 1917 to 1919, he received his academic training in chemistry at Harvard earning a BA in 1921, an MA in 1922, and a PhD in 1924. His doctoral work was under the supervision of Elmer P. Kohler. They co-authored an article in the August 1923 issue of the *Journal of the American Chemical Society* titled, "The Mechanism Underlying the Reaction Between Aldehydes or Ketones and Tautomeric Substances of the Keto-Enol Type."[3]

The article deals with a discussion of the several possible mechanisms for what is known as the Knoevenagel Reaction and offers chemical evidence justifying their explanation. The Knoevenagel Reaction is well known and is mentioned in just about every collegiate level organic chemistry text. Compendia such as *March* or *Organic Reactions* give detailed information as to the nature of the reaction and its numerous applications.

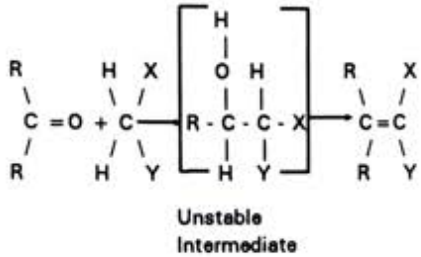
Heinrich Emil Albert Knoevenagel (1865-1921) was born in Hannover-Linden in Germany. He studied under Victor Meyer and received his PhD from the University of Goettingen. He then followed Victor Meyer to Heidelberg, working first as his assistant and finally succeeding him as professor of chemistry.

His reaction involves the condensation of an aldehyde or a ketone with a compound having an active methylene group, $-CH_2-$, whose activity is caused by the electron withdrawing nature of the other two groups attached to the methylene. This condensation can be shown by the following equations:

For aldehydes:



For ketones:



In these equations, the symbol R represents any carbon functionality such as methyl, ethyl, propyl, phenyl, and so forth, while X and Y are electron withdrawing groups such as CHO, COOR, CN, NO_2, and so forth.

Following his graduation, Corson began his teaching career at Middlebury College in Middlebury, Vermont, in 1924 as an instructor of

In a special paragraph, they warn the reader of the unusual physiological properties of the three compounds.

chemistry. Middlebury was founded in 1800 and is a liberal arts college. In the 1920's Middlebury had a total of about 1,000 students. Its four-member chemistry department worked in their own chemistry building which had been erected in 1900.

Within one year, Corson was promoted to assistant professor. Early in 1928, he, along with Hazen and Thomas, continued the study of the mechanism of the Knoevenagel Reaction and offered their final experimental proof of a mechanism not requiring keto-enol tautomerism of the aldehyde or ketone.[5]

They explained that the first step of the reaction is the nucleophilic attack of the carbanion of the active hydrogen compound (the methylene grouping) on the carbon of the carbonyl group of the aldehyde or ketone. This reaction would create an unstable intermediate alcoholic compound. This, in turn, loses a molecule of water to form the final product. The nature of the chemical bonding in the electron withdrawing groups fosters the formation of what we refer to as a double bond between the carbon of the aldehyde/ketone and the methylene carbon.

Later in 1928 Corson co-authored a paper with Roger W. Stoughton titled, "Reactions of Alpha, Beta-Unsaturated Dinitriles."[6] Stoughton had received his BA from Middlebury in 1927 and worked with Corson in 1927 and 1928. Their paper moves on beyond the possible question of the mechanism of the Knoevenagel Reaction to the use of the reaction to form a series of compounds called substituted unsaturated malonodinitriles. Malononitrile's formula is $H_2C(CN)_2$ and one can see that it is a compound with an activated methylene group. By reacting malononitrile with various aldehydes, they would create substituted dinitriles. Molecules that include a double bond, C=C, are called unsaturated and show unique chemical properties. The Greek prefixes, alpha and beta, are indicators to chemists that the unsaturation exists between the first and second carbon of the malonodinitrile.

Corson and Stoughton describe their process for creating the different malonodinitriles starting with ten different aldehydes. Their procedure is quite clear and has been used by several chemists since they first reported it.

Dinitriles. "*Preparation.-Equivalent quantities of aldehyde and malononitrile were dissolved in a suitable solvent and a few drops of piperidine added with shaking. The solution warmed up somewhat and became more or less reddish. Within fifteen minutes the mixture was solid with crystalline condensation product. It is advisable to carry out the reaction in an open beaker in order to facilitate removal of the solid. These condensations can be run without solvent, but the products are apt to be dark colored. Solvent is desirable.*"

They will, in the major portion of their paper, subject some of these new compounds to a series of reactions to examine their unsaturated nature. In tables IA and IB [of their paper]they describe the ten new dinitriles that they synthesized and characterized. They include in the tables usual information giving reaction solvent, crystallizing solvent, color, melting point, percent yield, some elemental analysis data, and, uniquely, a listing titled physiological action. For seven of the entries, the physiological action is listed as none, but for the other three, different entries are given:

I, benzalmalononitrile, sneeze and tear;

XVIII, m-nitrobenzalmalononitrile, sneeze;

XX, o-chlorobenzalmalononitrile, sneeze and skin irritant.

(In chemical literature, compounds are given Roman numerals in the order in which they occur in the article.)

In a special paragraph, they warn the reader of the unusual physiological properties of the three mentioned above.

"Physiological Properties.-Certain of these dinitriles have the effect of sneeze and tear gases. They are harmless when wet but to handle the dry powder is diastrous (sic). When crystallizing m-nitrobenzalmalononitrile, for instance, the alcohol solution should not be boiled very much since the alcohol vapor has a peppery sting. In sneezing caused by m-nitrobenzal- malononitrile (XVIII) the mucous discharge from the nose becomes bright yellow on exposure to air. In sneezing caused by o-chlorobenzalmalononitrile (XX) the face smarts, especially if damp. The smarting is intensified by washing. Most of the discomfort can be avoided if a gas mask is worn whenever dry solid is handled. However, the majority of the dinitriles reported in this paper have no irritant effect..."

The abstract of their article in *Chemical Abstracts* also clearly states the unusual physiological effects of the three new compounds.[7]

Roger Stoughton continued his education at the University of Illinois, receiving his doctorate working for Roger Adams, a giant in the field of

synthetic organic chemistry. Roger Adams had worked under Elmer P. Kohler at Harvard as had Ben B. Corson. Stoughton's work at Illinois had no connection with his earlier work at Middlebury. He served as a research associate in the Department of Pharmacy at Vanderbilt University and finally worked for the Mallinckrodt Corporation. All of his later work dealt with compounds of pharmacological interest. He published about 25 papers during his career in chemistry. He died a young man in St. Louis in 1957.

Ben B. Corson continued at Middlebury for several more years, being promoted to associate professor in 1929, but his reported research showed interests in different areas of chemistry. He was very active in the work of developing and checking procedures for the synthesis of organic compounds to be reported in *Organic Synthesis*. By the way, one on which he worked was the synthesis of malononitrile. In 1931 he moved to the Universal Oil Products Company, and then in 1939 to the Mellon Institute, where a majority of his work dealt with the chemistry of fuels. He authored or co-authored over 100 articles in chemistry. He died at Ventura, California, in 1987.

Corson's and Stoughton's article on dinitriles has been cited by many chemists seeking to synthesize similar compounds, but none seem too eager to repeat their work on compound XX, o-chlorobenzylidine malononitrile, or (2-chlorophenyl) methylene propanedinitrile as it is currently named. An article published in 1949[8] repeats and expands most of the work of Corson and Stoughton but misses, either accidently or purposefully, any mention of the formation of the irritant compound. The first article that specifically mentions o-chlorobenzylidine malononitrile is in *Cancer Research*.[9] This article deals with the measurement of possible activity of a large number of different malononitriles on tumors. o-Chlorobenzylidine malononitrile showed no unique activities.

The table below shows the number of times o-chlorobenzalmalononitrile has been mentioned in the chemical literature since Corson and Stoughton first reported it.

Years of Listing	Number of Entries
1927-1936	1*
1937-1946	0
1947-1956	2
1957-1966	9
1967-1976	80
1977-1986	88
1987-1993	48

* Corson and Stoughton's article

In our moments of idealism, most of us chemists imagine and hope that some day we will make a discovery that will aid humankind. Corson's work in fuels was to seek to provide the world with a better source of energy for civilization. Stoughton's work in pharmacology was a direct effort to reduce the suffering in the world. Neither Corson nor Stoughton would have ever imagined that the minor, unimportant, nonuseful compound that causes sneezing and skin irritation that they had prepared early in their careers in chemistry would be produced by the thousands of tons for use in Vietnam, by police forces for riot control, and would be known worldwide by the combined first initials of their last names, CS.

In our moments of idealism, most of us chemists imagine and hope that some day we will make a discovery that will aid humankind.

The author wishes to make the following acknowledgements:

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Sean Maloney, Associate Librarian, Siena College

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Notes

[1]Knoevenagel, Chem. Ber., 27, 2346 (1894).

[2]Knoevenagel, Chem. Ber., 29, 172 (1896).

[3]Corson and Kohler, Journal of the American Chemical Society, 45, 1974 (1923).

[4]Editor, Zeit. Angew. Chem., 35, 29 (1922)

[5]Corson, Hazen, and Kohler, Journal of the American Chemical Society, 50, 913 (1928).

[6]Corson and Stoughton, Journal of the American Chemical Society, 50, 2825 (1928).

[7]Chemical Abstracts 22:4514 (1928).

[8]Sturz and Noller, Journal of the American Chemical Society, 71, 2949 (1949)

[9]Can. Res. 12, 565-72 (1952).

Eugene J. McDevitt received his BS and MS from St. Bonaventure University. As an ROTC graduate he served for two years in Material Command at Edgewood Arsenal, Maryland. Following his military service, he was employed as an organic chemist in the Test Division of the Chemical Research and Development Labs. He has taught at Siena College since 1960. He has taken many courses and done research at Rensselaer Polytechnic Institute. His goal is to continue the story of the development of CS from its discovery to its current usage.

Integrate NBC

—commander's planning guidance for the NBC staff

By MAJ Ralph F. Kerr

How many times have you witnessed the omission of NBC when the commander gave his planning guidance for an upcoming operation? Without some initial guidance to focus the integration of NBC assets and NBC protection measures, the NBC staff is left in a void.

Integrating NBC defense measures will be much easier when your commander provides guidance on how he sees NBC assets supporting the operation and specifies acceptable or non-acceptable risks in regard to troop protection measures. Working with our commanders to integrate NBC defense operations will provide for success on the integrated battlefield.

A brigade commander's NBC planning guidance example allows us to identify and study the essential areas of concern for NBC operations. In this example, a heavy division chemical company (-) with headquarters section, the mechanized smoke platoon, one decontamination platoon, and one NBC reconnaissance squad are attached to the brigade. The brigade is the division's main effort for an offensive operation. The commander is speaking to the NBC staff (sidebar, right):

"I want the attached chemical company (-) to support the brigade's main effort. Coordinate NBC threat analysis in detail with the S2 staff to best conduct our offense to avoid contamination. If we can't avoid it, my intent is to fight contaminated. If maneuver units become contaminated any time after H-2 (H-hour being LD), they are to fight contaminated until such time that decon can be conducted. This does not include the reserves.

"Plan and coordinate decon sites to allow flexibility and prompt execution. Look at conducting operational decon at our initial objectives to return fighting units back into battle. Priority of decon during the fight is to the reserves, combat support, and combat service support elements. I want the staff to analyze the decon plan of the reserves in detail; I do not want the reserves conducting decon operations when it is time to commit them. Before and after the main battle, priority is to maneuver and field artillery units. Stress these priorities with the task force NBC staffs and ensure they comply with this directive.

"I want the smoke platoon to support the main attack. We'll retain command and control of the smoke platoon at brigade level; the main effort task force commander will have his hands full. Develop a comprehensive plan that integrates all our available assets and is event driven, not time driven.

"Use the NBC recon squad to support mobility of our maneuver units. Coordinate with the S2 to integrate NBC recon into the R&S plan and the inclusion of NBC into the decision support template. I want the staff to consider conventional recon assets for augmenting NBC recon and vice-versa. I want to place this squad in direct support of the main effort, so analyze and coordinate this with the main effort task force S3 and NBC staff.

"It is unacceptable to lose major combat power to contamination; that is, a specialty platoon and/or a maneuver company/team. I will, however, accept brigade elements fighting degraded by MOPP and in protective posture. I am concerned about our soldiers' ability to quickly identify chemical hazards and minimizing casualties due to chemical agents. I want chemical defense equipment reports scrubbed thoroughly and cross-leveling of essential items directed, if necessary.

"We have a great opportunity to use our NBC assets as the combat multipliers that they are and I want to take full advantage of their capabilities. What are your questions?"

The commander must issue guidance to the NBC staff on a variety of subjects to set the course for not only employing NBC recon, decon, and smoke elements, but also NBC protection measures. Guidance must encompass the whole of the operation, not just a single phase. If this does not occur, the NBC staff must seek specifics or clarification and be prepared to provide advice and/or recommendations. The guidance should allow for flexibility and sustainability and provide sufficient focus to optimize NBC support for the scheme of maneuver.

We will identify the key areas and look at the specifics of this guidance to effectively implement NBC operations in accordance with the commander's intent. By identifying the key areas, we give ourselves a mental checklist of the areas we expect the commander to address. This will allow us to ensure comprehensive guidance is provided in the future so we can solicit information should it be omitted. The key areas of NBC planning guidance are: the commander's intent for fighting contaminated; employment considerations for NBC assets; acceptable or non-acceptable risks; MOPP level guidance; and any other NBC concerns the commander may have.

NBC planning guidance, along with the guidance issued to the rest of the staff, provides a common starting point for planning and provides focus for development of courses of action by the staff.

Integration of NBC assets and timely execution of NBC protective measures will be made much easier with this focus. Let's review the NBC planning guidance and look at the specifics in each area of concern so we'll be better prepared to initiate the planning process in a field environment.

Fighting Contaminated

Of major significance not just to the NBC staff, but to the entire command, is the commander's intent for fighting contaminated. Our commander has specified that, if necessary, he intends to have his elements fight contaminated. They will not be immediately pulled out of the fight.

This is significant because it lets his subordinates know when to expect to conduct decon if required; therefore, they can devote their attention to fighting. This is also significant because it gives the staff the groundwork of what to plan for in regard to decon operations. The commander stated that should maneuver units become contaminated after H-2, they will conduct operational decon when the initial objectives have been secured, at the earliest.

This portion of guidance not only provides a time frame for decon operations, but also tells the NBC staff, chemical company commander, and the decon platoon leader the time period (H-2) they can plan to break down and prepare for repositioning, if they are not involved in executing a mission.

Considering NBC Assets

Our commander gave employment considerations for NBC reconnaissance, decontamination, and smoke operations along with NBC protection measures. Just because you do not have all these NBC assets chopped to your unit for a mission does not mean you should not consider these type operations. Conventional recon assets (scouts, for example) can be used to conduct NBC recon. Integration of organic decon assets must be planned and coordinated, and the use of projected smoke, VEESS, smoke pots and grenades must be synchronized.

Protection measures should predominately be found in unit field standing operating procedures, but due to nature of the NBC threat, the commander may feel it necessary to direct specific active and/or passive measures for the staff to develop, plan, and coordinate.

NBC Reconnaissance. The commander directed the use of NBC recon to support mobility of maneuver units. If there is any doubt as to what the commander means by this or any other guidance/directions, seek clarification. Insure you understand the commander's meaning to plan and coordinate operations to meet his intent. He wants NBC recon forward in the battle as opposed to using them in the brigade's rear area.

You might develop options to employ the NBC recon and present these in a decision brief format to get final approval for their mission. When developing options for this asset, refer to FM 3-19, *NBC Reconnaissance*, to quickly review employment concepts or ideas and coordinate with the unit's leadership on technical aspects which might influence their employment.

The commander told us to consider using conventional recon assets for NBC purposes and vice-versa. There is no reason to leave NBC recon elements out of the recon-counter-recon battle, just as there is no reason to not use scouts to augment NBC recon. In this case, the commander provided specific command and control guidance for the recon squad. Had this not been given, you would

Guidance must encompass the whole of the operation, not just a single phase.

also propose a command or support relationship and be prepared to defend it when making the recommendation.

Decontamination. The commander told us to look at conducting operational decon at our initial objectives and gave general guidance for priorities. He did not, however, state under whose command and control the platoon is to operate or any concerns for conduct of thorough decon operations. Remember, planning guidance is to focus the staff on developing a course of action; for us, the focus is on integrating our combat support with the scheme of maneuver.

Decon integration is simplified with the application of our doctrinal principles (found in FM 3-5, *NBC Decontamination*). Combining these principles with the commander's guidance, planning and preparing for decon operations can be integrated effectively. Coordination with the task force NBC staffs, the supporting chemical unit and other supporting units (medical for patient/casualty decon, MP for route control, for example) must address specifics for effective decon operations to occur. Work through details during the planning and preparation phases to prevent confusion at the decon site and not keep soldiers in MOPP longer than necessary or away from the fight.

Smoke Operations. Like the NBC recon squad, the commander gave general employment instructions for the smoke platoon and specific guidance for the command and control. Again, if you are not sure of the commander's intent (that is, "support the main attack"), seek clarification. Also, be prepared to develop options to accomplish his intent and coordinate other available smoke assets (that is, projected/indirect smoke, VEESS, smoke pots, and smoke grenades). You must wear your hat as "Synch Smoke" to ensure effective integration and synchronization of smoke to support maneuver.

Acceptable/Non-acceptable Risks.

The commander informed us that it is acceptable to fight degraded by placing soldiers in MOPP, but unacceptable to lose major combat power to contamination. With this guidance, we can plan to integrate NBC recon to support maneuver units (to prevent the entering of contaminated areas) and integrate protection measures. Other areas the commander may address include time periods for conducting NBC operations in relation to other critical events, maneuvering friendly units in smoke, use of other assets (MPs for decon site traffic control, for example) in close proximity to contamination, and/or troop safety criteria.

MOPP Level

Our commander did not provide any guidance concerning MOPP levels specifically, but he did state that he was willing to have units fight degraded by MOPP. Therefore, we must inquire to seek particular concerns and be prepared to make a recommendation. Do not make a recommendation or accept a "field standing operating procedure MOPP status" in haste. As *Operation Desert Shield/Operation Desert Storm* taught us, MOPP suits are not only expensive, they can place a strain on the logistics channels. Ensure the flexibility of the MOPP system is considered and that the recommended MOPP level falls within common sense. There is no need to place an entire command in MOPP if they are not all expected to be in a hazard area.

Other Concerns

This is the proverbial "catchall" portion that is open for any NBC areas that the commander may want to discuss or that you, the NBC staff, may desire to seek guidance on. Our commander stated his concern for identifying chemical hazards and desire to minimize casualties, and directed CDE reports be scrubbed. This may be interpreted as making sure equipment is readily supplied and refresher training conducted in certain areas. We could see any of several issues addressed here to include: command and control of decon sites; patient/casualty decon; additional active and/or passive NBC protection measures to emphasize and enforce; critical information requirements of an NBC nature, and so forth.

Your role as an NBC staff member is to plan NBC defense operations IAW the commander's intent. Planning and coordinating these operations will be much easier when you receive guidance that covers the key areas identified in this article. Applying the key areas of NBC planning guidance will facilitate effective integration of NBC operations and assets to avoid contamination and minimize the effects of hazards on the battlefield.

US Army Technical Escort Unit

—DOD's hazardous materials handlers

By CPT Victoria A. Kost-Swinson

During the period of 5 January 1993 to 2 February 1993, the United States Army Technical Escort Unit distinguished itself while executing an emergency response munitions recovery mission at Spring Valley, Washington, DC, *Operation Safe Removal.* The Technical Escort Unit was on site within hours and swiftly established itself as a key player in the recovery effort, interfacing closely with local law enforcement agencies, disaster preparedness and emergency medical response teams. Using rudimentary tools coupled with hard work and steadfast determination, the unit quickly and safely began unearthing a myriad of World War I era suspect chemical munitions. Unit personnel worked long and arduous hours and safely excavated, assessed, stored, packaged and transported, and/or destroyed a total of 147 munitions items and a great amount of scrap munitions and components. The unit performed this tedious task without incident while thrust under the intense scrutiny of local and national news media and a weary public. The professionalism, superb technical knowledge and dedication displayed by unit members were outstanding." [*Army Superior Unit Award, General Orders Number 12, dated 13 May 1993.*]

SSG Wayne Danjou (in the hole) and other Technical Escort Unit personnel at the burial pit at Spring Valley.

Jim Major and Kim McGhee, Technical Escort Unit personnel, pack HE munitions for transport to AP Hill for destruction.

Operation Safe Removal was the Department of Defense's (DOD) first service response force operation. Working closely with Military District of Washington personnel, the Technical Escort Unit (TEU) spearheaded both the emergency response phase and *Operation Safe Removal*. TEU's participation in this mission ensured the successful completion of a potentially disastrous operation.

The Unit

TEU is a one-of-a-kind DOD asset. Aligned under the Chemical and Biological Defense Command, the unit is configured as a battalion. The unit's 130 members include an equal mix of chemical and explosive ordnance disposal soldiers and Department of the Army civilians. Its headquarters and three detachments are at Edgewood area, Aberdeen Proving Ground, Maryland. A fifth detachment is located at Dugway Proving Ground, Utah. Its sixth detachment is located at Pine Bluff Arsenal, Arkansas.

The unit's mission is one of the most diverse and unique in the military. TEU is a specialized chemical operations unit responsible for joint service, worldwide response for technical escort and recovery, stabilization, movement and disposal of lethal chemical agents, munitions, and related materials.

The unit is responsible for emergency response to Chemical Accident/Incident Response Assistance operations in support of the DOD. In addition, TEU is one of the few assignments in the Army where chemical and explosive ordnance disposal soldiers work with real chemical agents and munitions on a regular basis, in forms ranging from a one-ton storage container to a one-milliliter glass vial.

The Past

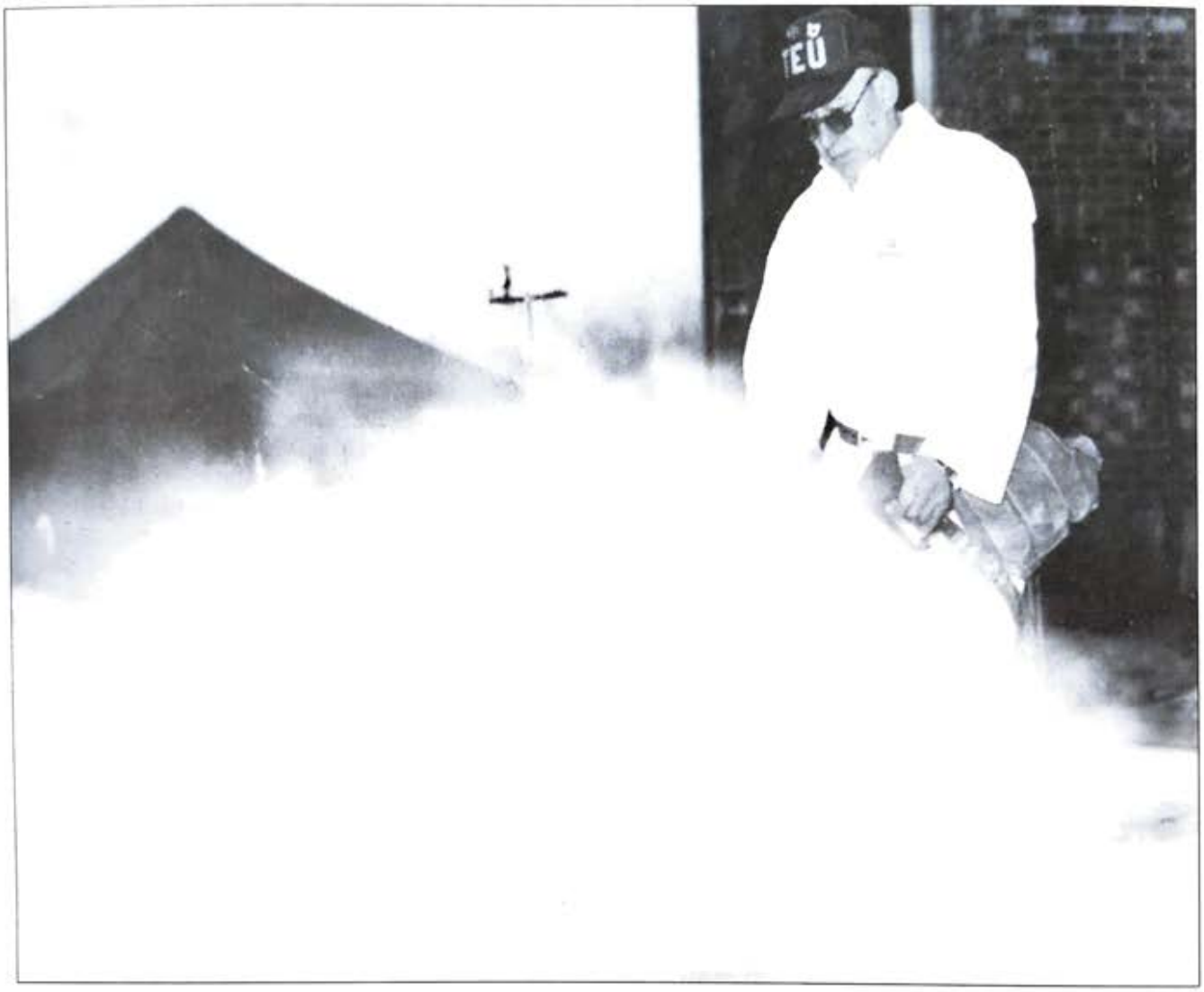
TEU was established 20 January 1943 as the Guard and Security Division of the Chemical Warfare Service. Its original home was Camp Sibert, Alabama. The unit's initial mission was to conduct chemical munitions movements during World War II. TEU moved to Edgewood Arsenal in 1944. By the end of the war it had become the United States' focal point for decontamination, demilitarization, and disposal of thousands of tons of unused and captured chemical agents and munitions.

Mr. Earnie Bryant, a former TEU sergeant major who now works for the unit as a DA civilian, recalls some of the missions in which he participated. "I remember going out on these ships full of rounds encased in concrete 'coffins.' We'd rig 'em with explosives [the ships], and get on another boat and watch 'em go down. We had to stay until we were sure all the 'coffins' sank...some of them would come back to the surface." He conducted these operations off the coast of New Jersey.

Mr. Billy Russell was assigned to TEU in the late sixties and again in the early eighties. He remembers doing open pit burns of all kinds of agents "back before the EPA was such a hassle." He participated in sea dumps off the coast of Okinawa in the late sixties and "did lots of escorts." In addition, Mr. Russell participated in *Operation Redhat*, the movement of chemical munitions from Okinawa to Johnston Atoll. It was the first large-scale move of chemical munitions to the atoll. The Weteye bomb movements from Denver, Colorado, to Tooele Army Depot, Utah, in 1980 and 1981 were the last major munition moves for TEU for some time.

The Present

The unit underwent a major change in 1989. Up until then the unit was predominately military, the only civilians were on staff. In 1989 DA directed that the unit civilianize, due



Mr. Dennis A. Anderson prepares for a decon operation during Operation Safe Removal, *Spring Valley, Washington, DC, January 1993.*

to a decreased authorization for soldiers. The unit opened detachment positions to civilians. Many of the civilians who filled the jobs were retired, former members of TEU and former soldiers in general. The civilianization stopped before it was complete. The "new" TEU had civilian detachments with military leadership and a military command group. While some saw this as a change for the worse, the civilians actually lent a continuity that was not possible with the continual military personnel changes.

In 1990 TEU took the spotlight once again. This time the mission was *Operation Steel Box*, the removal of chemical munitions from Europe. *Retrograde*, as the operation was commonly called, took a year to plan. Coordination efforts included DOD, DA, the Federal Republic of Germany, the US Navy, and the US Air Force. According to Mr. Thomas Swinson, a former TEU soldier and current TEU civilian, "Trains came every day for a week from the railhead at Miesau [to the port at Nordenham], with containers full of rounds to load on the ships." TEU personnel loaded two US Merchant Marine ships and stayed on them for the 45-day voyage to Johnston Atoll. This was TEU's last large-scale chemical munitions move. Additionally, *Retrograde* was the last TEU operation to include road, rail, and sea escorts and require joint service assets and multinational cooperation.

Steady change marked the next few years. Initially, TEU's operations focused on emergency responses and agent escorts. Unit personnel logged thousands of travel miles responding to missions around the world. Response missions included unearthed World War II era chemical gas identification kits at Fort Jackson, South Carolina, and Fort Richardson, Alaska; a possible disposal site at England Air Force Base in Louisiana; and possible use sites in foreign countries. The unit began to get

Thomas Swinson packages rounds at Spring Valley, Washington, DC.

involved with site remediation projects—evaluating sites to assess the extent, if any, of chemical contamination and conducting clean-up efforts.

As TEU became more involved with site remediation efforts, it became more influenced by local, state, and federal environmental regulations. The unit's mission equipment changed to comply with the additional regulatory guidance. Similarly, the unit's training requirements changed. Today, members of TEU must achieve and maintain the technical competence to run a gas chromatograph/mass spectrometer and be versed in Occupational Safety and Health Act and Resource Conservation and Recovery Act regulations, in addition to their technical escort training. They receive comprehensive environmental sampling training as well.

Operation Safe Removal allowed TEU to demonstrate its newly acquired capabilities on a grand scale, under the watchful eye of a nervous public. As described above, TEU rose to the occasion and shined. Although *Operation Safe Removal* ended 2 February 1993, TEU remains involved with the clean-up efforts at Spring Valley. The service response force operation and follow-on mission provided a fitting entrance for TEU into its new line of work.

The Future

In the early years of the chemical warfare program, research, development, testing, evaluation, and training occurred at sites all over the United States. Seven thousand of these formerly used defense sites exist. DOD has the responsibility to remediate these sites, over 200 of which could contain unexploded chemical munitions or material.

As DOD's hazardous materials handlers, TEU plays a big role as subcontractors determining the extent of possible chemical surety material contamination on these sites. Unit personnel conduct sampling, air monitoring and recovery operations; they are already involved in extensive monitoring operations at Dugway Proving Ground and Tooele Army Depot, in addition to the operation at Spring Valley.

This year TEU will be the main contractor on a remediation site in Ogden, Utah. It will be the ultimate test of the unit's adaptation to its ever-changing role in the DOD. The unit continues to respond to chemical surety material emergencies, but formerly used defense sites initial investigations and remediations fill a growing portion of the unit's workload.

The Technical Escort Unit began as a security force to protect America's arsenal of chemical agents and munitions. Today the unit works to clean up those very sites where the materiel they once guarded was used. TEU's mission continues to change as the international and national chemical weapons climate changes. Whatever mission may arise, TEU will answer the call. The two Department of the Army Meritorious Unit Citations and three Army Superior Unit Awards that TEU earned during its first fifty years attest to the unit's expertise and proficiency.

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CPT Victoria Kost-Swinson was assigned the US Army Technical Escort Unit from July 1991 to April 1994. She spent two years as an escort detachment executive officer and commander and one year as the unit's supply officer. She participated in numerous planned and emergency responses (both CONUS and overseas), conducted two site remediation projects, and led chemical agent escort missions regularly. Her first tour of duty was with the 2d Infantry Division in Korea, as the chemical officer in an attack helicopter battalion. Currently, she is stationed at Fort McClellan, Alabama.

2nd Place

Facing the Future

—staying chemical trained and ready

By MAJ Robert C. Neumann

During the past four years, the US Army and the Chemical Corps have experienced profound changes. These changes are not the last ones that the Corps will see as the 20th century ends and the 21st century begins. The Chemical Corps must meet new challenges and adapt. Failure to adapt will signal the demise of the Corps and the relegation of NBC defense as just another part of force protection.

One of the primary threats facing the Corps is the non-threat. Many believe the threat of NBC warfare disappeared with the collapse of the Soviet Union and Warsaw Pact. Additionally, the myriad of treaties in force or soon to be in force will ensure these weapons will never be used again. But treaties will not deter the most determined nations from violating them. History is replete with examples of this. NBC weapons technology is more wide-spread today than at the height of the Cold War.

Throughout this paper I will refer to chemical in the sense of the Chemical Corps, not as a part of nuclear, biological, and *chemical*. The chemical mission area covers NBC defense, smoke, flame, and non-lethal operations.[1]

Today's Challenges

It's clear that today we are faced by a number of dangers as the 21st century approaches. The spread of NBC weaponry continues to grow. While many of these dangers are similar to ones we have faced in the past, many are new. MG Robert D. Orton, former Chief of the Chemical Corps, identified four challenges the Chemical Corps faces today during a speech at the 13th Worldwide Chemical Conference. They are:

- Staying trained and ready for any contingency.
- Battlefield asymmetry.
- Complex non-military hazards.
- Proliferation of sophisticated target acquisition and sighting systems.

Staying Trained and Ready For Any Contingency

A number of counter-proliferation efforts are reducing the number and size of NBC weapons stockpiles. These efforts include the Chemical Weapons Convention, Nuclear Non-Proliferation Treaty, Biological Weapons Convention of 1972, and others. It is a given that rogue nations will continue to develop these weapons in spite of counter-proliferation efforts. To avoid detection and world condemnation, these efforts will be well hidden. Additionally, the size of the stockpiles will be much smaller. A number of delivery options will be available to employ NBC weapons. More advanced nations will have theater ballistic missiles with ranges of 1,000 km, and less advanced nations will use rented trucks and small agricultural sprayers. Commanders, regardless of the contingency, must be prepared to face the threat or actual use of NBC weapons. Use against an early entry force could determine the outcome of the operation.

Battlefield Asymmetry

The United States will no longer respond to a chemical attack with an attack in kind. In the past, the ability to retaliate in kind with chemical weapons provided the first line of deterrence. A strong NBC defense capability, the ability to operate under NBC conditions, was our second line of deterrence. In simple words, "if you attack us with chemical weapons, we will then use them against you. Oh, and by the way. It won't bother us because we have the ability to operate under those conditions." We will no longer

retaliate in kind with chemical weapons and have totally renounced the use of biological weapons. Protection —NBC defense—is critical to our ability to deter the use of these weapons. We cannot assume that treaties alone will eliminate these weapons from future conflicts. "Today we must protect the force, absorb the attack, and drive on accepting the degradation that the attack has caused."[2]

Complex Non-Military Hazards

Technology hazards exist in all areas where the US Army could deploy. From south Florida in support of relief efforts after Hurricane Hugo to peacekeeping measures in Bosnia, the future battlefields and areas of operations are dotted with nuclear facilities, chemical production facilities, high technology industries, and numerous hazardous materials. British peacekeepers in Bosnia recently found themselves at risk from an abandoned chemical manufacturing plant. Fumes from leaking nitric acid, formaldehyde, and other hazardous materials were drifting into their position. Believing there was no NBC warfare threat, the unit had left their "NBC kit" behind, to include their respirators. The unit was not prepared for this situation. They lacked the proper protective equipment and the knowledge on how to deal with the situation. We must protect the force against all hazards (NBC-related weapons and technology). To achieve this goal, we must provide better avoidance, protection, and decontamination tools for our soldiers.

Proliferation of Sophisticated Target Acquisition and Sighting Systems

During *Operation Desert Storm*, Abrams tanks engaged Iraqi tanks at distances of 3,000 meters with one round hit accuracy. The advanced fire control system of the Abrams provided us a technological advantage. However, high technology weapons are proliferating at an alarming rate worldwide. During *Operation Desert Storm* we clearly owned the night, but soon many potential enemies will also own the night. "This technology grows geometrically and is widely available throughout the world. The spread of these systems is uncontrollable."[3] The Chemical Corps plays an important role in protecting the force through the employment of smoke and obscurants. Current smoke systems defeat target acquisition and sighting systems in the visual spectrum. The newest generation of smoke generators, the XM56 and XM86, provide us with the capability to screen both the visual and infrared (IR) spectrums. In the near future millimeter wave obscurants will give us an even more expanded capability to defeat enemy reconnaissance, intelligence, surveillance, and target acquisition (RISTA) systems. Smoke is and will be a combat multiplier.

Tomorrow's Solutions

For each challenge, there exists a solution.

Chemical Trained and Ready

The future brings reduced budgets, smaller forces, and additional and varied missions. Commanders will face a myriad of challenges to maintain readiness. It is our responsibility to ensure chemical training is not put on the back burner. Chemical training is the foundation of being chemical trained and ready.

Chemical trained and ready covers all the chemical mission areas—

- NBC defense
- Smoke
- Flame
- Non-lethal operations

Chemical units as well as the chemical battle staffs must focus on readying their organizations for combat operations under NBC conditions and technological hazards. The Chemical Corps has been charged with a set of tough standards. We must prepare ourselves and the units we support to operate under these standards:

- No long-term health effects.
- No large numbers of immediate casualties.
- No uncontrolled environmental hazards.
- No environmental "trashers."[4]

Operations Desert Storm and *Restore Hope* have established that the American forces have a new center of gravity—casualties. It is clear that the American people will not accept high numbers of casualties from military operations. NBC weapons can generate a high number of casualties from a single attack, and that could signal the end of American operations.

Chemical situations must be an integral part of all training. No large-scale smoke operations were conducted during *Operation Desert Storm*. One reason for this was the fear on part of the commanders that their units had not trained under smoke conditions, and they could not predict how the units would operate under smoke if it was used. Fortunately smoke was not necessary to breach the Iraqi defensive positions. However, the National Guard units training at the National Training Center for deployment to Saudi Arabia found it impossible to breach the Iraqi style defensive position without smoke. At one point, two mechanized smoke platoons were placed in support of the task force executing the breach of the defensive position training lane.

We must understand how our operations, both in training and actual conflicts, affect the environment. Smoke training is becoming more difficult because of stricter environmental standards. We must learn how smoke affects the environment and discuss this with the local regulators. Not only is smoke training being restricted, but so is decontamination training and the use of chemical agent simulants. In all areas of chemical

training, we must understand how this training does or does not affect the environment. If we fail to determine whether our training does or does not affect the environment, our ability to train will be restricted and our readiness will suffer.

Overcoming Battlefield Asymmetry

The Chemical Weapons Convention (CWC) will restrict, but not eliminate NBC weapons availability. The CWC and existing treaties give us a real head start for eliminating most of the NBC weapon stockpiles throughout the world. We must recognize that some nations will never comply fully with any arms control treaty. In the past we primarily relied upon the ability to retaliate in kind, with force protection a secondary consideration. Today we must back the CWC with a strong force protection posture. We cannot afford to eliminate our protective posture because the CWC has eliminated the threat of chemical warfare. Chemical weapons exist today and will exist tomorrow. Chemical defensive training must be conducted today and into the 21st century as one of the keys to overcoming battlefield asymmetry created by the CWC.

Currently efforts are underway to build verification into the Biological Weapons Convention of 1972.[5] It is clear that the 1972 BW accord did not deter nations from developing an offensive biological weapons capability. As a result of the 1991 Gulf War, biological defense has become a priority program with the Department of Defense. This effort to increase the biological defensive posture of the US armed forces is clearly a catch-up effort because of years of neglect. The US blindly assumed that the 1972 BW accord had eliminated the threat and that biological defense was no longer needed.

We must understand that treaties will not eliminate the danger of NBC weapons. The threat will always be present, albeit in smaller quantities.

...treaties will not eliminate the danger of NBC weapons.

For the present and the future, the only means of overcoming the battlefield asymmetry is through the maintenance of a strong defensive capability.

Dealing with Technological Non-Military Hazards

During combat operations and operations other than war, we will face complex hazards from commercial industries, lax environmental pollution controls, and other sources. We must be prepared to advise the units we support and deal with these hazards.

The situation in the former Republic of Yugoslavia brings this point home. Leaking chemicals from industrial complex, warring factions threatening to use commercial chemicals as weapons, and hazards from improper disposal of hazardous materials all threaten the safety of the troops deployed. Yugoslavia is not atypical.

US forces will face these hazards worldwide. Chemical troops, both units and battle staffs, must prepare to meet this challenge. There is much to learn in this area from the civilian hazardous materials (HAZMAT) teams that operate throughout the country. Additional training and equipment must be identified and procured. We must identify the soldiers who have received specialized training in dealing with non-military hazards with skill identifiers. Specific chemical units must be equipped with the specialized equipment to enter and operate in hazardous environments created by technological non-military hazards. Training must focus on identifying potential hazards, selecting the proper protective posture, and mitigating or eliminating hazardous situations.

Technology Hazards

These include a range of hazards emanating from the manufacture, transportation, and use of such substances as radioactive materials, chemicals, explosives, flammables, agricultural pesticides, herbicides, and disease agents; oil spills on land, coastal or inland water systems; debris from space.[6]

No matter where US troops are deployed, chemical specialists and protective equipment must also be deployed. It is our mission to protect the force against all NBC threats, military or non-military, released intentionally or by accident.

Countering Proliferation of Sophisticated Target Acquisition and Sighting Systems

The proliferation of sophisticated target acquisition and sighting systems will continue. Only draconian measures will slow their proliferation. We must counter their use by active and passive measures. Multispectral smokes and obscurants will provide us means to actively counter high technology weapons systems. Care must be taken that these active measures do not degrade or defeat our own weapons. "We must push smoke forward with better obscurants. Our future force cannot be bound by the limitations of fog oil."[7]

Leveraging of information age technology will allow us to see the battlefield as we have never seen it before. By keeping our knowledge of the battlefield high, we will passively

assist in the defeat of high technology weapons and sighting systems. As the Army develops new information age systems, the Chemical Corps must be a part of this development. IVIS—inter-vehicle information system—is not just a combat vehicle system, but should be an integral part of smoke and NBC reconnaissance platoons. IVIS allows the passing of information, vehicle locations, combat instructions between vehicles and echelons of command. The system displays friendly and enemy vehicle locations on a digital map. NBC reconnaissance vehicle crews could rapidly enter the locations of contamination into IVIS, allowing the entire combat force to see where the contamination lies in relation to their own vehicle. Smoke platoons could see where enemy and friendly vehicles are located and adjust their smoke screens accordingly. The challenge the Chemical Corps faces is to ensure we understand the value of these systems to our own mission areas.

Conclusion

The Army of today is different from the Army of the 1980's; and the Army of the 21st Century is being built today. It is clear that the Army will have an expanded role in domestic support and humanitarian operations throughout the world. Operations other than war will take a lion's share of the Army's resources. But, we must remain warfighting focused. It was clear that while the Army in Somalia was there to support humanitarian relief efforts, "gun-fighting" skills were needed and used.

The key to the future is a wider recognition of the Chemical Corps' value. We must believe in the value of our Corps and sell it at every opportunity. Our strength lies in our versatility. The Chemical Corps provides a vital service in protecting our forces whether through NBC defense, defeat of RISTA, or by the use of non-lethal systems. "We can respond to nuclear plant accidents, decon after flood, pump water, react to chemical spills, handle hazardous materials, and assist FEMA."[8] Chemical units can decontaminate, provide showers, clean vehicles for redeployment, provide limited fire fighting, and water transport. Chemical units and personnel have, are, and will deploy in support of our forces throughout the world.

It is clear that we must remain chemical trained and ready now and for the 21st century.

Notes

1. The term non-lethal is used here, however it may no longer be in vogue. Less than lethal, temporarily disabling, and others have been used to refer to these type of weapons and systems.
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Major Robert C. Neumann is the Executive Officer of the 82d Chemical Battalion at Fort McClellan, AL. His last assignment was Chief, Doctrine Development Center at the US Army Chemical School. His previous assignments include observer-controller at the National Training Center, assistant division chemical officer, company commander, brigade chemical officer, brigade plans officer, and assistant S-3 for a mechanized infantry battalion. He holds a BS in Chemistry from Norwich University and is a graduate of the Army Management Staff College.

Operations Other Than War

—smoke integration

By CPT Andrew Harbst

I received 3 years experience as a light infantry battalion chemical officer and dual purpose platoon leader while stationed in Berlin. The 12 months spent as platoon leader were the best of my 11 years service in a variety of positions in both active and reserve units. I found the smoke aspect of the dual purpose job to be the most rewarding.

The chemical platoon's 23 dragon soldiers maintained six M157s and two tank and pump units for sustained smoke operations from July 1992 to July 1993. We conducted smoke operations at the Combat Maneuver Training Center in Hohenfels, Engineer Qualification Area and Maneuver Rights Area in Wildflecken, and Doughboy Cities I and II in local MOUT training areas. We supported two light infantry battalions, 5-502 IN and 6-502 IN, as well as separates that included E-320 Field Artillery and 42d Engineers. In my tenure as platoon leader, the M157 operators accumulated approximately 40 hours of smoke operation; their equipment consumed approximately 5,700 gallons of fog oil.

I'll address the employment of smoke in operations other than war (OOTW) as they pertain to FM 100-5, *Operations*. While in Silopi, Turkey, in July 1992, as part of *Operation Provide Comfort II*, I spoke often with British officers and soldiers who conducted OOTW in Northern Ireland. This was my official exposure

Photo courtesy *Soldiers* magazine.

Dragon soldiers are writing the doctrine on smoke operations in operations other than war.

to OOTW. We consistently returned to four particular OOTW tasks that included: convoy operations, checkpoints, food distribution points, and airfield operations. These four tasks would later become the platoon's battle drills for smoke integration in OOTW.

The chemical platoon began smoke integration training in OOTW when I came on board in July 1992. Current world events drove the OOTW sensitivity to new heights. My platoon was the only one of its kind in the brigade. We were required to respond to new operational requirements. Our success depended on the aggressiveness of our leaders. Mission training plans for smoke operations in OOTW did not exist. So, the platoon's soldiers were responsible for setting the standard in the integration of smoke in OOTW.

Initially, we were consumed by the wargaming process. We developed a variety of scenarios based on current Bosnian-Serb intelligence. We trained diligently, realizing that our upcoming exercises would become the only experiences to draw upon once deployed. Tasks were prioritized according to their prevalence in OOTW.

Smoke in support of convoy operations was trained first. Smoke use at checkpoints; food distribution points and airfields followed. The brigade intelligence section provided country studies, profiles on benevolent groups, and the current disposition of select NATO forces. The Combat Maneuver Training Center provided an OOTW after-action review that evaluated Dutch Commando's operations in Hohenfels. CNN provided coverage of NATO forces conducting OOTW in Bosnia. We assimilated these mediums and were convinced that smoke could become a formidable combat multiplier in OOTW. It could protect the force and preserve the lives of soldiers and their equipment.

In OOTW, conservation of life begins at the embarkation point, where loaded convoys move precious cargo to areas of need. Convoys are vulnerable throughout their operation. Force protection is their rule. In accordance with FM 3-50, *Smoke Operations*, carefully placed smoke increases a convoy's survivability by:

- screening its movement,
- isolating hostile forces, and
- providing a reactionary force capable of assisting in the breaking of contact with belligerent groups.

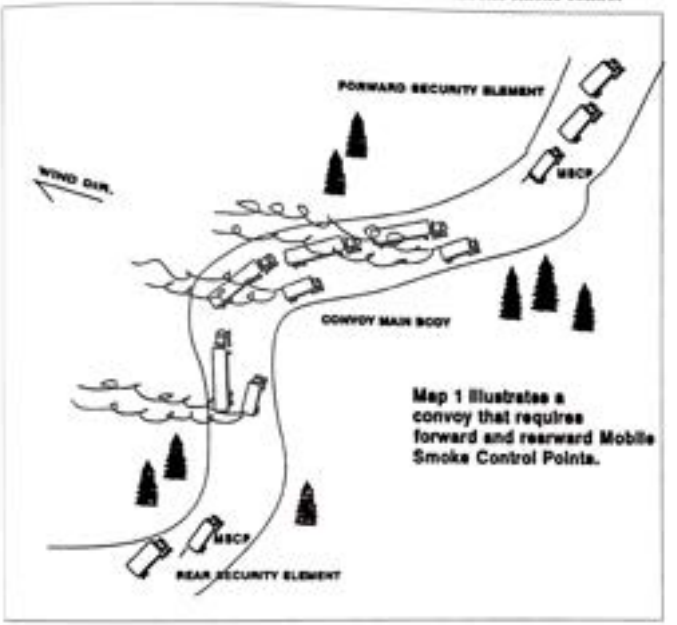
These tasks are accomplished by careful planning, rehearsing, and precision execution. Several factors impact on smoke requirements:

- the size of the convoy,
- the mission's length,
- weather and road conditions, and
- threat level.

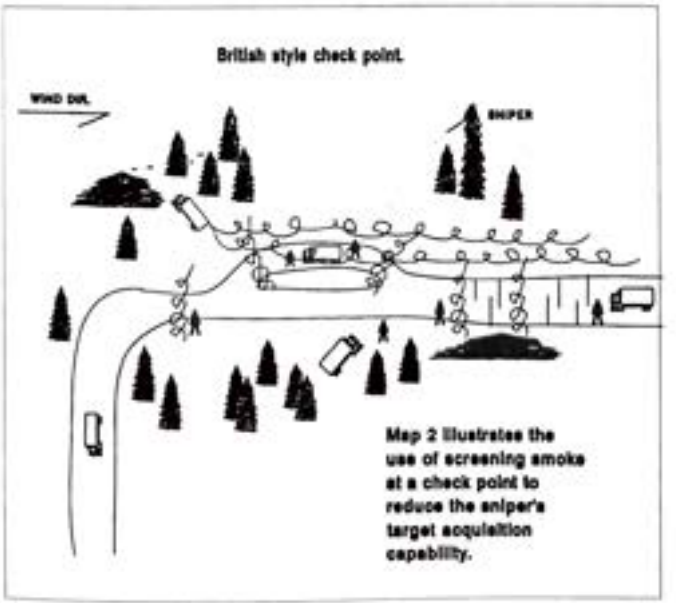
The size of the convoy and weather and road conditions dictate how the M157s will be employed during the operation. The mission's length and threat level impact on logistical

requirements such as fuel, weapons, and ammunition. Experience has proven that the platoon's mobile smoke control point is best positioned with the forward security element.

Using an M157 or this purpose adds flexibility to the operation. A rear mobile smoke control point is required when the convoy extends past the forward mobile smoke control point's field of view for extended periods. Initially, M157s are best positioned throughout the convoy and abreast of its units (Map 1). A note of caution: obscuring smoke may cause hazardous driving conditions, reduce convoy speed and/or could result in breaks in contact along the convoy route. Risks associated with movement through obscurants are reduced when training is conducted in similar conditions, the intensity of vehicular visual markers is increased, and vehicle commanders are required to actively participate during movement. The risk of sustaining sniper casualties at checkpoints is great. This risk is reduced when screening smoke is integrated into the security plan. Within seconds, a pre-positioned M157 can provide a quick smoke screen over the checkpoint. In addition, the M157 operators can tie into the security plan and provide additional firepower and communications systems. The M157(s) normally is OPCON to the checkpoint officer in charge and best placed in hiding, upwind of the checkpoint (Map 2).



Map 1 illustrates a convoy that requires forward and rearward Mobile Smoke Control Points.



Map 2 illustrates the use of screening smoke at a check point to reduce the sniper's target acquisition capability.

Smoke pots are positioned upwind of the M157(s) and electrically ignited when fires are taken from its upwind side. Once the sniper's location is pinpointed, the static M157 is capable of transitioning into the mobile mode and shifts the screen to afford greater coverage.

Hostile threat by snipers and other organized forces is an obvious one, and the threat by the masses: refugees and civilians, although less obvious, is just as likely to occur at food distribution points. In this operation, smoke increases survivability in two distinct ways. First, as with checkpoints, smoke delivered between friendly and hostile forces degrades their ability to harm soldiers and civilians. Once fired upon, the M157(s) begins smoke that blankets the area and prevents further unobscured observation of friendly forces and civilians. Secondly, smoke

is used to quell rioting associated with distribution of food and supplies to refugees. In this case, smoke isolates the crowd and causes confusion. The mob responds by scattering and seeking smoke-free areas. Furthermore, a method of crowd dispersion which warrants the approval of higher authority and when lesser methods of force are attempted, is the use of riot control agents in conjunction with the M1057 system. CS powder scattered above the generator's baffles is dispersed with fog oil particles. Smoke generator operators and friendly forces operating in the vicinity must take care to protect themselves against the RCA's incapacitating effects.

During airfield operations, obscuring smoke protects workers, soldiers, and their equipment by hindering enemy surveillance and by degrading his ability to engage targets of opportunity. It is a precision smoke operation, since aircraft have minimum visibility requirements. Mobile smoke screens airfield activities and protects the secrecy of select cargo. Command and control of M157s at the airfield is best accomplished from the tower, where the entire airfield can be observed. This mission is normally coordinated with the airlift control element and unit's arrival/departure airfield control group.

Present dragon soldiers are writing the doctrine on smoke operations in operations other than war. They are gathering information from a variety of sources assimilating the data and developing MTPs that support the integration of smoke in OOTW. They are on the initiative and breaking new found in the peacekeeping and peacemaking operations associated with conflicts on Bosnia, Northern Ireland, Somalia, and Haiti.

Convoy operations, checkpoints, food distribution points, and airfield operations are fundamental OOTW tasks that require precision smoke to increase the survivability of personnel and materiel. This endstate, preservation of life and materiel, is most often accomplished by the platoon leader who dismounts, marches to the sound of the guns, and leads his platoon from the front.

At the time this article was written, CPT Andrew M. Herbst was assigned as the 82d Airborne Division Artillery Chemical Officer. CPT Herbst has a BA in Biological Science from florida Atlantic University. His source of commission is Officer Candidate School at Fort Benning, Georgia. He is a graduate of chemical officer basic and advanced courses. Previous assignments include battalion chemical officer, 5-502 and 6-502 Infantry Battalions, and dual-purpose platoon leader, Berlin Brigade.

172d Chemical Company Tests New Smoke Generator

By PFC Chris Mercergill

The 172d Chemical Company, from Fort Carson, Colorado, tested the XM56 smoke generators at Fort McClellan, Alabama, this summer.

The XM56 smoke system is a turbine generator mounted on a heavy version (M1097) HMMWV chassis. The XM56 provided static or mobile large-area smoke in the visual or infrared spectrum. The system uses fog oil to provide the visual obscuration and graphite and fog oil to provide the infrared smoke.

Before the test began, second and third platoons went through a week of classroom and hands-on new equipment training. These soldiers were "certified" prior to the start of the test.

The second platoon executed the smoke missions while the third platoon collected data on the performance of the XM56 system. The smoke missions provided concealment of the Long-Range Surveillance Detachment of the 104th Military Intelligence Battalion. The 104th MI is also from Fort Carson.

The first platoon, 172d was the opposing force while the 4th platoon provided support to all of the elements.

The test was successful and the generators were well-liked by the company chain of command. CPT Ted Ruske, commander of the 172d said, "the test provided a good train-up for conducting smoke and fuel resupply operations at Pinion canyon and the upcoming National Training Center rotation."

3rd Place

Battlefield Smoke

—integration and synchronization

By CPT Mark Frahm

On the modern battlefield the integration and synchronization of smoke systems is an essential combat multiplier.[1] When used properly smoke is highly effective and capable of changing the outcome of battles. Military forces have become dependent on electro-optical systems and weapons which can be defeated by smoke. This includes night-vision devices, near infrared weapons and systems, laser designated weapons, and other systems. In the future there will be more electro-optical systems in use on the battlefield and they will be more effective. However, new improvements in smoke technology will enable it to defeat the new as well as the old systems.

To effectively employ smoke, commanders must realize the limitations and capabilities of this combat multiplier. They must integrate smoke into the tactical plan, using various systems, to do the job it is designed to do. The systems that deliver smoke include, but are not limited to, artillery, mortars, smoke generators, and smoke pots.

The Arab-Israeli War in 1973 introduced the first effective use of smoke and obscurants against electro-optical systems. The Egyptians used smoke to cover their crossing of the Suez Canal and the Israelis used smoke to protect against Arab electro-optical systems. In both instances smoke increased the force's survival on the battlefield. This caused the United States military to renew its interest in smoke and obscurants.[2]

The overall goal of the military during war is the destruction of the enemy's forces. This is achieved through the successful application of the tenets of Army doctrine. The military must use initiative to the maximum, exercise agility in operations, fight in depth, synchronize their efforts,and use versatility in conducting operations. During military operations the enemy will attempt to use many lethal systems against us. We must be able to destroy or degrade these systems to the maximum extent possible.

To better understand the effective integration and employment of smoke and smoke systems, we will examine two examples of smoke employment at the National Training Center at Fort Irwin, California. I will focus my discussion in the following examples on the way smoke was employed and whether it was effective.

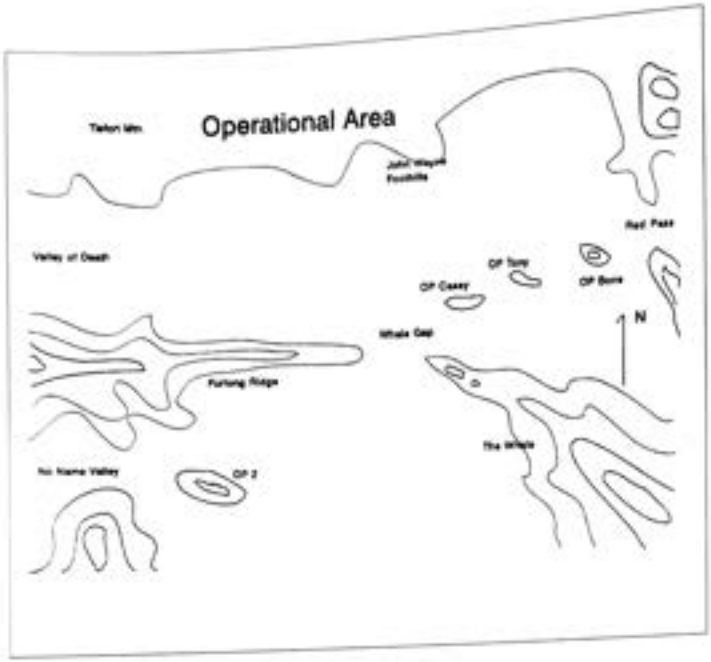
Mission 1

The first example occurred during a rotation I was on with the 1st Cavalry Division at the National Training Center. The mission of the brigade was to breach an enemy obstacle system in stride, attack the enemy defensive positions, and drive on to subsequent objectives in the enemy's rear. The brigade's task forces (TFs) attacked west to east through the Whale Gap to enemy defensive positions in Red Pass (see figure next page). An armored TF had the mission of breaching in stride with a mechanized TF exploiting the success of the breach. The two TFs would then push through the enemy defenses and on to the rear.

The enemy obstacle system was about 800 meters wide, made up of wire, mines, and dug-in positions. The enemy had two observation posts in place. The first was on OP Tony and the second, a well covered and concealed position, on OP Bone (see figure next page).

Task Organization

The brigade was organized with one heavy armored TF and one heavy mechanized TF. It consisted of a field artillery battalion in direct support,



one engineer company, an ADA battery, and a mechanized smoke platoon. The usual CS and CSS units were in support of the brigade.

Concept of the Operation

The brigade commander organized his force into two groups: the support/breach force and the assault force. The support/breach force would move under the cover of mechanized and artillery smoke with the assault force following behind it. The support/breach force would breach the enemy obstacles in stride and move on to assault the enemy defensive positions. The assault force would then exploit the support/ breach force's success and move to the enemy rear and follow-on objectives.

As the two TFs prepared in the assembly area, in the vicinity of No Name Valley and Furlong Ridge, a fire support team and the smoke platoon moved into place. The fire support team occupied a position on the Whale where they could call in fires up to Red Pass. The smoke platoon moved through the Whale Gap to a position on the north face of the Whale. The smoke platoon was just forward of OP Casey along the north face of the Whale. The smoke platoon and the fire support team were in place around 0430.

At 0500 the TFs began to move out from the assembly area toward the Whale Gap. Artillery smoke rounds began to land on the objective and the smoke platoon began producing a smoke blanket. Initially the winds were blowing from the southwest; this was excellent for the artillery smoke, but not for the mechanized smoke.

As the TFs moved through Whale Gap the wind direction began to shift to the northwest. This shift caused the mechanized smoke to move, creating a blanket from south of OP Tony to the edge of the John Wayne Foothills. Unfortunately the artillery smoke began to dissipate and blow off the objective. The enemy elements on OP Tony had been destroyed during the counter-recon fight, but OP Bone still had a recon team on it.

Between 0545 and 0600 the initial elements of the brigade began to exit the smoke blanket and were silhouetted. The objective still had a light smoke haze on it, but OP Bone was totally clear. The enemy elements on the Bone were able to call artillery fires on the TF as it emerged from the smoke. They were also able to let the defensive positions know when and where the TFs would hit the obstacle system.

As the support/breach force hit the obstacle belt they began to take more loses, but were able to clear lanes through the obstacle. The assault and breach forces moved forward and attacked the enemy main defenses. After considerable losses on both sides, the battle ended as a draw.

Why was this mission unsuccessful?

Some leaders feel that a draw at the National Training Center is as good as a win. That is not the case in this battle. Proper smoke integration coordination, and synchronization could have made this attack an overwhelming success. During the planning process and execution phase, the brigade chemical officer and fire support officer never communicated with each other. They both created separate smoke plans which were never integrated or properly synchronized. Also, the mortars had very few smoke rounds with them and were never effectively integrated into the plan to use their smoke.

The TF chemical officer did not take part in the planning process for the use of the TFs chemical assets. Consequently, the smoke platoon leader had to do all the planning and coordination with the TF S-3.

The brigade and TF commander never really understood the need for an integrated smoke plan. This led to poor guidance and intent being given to the chemical officer, fire support officer, and smoke platoon leader. There were no control measures specified nor plans made for adjusting the mechanized or artillery smoke.

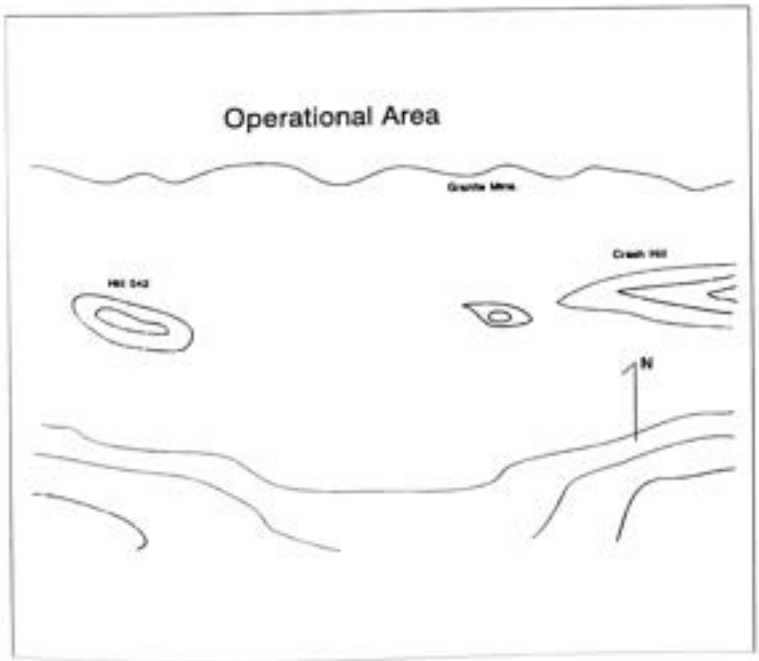
Additionally, there were never any plans for follow-on smoke missions should they become necessary. The maneuver plan never adequately addressed the fundamentals of breaching operations--suppress, obscure ,secure, and reduce.

There was never any properly synchronized execution of artillery, mortar, or mechanized smoke. The smoke delivery systems were never properly controlled or integrated to achieve mission success. Units and commanders must remember that uncoordinated, misplaced, and insufficient smoke can cause the loss of friendly forces and mission failure.

...uncoordinated, misplaced, and insufficient smoke can cause the loss of friendly forces and mission failure.

Mission 2

The second example is taken from a paper written on a reserve unit rotation during the preparation for *Operation Desert Shield/Operation Desert Storm*. The mission of the brigade was to breach a complex system of enemy obstacles and attack the defensive positions. The brigade was to attack from east to west, between Crash Hill and the Granite Mountains, toward the objective vicinity of Hill 542 (see figure below). An armored TF had the mission to conduct a deliberate breach with a mechanized TF to exploit and seize the objective. The armored TF was supported by a mechanized smoke platoon. The obstacle system was about 1,200 meters wide with mines, wire, and an antitank ditch. The obstacle system was overwatched by a dug-in infantry battalion.



Task Organization

The brigade was organized with a heavy armored TF and a heavy mechanized TF. It also consisted of a field artillery battalion in direct support, two engineer companies, an ADA battery, and a mechanized smoke platoon. The usual CS and CSS units were in support of the brigade.

Concept of the Operation

The brigade commander organized the force into three groups: the support force, the breach force, and the assault force. The support force set up an attack by fire position to isolate the breach and set up and suppress enemy elements. The breach force then set up breach lanes in the obstacles, and the assault force crossed the obstacle to destroy the enemy forces.

As the support force approached the obstacle, the fire support team triggered the initial artillery smoke rounds. The support force would use the artillery smoke screen to hide from the enemy and allow it to get into position. The artillery smoke would cease once the support force was in position. Then the smoke platoon would come up and create a smoke curtain to isolate the breach area. The support and the artillery forces would then suppress the enemy with fires.

The breach force came forward and the mortar platoon began to deliver smoke on the far side of the breach. This further degraded the enemy acquisition systems and allowed the

breach force to create lanes in the obstacle belts. The assault force then moved forward, cleared the enemy defensive positions, and drove on to seize the objective.

Why was this mission successful?

This brigade's ability to integrate its smoke-producing assets in a planned and logical sequence directly contributed to its success on the battlefield. First, the brigade used the fundamentals of breach operations when creating its plan. They suppressed the enemy, obscured their force from the enemy, secured the position, and reduced. This example shows that smoke is a key ingredient in maneuver operations. The operation proved that "obscuration hampers enemy observation and target acquisition and conceals friendly activities and movements."[3]

The chemical officers and fire support officers were an active and integrated part of the planning process. Mechanized and indirect smoke were combined into a single plan which supported the entire operation. The smoke platoon leader was also an active and integrated part of the planning process. He assisted overall successful planning and execution by providing his knowledge of smoke, the prevailing weather conditions, and proper troop-leading procedures.

The brigade commander recognized and understood the need for smoke to support the scheme of maneuver. He gave clear and concise guidance and intent for using obscurants. He not only ensured smoke was integrated during the planning and execution phases, but during a key phase of the operation: the rehearsal.

In this example we see proper synchronization and execution of artillery, mortar, and mechanized smoke. The smoke systems were controlled and adjusted to ensure overall success of the mission.

Recommendations and Conclusion

Proper smoke coverage is essential to mission success. When units integrate and use smoke assets properly they become an effective combat multiplier. When units do not use them properly they can cause mission failure. "Smoke complicates an attack, but confusion favors the bold if confusion is equally present on both sides."[4] Units that use smoke in their operations must remember that it is a "two-edge" sword. They must plan for how this will impact on their operations.

Commanders must give planners clear and concise guidance. They need to ensure the staff understands the intent for the mission and for the use of smoke in the operation. Then the smoke experts, chemical officers, fire support officers, and smoke platoon leaders can develop an effective plan. The experts must work together to use their assets for overall mission success. The previous examples demonstrate that all available smoke assets must be integrated on the battlefield to provide support for tactical operations.

In many instances Army commanders and units are underestimating the impact of smoke operations on the modern battlefield. Simulations have shown a reduction in the loss of combat power by 30 percent, a force survival increase of 70 percent, and a reduction of advance rates when smoke is properly employed.[5] This could eliminate a portion of the direct fire battle. If the Army does not improve the integration and planning of smoke and smoke systems, we will not be prepared on the next battlefield.

Notes

1. Jordan, Larry R., LTC, "Battalion Commanders View on the Use of Smoke," *Proceedings of the Smoke/Obscurants Symposium X*, Aberdeen, MD, 22-24 April 1986, pg. 507.

2. Thornton, Robert E., LTC, "Smoke Integration Concept," *Proceedings of the Smoke/Obscurants Symposium IX*, Aberdeen, MD, 23-25 April 1985, pg. 465.

3. Neuman, Robert C., MAJ, "Into the Breach-Smoke During Breaching Operations," Unpublished report, Directorate of Training Developments, U.S. Chemical Center and School, Ft. McClellan, Alabama, pg. 2.

4. McDonough, James R., *The Defense of Hill 781*, Presidio Press, 1988, pg. 138.

5. Army Science Board, *Ad Hoc Group on the Army Smoke and Obscurants Program*, Washington, D.C., December 1983, pg. 6.

At the time this article was written CPT Mark Frahm was attending the Chemical Officer Advance Course at the US Army Chemical School. After leaving here he will be assigned as a brigade chemical officer to the 25th Infantry Division, Schofield Barracks, HI. CPT Frahm graduated Clarkson University in New York in 1989 with a bachelor of science degree in chemical engineering. Some of his past assignments include the Chemical Officer Basic Course; battalion chemical officer 3rd Battalion 82nd Field Artillery, 1st Cavalry Division; and smoke platoon leader and company executive officer 68th Chemical Company, 1st Cavalry Division.

Smoke and Obscurants

—protecting rear area assets and operations

By SFC Anthony J. Violante and Randall R. Williams

The 1998 vintage Sukhoi Su-34 flew low and fast over the dawn-lit desert terrain. The aggressor aircrew's mission was to destroy a blue coalition C^3I mission-critical asset. Nearing the target, the aircraft responded with a pop-up maneuver to avoid active defenses.

At 24,000 feet slant range to target, the weapon system officer encountered difficulty acquiring the target. The exact reported target location seemed fogged-in, obscured. Approaching the critical weapon release point, the weapon system officer acquired the distinct target signature just beyond the reported Global Positioning System target coordinates. With glee, he released his string of destructive weaponry; satisfied of a sure, albeit difficult, kill, the aircrew rapidly turned the aircraft toward home. The next day the aircrew learned with shock that they had been deceived! They had successfully targeted and bombed a simple and inexpensive decoy. The real target, the mission-critical C^3I, had survived. It had been effectively concealed and camouflaged by a multispectral smoke and obscurant screen.

As portrayed in this fictional but plausible futuristic scenario, our forces can and must gain survivability advantage from passive defenses such as camouflage, concealment, and deception. Particularly, for rear-area fixed and relocatable mission-critical targets, limited-and large-area smoke and obscurants (S/O), properly employed in a deception scheme, will provide increased survivability.

"Major Murphy told me that he could not add smoke in the plan since the stencil had already been cut. That was one of the most foolish remarks that I heard during World War I."

General George S. Patton, Jr.
Patton's Diary, **September 8, 1918**

Background

Armies have used S/O to confuse and deceive their enemies throughout history. Recorded use of S/O dates to the Peloponnesian Wars (circa 400 BC). There are numerous examples in our Army's history where the use of S/O greatly reduced the vulnerability of rear areas and fixed sites from threat reconnaissance, intelligence, surveillance, and target acquisition (RISTA) efforts.

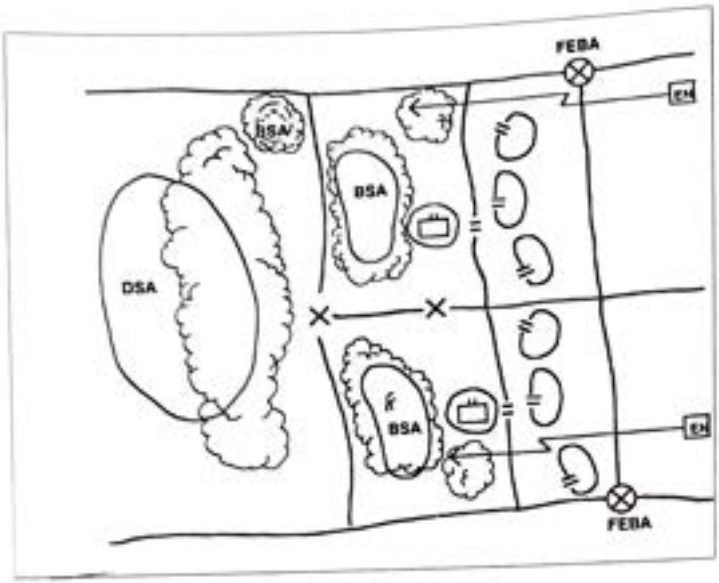
S/O was used effectively in WW II to screen major port facilities, bridges, main supply routes, and airfields. In 1943, a fog oil smoke blanket placed over the supply facilities at Bizerte Harbor in North Africa (used to protect assets from attacking German aircraft) resulted in 3,000 bombs falling harmlessly in and around the area.

Near the end of the Korean War during the operations around Pork Chop Hill, construction, supply, and evacuation operations had to be carried out under direct observation of North Korean troops. To provide protection from direct enemy observation, a smoke screen was continually employed for four months.

The successful operation continued until terminated by the commander due to manpower shortages. Subsequent enemy fire and resulting casualties brought the smoke generators back.

Threat

Technological change is inducing a revolution in threat deep-strike warfare capability. Future threats will potentially possess a greater capability to effectively conduct RISTA against



mission-critical assets and operations over an extended area of the projected battlefield. Warfare will become an even more competitive and lethal end-game of "hide and seek."

Impending threat resolve will most certainly dictate employment of long-range precision strike systems against target-rich environments. Innovative passive defense strategies must be effectively coupled with active defense doctrine to counter the increasing technological advantage afforded by extended-range weaponry.

Because of the physical size of most mission-critical assets and the area required for operations, it is difficult to think of using passive CCD equipment and techniques to counter the future accuracy and lethality of sophisticated RISTA systems. However, large- or limited-area S/O, when properly employed, has proved to provide excellent CCD for large-area mission-critical assets, facilities, operations, and other potential rear-area targets.

FM 3-50, *Smoke Operations*, states that smoke can be used in rear operations to: *Conceal support forces, facilities, and activities, thereby reducing enemy observation and the necessity to move frequently.* Figure above (from FM 3-50) shows an example of S/O employment in rear operations using large-area S/O to conceal support activity from enemy RISTA efforts. Note the use of deceptive clouds employed on several avenues of threat approach. Recent developments have improved the perception of, and the effectiveness of, large-area S/O screens as a countermeasure for protection of large fixed facilities.

Recent tests and demonstrations have successfully shown that this traditional "low-tech" asset can be an effective counter-measure to "high-tech" weapon systems. These events include extensive demonstrations by the US Air Force for airfield and air base mission-critical asset protection. As a result, the USAF has purchased a relatively large number of S/O generators and has included guidance for S/O employment in the "Air Base Camouflage, Concealment, and Deception Guide." Additionally, modeling and simulation efforts within the Joint Service and NATO RDT&E community, along with S/O employment during *Operation Desert Shield* have effectively demonstrated to many skeptics that large-area S/O employment is much more operationally compatible and effective than expected.

Testing conducted by the Office of the Secretary of Defense Joint Camouflage, Concealment, and Deception Joint Test Force has addressed the quantification of the effectiveness of S/O screens against attacking aircraft. Using U.S. aircraft (monitored for time, space, positioning information) as surrogates for hostile aircraft, electronic simulated release of munitions has provided a recorded capability to score these operationally near-realistic battlefield test events.

The joint test force employed limited-area, as compared to large-area, S/O screens to meet environmental constraints. Even with critical airfield target cues exposed, due to limited target area coverage, the limited-area S/O provided some elements of CCD to the attacking aircrews, thus negatively impacting their targeting capabilities .

Deny the enemy use of landing zones and/or drop zones. According to FM 3-100, S/O can also be placed to restrict enemy observation of pickup zones without interfering with friendly operations.

Isolate enemy forces in the rear area. The above figure (from FM 3-50), shows secondarily an example of isolating enemy forces in rear operations. Through the use of dummy brigade support area, or deceptive S/O screens, enemy intelligence gathering is disrupted. If the enemy penetrates the brigade support area or the division support area, its command, control, communications, and intelligence capabilities are disrupted or made more complicated.

Defeat rear-area threat acquisition efforts and support base, base cluster, and rear operations response to the threat. It sometimes happens that tactical commanders are so intent on their forward offense and the support

of this offense that they neglect to ensure that their rear area is adequately protected by available S/O assets. The senior author witnessed this at the National Training Center (NTC) during his last visit.

At the NTC, on several occasions the rear area was harassed by Opposing Forces snipers and eventually overrun. During one offensive maneuver, the Opposing Forces blitzed through the Blue Forces with the intent of destroying as much of its rear-area assets as possible. The rear was quickly overwhelmed.

The Blue Force made a valiant effort to move to its alternate position; however, many simulated casualties occurred while the unit was in movement. It is difficult to hide 5-ton trucks with trailers and other large vehicles in a flat terrain such as a desert even with the use of traditional camouflage. This is where the use of S/O can make a difference. The US Army Chemical School has recognized this problem, and it was recommended to be brought to the attention of the Vice Chief of Staff of the Army during the School's Functional Area Assessment in October 1994.

Why S/O are not Used in Rear Area/Fixed Sites

Service Support: A 1993 study contracted by the Chemical School (MPRI 1993) found that no non-proponent officer advanced or basic courses contain the necessary dedicated instruction in S/O to ensure that their graduates can effectively operate in an obscured environment. In all advanced courses, it appears that tactical scenarios used by the students do not include a specific task or objective involving employment of S/O.

No NCO course (advanced or basic) contains the necessary instruction in S/O, nor do any course POIs (officer and NCO) conform to TRADOC Pam 525-3, which directs that specific impacts of S/O be taught in combat and combat support officer advanced and basic courses and NCO professional development courses. (It should be noted that since this study was completed, some of these findings may have changed.)

Training. Unit commanders not properly trained in S/O will avoid its use. Operating on the battlefield in obscured conditions is a challenge; however, with relevant and realistic training S/O becomes a manageable survivability enhancement. The benefits afforded the tactical commander skilled in using S/O for rear-area asset protection cannot be ignored. We must train with S/O the way we plan to fight in the future.

Other. S/O testing and training is becoming increasingly restricted due to environmental issues, health concerns, and limited budgets. However, most of these constraints can be overcome by adequate planning, coordination, and knowing where to get help.

Conclusions

Although there are some challenges to improving realistic training for the optimum use of S/O, the US Army Chemical Corps and School stand ready to provide assistance. Every brigade, division, and corps has well-trained and dedicated Chemical Officers and NCOs whose mission it is to support the tactical commander.

For problems or questions on doctrine, training, or developing environmental assessments for S/O training, users requiring assistance are encouraged to contact TRADOC Smoke Integration Proponency Office at DSN 856-4435/5654 or Commercial (205) 848-4435/5654, or the USACMLS Directorate of Chemical Branch Readiness Help Line at DSN 865-5592 or Commercial (205) 848-5592.

SFC Anthony J. Violante is the Senior Smoke NCO at the TRADOC Smoke Integration Proponency Office, US Army Chemical School, Fort McClellan, Alabama. He has served with the Second Chemical Battalion and was a Small Group Leader at the NCO Academy.

Randall R. Williams is the CCD Plans Officer for Office of Secretary of Defense, Joint Camouflage, Concealment, and Deception Test Force, on assignment from U.S. Army Corps of Engineers, Waterways Experiment Station, Vicksburg, Mississippi. He is the recent author of the USAF "Air Base CCD Guide" and served as Science Advisor for Deception, CENTAF Forward during the Persian Gulf Conflict. He holds a MS degree from the University of Florida and a BS degree from the University of Southern Mississippi.

Change of Command for the 404th Chemical Brigade

COL David Marc Wilson assumed command of the 404th Chemical Brigade, Machesney Park, Illinois, 4 September 1994. His previous assignment was Deputy Commander of the 33d Separate Infantry Brigade. Prior to that assignment, he commanded the 66th Infantry Brigade.

The outgoing commander, BG Bruce W. Vander Kolk, has retired after an outstanding career. We wish BG VanderKolk and his family the very best in the coming years and thank him for his contribution to the Chemical Corps.

NBC Defense Officer/NCO Course

A revised NBC Defense Officer/NCO Course will be distributed to schools in January 1995, instead of September 1994 as reported in the July 1994 edition of *CML, Army Chemical Review*. A shortage of printing funds at the Army Training Support Center caused the delay. The course remains 80 hours in length. Units are reminded that the course is not MOS- or AOC-producing. Graduates are not eligible for award of MOS 54B or AOC 74. Additional Skill Identifier 3R (officer) and Special Qualification Identifier C (NCO) have been deleted, despite the fact that they are still listed in Chapter 11, AR 350-41, *Training in Units*, dated 19 March 1993. Graduates of the course will no longer be awarded an ASI or SQI. The correspondence version of the course, which is listed in DA Pam 351-20, is a refresher course. Only graduates of the resident course are eligible to enroll.

Chemical Officer Advanced Course —Reserve Component

Effective 1 October 1994, officers in the rank of major or below desiring to branch transfer to the Chemical Corps must first take the NBC Defense Officer/NCO Course (80 hours) prior to attending the resident phase of the Chemical Officer Advanced Course (RC). The Chemical Branch Transfer Phase of the COAC, which was conducted in FY94, is no longer available. The NBC Defense Officer/NCO Course and Phase I of the COAC may be taken in any order. However, both must be completed prior to attending Phase II of COAC. Officers at the rank of major(P) or above are required to complete the Chemical Senior Leader Qualification Course. Phase I is available through correspondence only and consists of 16 subcourses listed in DA Pam 351-20. Phase II is the Joint Senior Leader/Chemical Officer Course, which is a three-day course conducted at the U.S. Army Chemical School. The next Joint Senior Leader/Chemical Officer Course is scheduled for 17-19 March 1995.

Reserve Component 54B10 and 54B20/3OR Courses

Units are reminded that enrollment in the Reserve Component 54B10 Course, Chemical Operations Specialist, is limited to soldiers in the grades E4 and below. Enrollment in the 54B20/30 Reclassification Course is limited to soldiers in the grade of E5 and above. Soldiers in the grade of E4 are eligible to attend if in a promotable status or are recommended by their commander.

Deputy Assistant Commandant—Reserve Component LTC Randy Kennedy

Please feel free to contact me if I can be of assistance. I welcome your thoughts and suggestions. My address is Commandant, U.S. Army Chemical School, ATTN: ATZN-CM-RC, Fort McClellan, Alabama 36205. I can also be reached at DSN 865-5005, commercial (205) 848-5005.

BIDS

—what is it? how does it work?

By CPT Richard D. Howell

Biological weapons have been around at least since soldiers projected plague-infected corpses over the walls of besieged castles. Although biological weapons have been with us throughout history, at no time have political and technological circumstances been as favorable as they are now for their wartime use. An array of agents of biological origin (ABOs) can now be produced using common pharmaceutical equipment and processes, thus making them known as the "poor man's nuclear weapon."

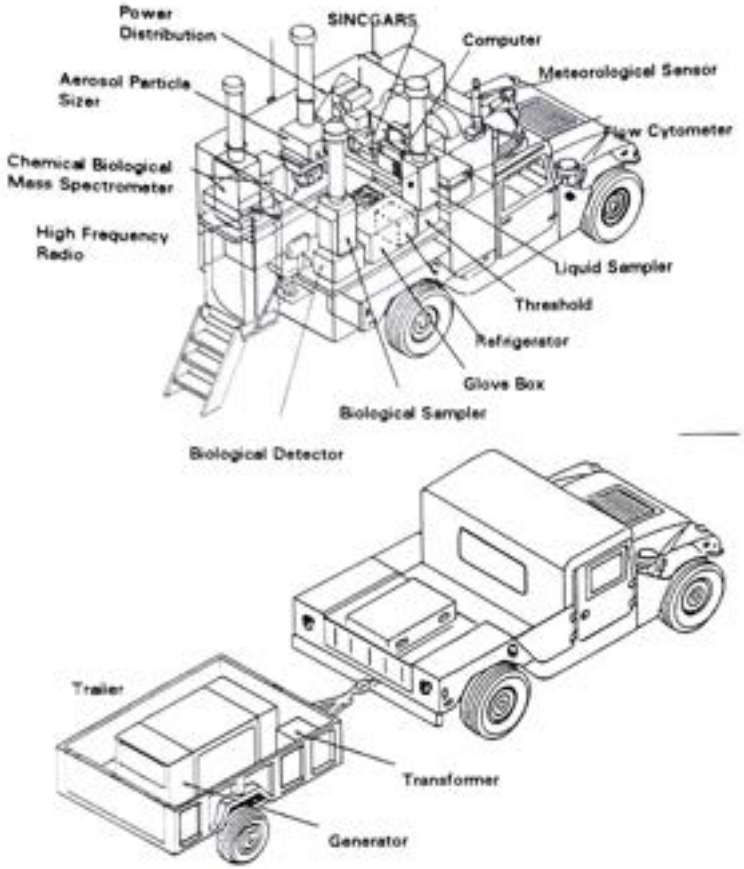
Part of the US response to this primarily Third World threat is the BIDS, the Biological Integration Detection System, now about two years away from fielding. The BIDS configuration currently emerging from the system-definition phase of procurement is a HMMWV-mounted shelter housing modular electronic analytical components. A sample-transport vehicle, a trailer, and a generator complete the system (see figure, next page). This article describes the BIDS and updates the reader on the biological warfare threat it's intended to counter.

Objective

The objective of the BIDS is to mitigate the effects of large-area coverage biological warfare attacks. The four main functions the BIDS must perform are:

- Accurately determine the presence of a biological warfare agent with minimum false positives.
- Produce, preserve, protect, and transport an environmental sample to the appropriate laboratory for definitive identification.

Pathogens		
Organism	Incubation	Symptoms
Coxiella burnetti	14-16 days	Fever, headache, weakness. Low morality rate, but long convalescence period. Slow response to antibiotics. Vaccines available.
Bacillus anthracis (Anthrax)	1-7 days	Carbuncles, swelling, cyanosis. Inhalation of spores usually fatal in 4-5 days, regardless of treatment.
Brucella sp. (Brucellosis)	6-60 days	Fever, pain in muscles and joints
Yersinia pestis (Plague)	4-7	Fever, extreme weakness, death. Vaccines available.
Psittacosis virus	6-15 days	Pulmonary infection, headache, backache
Toxins		
Toxin	Rate of Action	Symptoms
Botulinum	12-72 hours	Vomiting, constipation, sweating, death
Staphylococcus	.5-4 hours	Violent vomiting, cramps, diarrhea. Common food poisoning.
Trichothecene (T2) toxins		Dizziness, bloody vomiting, internal hemorrhage, skin irritation. Yellow rain reported in SE Asia and Afghanistan, produced by fungi. Absorbed through skin. Highly toxic.



•Communicate with command and other BIDS in the area.

•Be capable of frequent relocation and quick set-up.

The Threat

The number of countries developing biological weapons continues to grow, currently as many as thirteen. The ABOs listed in the table (on previous page) are a representative sample of those considered to be of military significance. They include both pathogenic microbes and toxins produced by a variety of organisms. It's of tactical significance that most toxins are, by weight, thousands of times more toxic than standard chemical agents. Some toxins are rapid acting, while most pathogens require an incubation period of at least a few days. ABOs can be delivered anywhere in the theater of operations by rockets, bombs, artillery, and missiles, and some countries have developed special spray devices and aerosol generators to disseminate ABOs. Special forces operating in rear areas are a particular threat with ABOs because of their potential light weight, ease of concealment, and covert dissemination capability.

Biotechnology promises great human benefits, but it has also created new threats, particularly in the area of recombinant DNA. Using this technique, it's possible to insert toxin-producing genes into organisms that ordinarily infect humans without producing significant illness.

Similar techniques may be used to produce large quantities of previously difficult-to-obtain toxins through culturing. The possibilities are nearly limitless. Just as the United States led the way in analyzing and countering the Soviet conventional, chemical, and nuclear threat during the Cold War, we must continuously monitor the development of chem-bio weapons and develop ways to counter them. The BIDS is a big step forward in that direction and provides us the flexibility to detect new ABOs as they appear.

System Development

Instead of waiting for the development of the entire complement of detection technologies needed to detect all potential ABOs, the Chemical Corps is acquiring the BIDS in an evolutionary manner. This will be a three-phased process, starting with an Interim BIDS, followed by a Preplanned Product Improvement (P^3I) version, and culminating with the Objective BIDS. Functional prototypes of the Interim BIDS will be operational by 1996. This configuration will have a limited manual detection capability, able to detect four known ABOs. The P^3I BIDS will be semi-automated, with a detection capability expanded to a total of eight ABOs. The Objective BIDS is intended to be capable of detecting and identifying all ABOs listed in category A of the International Task Force 6 Report (Secret) dated 9 February 1990. It also will be capable of being reprogrammed or modified to detect and identify other ABOs on the battlefield. The detection instruments used in the Interim BIDS are all commercially available and are the result of an extensive market survey in which Battelle Edgewood Operations evaluated 250 different candidates.

Interim System Configuration

The instruments used in the BIDS will provide an overlapping detection capability. If an agent gets past one type of detector, it will most likely be picked up by another. Three air sample intakes protrude from the roof of the shelter. Each air sampler collects air at the rate of 1,000 liters per minute and concentrates particle in size ranges corresponding to ABOs. If particles of the appropriate size range are detected, the M42 alarm is activated and the sample carousel is initiated .

At this point, the second air sampler goes into action and provides a sample for the sample carousel, which has four different components. The ATP detector looks for adenosine triphosphate, an organic substance common to all organisms. The flow cytometer uses light diffraction to detect cells of microorganisms. The immunoassay instruments treat the sample with reagents and antibodies to detect specific antigen-antibody reactions, thus identifying toxins or organisms. Self-contained detector tickets are also to be used to test for a set group of ABOs.

The third air sampler (the XM2) incorporates a collector/concentrator which provided an atmospheric sample embedded in distilled water. The purpose of the second BIDS vehicle is to bring these samples to a stationary in-theater or CONUS laboratory for detailed analysis.

Ancillary Equipment

In addition to the mission-critical detection equipment, the BIDS also requires a number of ancillary systems. For communication, the BIDS design contains a high-frequency, single-side band radio (GRC-193) capable of communicating up to distances of 300 kilometers and multiple subscriber equipment. A single-channel ground- airborne radio system (SINCGARS), and a satellite-supported global positioning system provide local communication and navigation assistance.

The BIDS can be powered from any of four sources. The system is designed to be fully functional using 220VAC or 110VAC external or generator power. The 200A alternator on the HMMWV engine provides 28VDC for emergency use.

The BIDS computer will contain a real-time operating system that will interface with the various detection instruments and control the operation of the system in the P^3I and Object BIDS.

Summary

The BIDS will soon be available to corps commanders as an important asset in deterring the use of biological weapons and guiding the United States response should they ever be used against us. By detecting and identifying biological agents, it will help determine what course of medical intervention is required for casualties and what prophylactics we must provide to friendly personnel in the theater of operations. Most importantly, the BIDS will provide these benefits while growing in an evolutionary manner to meet an ever-changing threat.

At the time this article was written, CPT Richard D. Howell was a student in the Chemical Officer Advanced Course at Fort McClellan, Alabama. He has served as a battalion chemical officer in Germany and a decon platoon leader in the 5th Infantry Division (Mech), Fort Polk, Louisiana. He holds a degree in science education from the University of New Orleans.

Integration

—a program framework for commanders

By CPT David M. Dilutowski

Few aspects of military life are certain during these unstable times of drawdown, decreasing defense budgets, and fluctuating military roles. One of the few things the Army can guarantee is change.

On 29 July 1994, Secretary of Defense William Perry announced the opening of 32,699 military positions to women. These changes, effective 1 October 1994, present commanders (specifically at the company level) with a unique opportunity to implement a comprehensive integration program.

Webster's dictionary defines integration as *the act or process of incorporation as equals into society or an organization of individuals of different groups; to form, coordinate, or blend into a functioning or unified whole.* This is the commander's challenge for a unit assigned female soldiers for the first time. The integration process demands detailed, deliberate planning to minimize organizational disruption and maintain unit morale and cohesion.

This article provides commanders a framework for an effective integration program. It's beyond the scope of the article to present a specific program for all units. But I would like to offer a three-phased strategy, a tool for commanders to use when developing their own integration program. The three- phased process involves:

- Thorough unit pretraining
- A comprehensive inbrief
- Periodic, mandatory follow-up training

The framework is patterned after lessons learned during the integration of the 84th Chemical Company, a mechanized smoke generator company at Fort Polk, Louisiana. 84th Chem had females assigned for about a year to assist in the unit's deactivation. The 84th failed to devise an integration program. Frequent, in some instances serious, personnel problems arose.

Issues involved alleged sexual harassment, equal opportunity violations, and fraternization. The company's morale declined sharply and unit cohesion splintered. By developing a simple three-phased integration plan, other commanders can avoid these time-consuming and stressful lessons learned "the hard way."

Preparation

The introduction of women into a traditionally male unit can cause turmoil and tension if conducted frivolously. Improper attitudes and stereotyping will erode unit cohesion and degrade readiness. Nancy Loring Goldman, *Female Soldiers—Combatants or Noncombatants? Historical and Contemporary Perspectives*, says "The lack of acceptance of women by many military men creates problems for the women. As in other predominantly male settings, military women often face prejudice from male superiors, peers, and subordinates, and face certain male behavior that creates stress and interferes with their job performance. Such behavior includes differential treatment and sexual harassment of varying degrees."

Before conducting the first phase of pretraining, the commander should inform the company when the female soldiers will arrive. Carefully consider the tone and manner in which the announcement is made—it may set the precedence for unit acceptance and unification of the new soldiers. Hold an informal company briefing to consider soldiers' questions and concerns. Present a strong, positive command emphasis and ensure all personnel are present.

To assure thorough integration, assign female soldiers equally throughout the unit. Avoid creating "the female squad" or "the male

platoon." This type of isolation or separation discourages complete integration and fosters an "us" and "them" mindset. Simply assign the female soldiers as you would any other new arrivals.

Pretraining

Conduct thorough unit pretraining as early as possible before the female soldiers arrive. Ensure maximum participation (to include leaders) and provide make-up training for those unable to attend the initial training. Pretraining should include (but is not limited to):

- Commander's expectations/ standards
- Sexual harassment regulations
- Fraternization policies
- Equal opportunity training
- Barracks policies

Conduct pretraining with a positive, enthusiastic and well-qualified instructor. Thorough understanding of the most current policies is essential. Soldiers may feel this training is unnecessary or useless. Consider role playing or other direct involvement of the audience. Emphasize what constitutes sexual harassment and the complaint procedures and consequences under the Uniform Code of Military Justice. The commander must stress the seriousness of these policies and convey total commitment to the integration program.

The Inbrief

An effective welcome and inbrief from the commander can go a long way toward easing the tensions of newly assigned female soldiers. Set the stage for their acceptance and equality by introducing them to high unit standards of conduct and effective personnel policies.

Stress the importance of openness, fairness, and communication. Assign unit sponsors to assist with inprocessing. Explain the company integration program, clearly define the scope and objectives of the plan.

Improper attitudes and stereotyping of women will erode unit cohesion and degrade readiness.

Let them know that smooth integration is your chief concern, and that you are totally committed to *your* program.

"An action program must begin at the top. Ultimate responsibility for the problems of military women should be placed at the levels of the military commander rather than at the NCO level. The attitude of the commander is the single most important factor in determining the implementation of reforms," writes Michael L. Rustad in *Women in Khaki, The American Enlisted Women.*

A few other considerations that both soldiers and leaders should be familiar with include:

- The commander's open door policy
- Single parent/family care plan requirements
- Necessary provisions in the field
- Physical training programs
- Spouse support groups
- Post support activities

By taking the time to get involved and clearly explaining these issues, the commander can convince the recently assigned soldiers that he is dedicated to ensuring their smooth transition into the unit.

Follow-up Training

The commander must remain involved and committed to the integration program. Training should continue periodically. Problems are likely to arise as the initial assignment of female soldiers interact and gain acceptance into the company.

"In addition to all the other things they need to learn, military men and women must also learn about others' understanding of the relationship between the sexes—their ways of flirting, their style of bargaining, the responsibilities each sex accepts and expects of the other. Both men and women undoubtedly make mistakes in receiving, interpreting, and sending sexual signals; for women such mistakes may be quite consequential," comments Judith Hicks Stiehm, in *Arms and the Enlisted Women.*

In the military any such mistake may be quite consequential. The commander is ultimately responsible for ensuring proper procedure is followed should serious *mistakes* occur within his command. Don't hesitate to call the Judge Advocate General's Office, the Inspector General, or your next higher headquarters' equal opportunity or sexual harassment representative for advice should a *mistake* occur within your unit.

As stated earlier, change is assured in the military. New soldiers arrive, trained soldiers depart, new leaders come and go. Follow-up training is critical for proficiency sustainment. In addition to sexual harassment, equal opportunity and fraternization instruction, follow-up training may include sensing sessions and preventive medicine briefings.

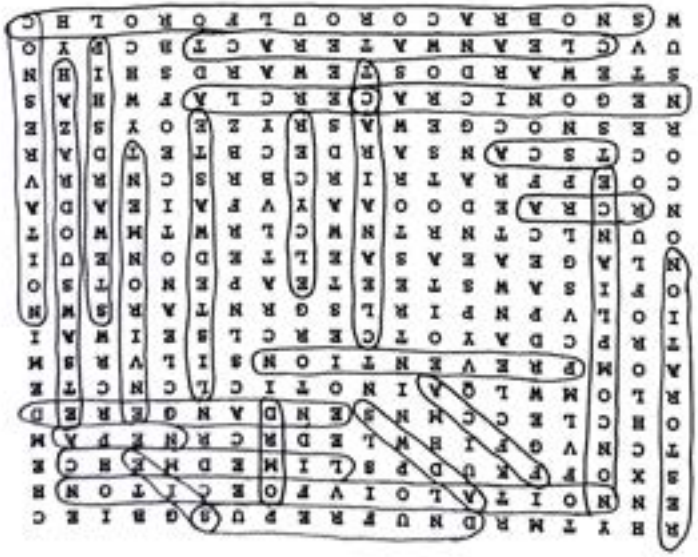
Sensing sessions provide a platform for female soldiers to privately or anonymously disclose potential or actual conduct violations. These sessions provide the commander with an invaluable insight into his command climate.

Briefings conducted by preventive medicine personnel educate soldiers on various sex-related subjects including birth control, pregnancy, and sexually transmitted diseases. Although this briefing may, at first thought, seem unnecessary, remember that the average enlistee is 18-20 years old. "Junior enlisted personnel are at a sexually active stage of their lives. Many are away from family and community restraints for the first time, and the culture seems to encourage (at least for men) heterosexual experimentation," says Hicks.

As evidenced by the opening of almost 33,000 new positions, women are becoming a more integral part of the United States military establishment. It seems likely that as the Army continues to restructure and reshape its organization and missions, so, too, will it reevaluate and redesignate the role women will play.

Thus, commanders must continuously strive to unify men and women into an effective and cohesive, sexually integrated team. By incorporating this simple three-phased strategy of pretraining, inbriefing, and follow-up training, commanders can meet this challenge and minimize internal personnel conflicts and focus on maintaining combat readiness.

At the time this article was written, CPT David M. Dlutowski was attending the Chemical Officers Advance Course. CPT Dlutowski's previous assignments include two years as squadron chemical officer with 3-1 Cavalry, 5th Infantry Division (Mech), Fort Polk, Louisiana; and platoon leader and executive officer of the 84th Chemcial Company (SG) until the unit's deactivation in 1994 at Fort Polk. CPT Dlutowski graduated from Indiana University of Pennsylvania with a BA in criminology. He attended the Chemical Officers Basic Course and Airborne School.



Answer to Environmental Word Search Puzzle

Dragon Warfighter Center

By MAJ Ralph Kerr

Chemical officer advanced course and advanced noncommissioned officer course students coming to the US Army Chemical School are challenged with battle simulation exercises to hone their tactical and staff operations skills.

The Dragon Warfighter Center in Sibert Hall is a fully functional, high-tech complex used to train current Army operations doctrine, maneuver concepts, and NBC defense operations. The Dragon Warfighter Center provides the necessary tools to train chemical officers and NCOs in tactical and NBC defense operations to better prepare them for work as part of the combined arms team.

Effective integration of NBC assets and synchronization of NBC missions are emphasized to better minimize risks on the integrated battlefield and enhance operational success. The system uses brigade/ battalion battle simulation as the vehicle for implementing a scenario to draw lessons learned for after-action reviews.

The Center currently supports Chemical Officer Advance Classes

ANCOC students conduct NBC battle management during a Dragon Warfighter Center command post exercise.

with two command post exercises. A brigade defensive mission is *fought* to exercise students' expertise in the tactical decisionmaking process, integration and synchronization of the battlefield operating systems, and staff coordination.

This first command post exercise reinforces classroom instruction students receive in the common core block of their course. The second exercise students conduct focuses on chemical operations. The tactical scenario shifts to friendly forces conducting a counterattack with the enemy relying on its chemical capabilities to fight the battle.

The second command post exercise reinforces classroom training the Chemical Officer Advance Course students receive in the chemical-biological block of the course. This exercise emphasizes NBC threat analysis, commander's planning guidance for NBC operations, development of NBC missions, and integration and synchronization of available NBC assets.

The students must defend their planned employment options for NBC assets by completing a decision brief; prepare, write, and execute a chemical company operations order; and prepare, write, brief, and execute a brigade NBC annex.

The Advanced Noncommissioned Officer Course conducted its pilot command post exercise (CPX) last year with emphasis on NBC and staff operations to prepare our NCOs for staff positions. This exercise trains our senior NCOs for their roles in effectively integrating NBC assets and operations when they return to their units.

The Chemical Officer Basic Course also conducted its first end-of-course CPX last year, to help prepare our junior officers for their first assignments.

The Basic Noncommissioned Officer Course uses the Dragon Warfighter Center to conduct two-day MAPEXs using only the maneuver control system that is an integrated part of the training complex.

The brigade/battalion battle simulation system includes many enhancements to support the training of our chemical soldiers. These include chemical and nuclear predictions, decontamination via M12A1 and M17 decon apparatuses, and NBC reconnaissance with the M93 (Fox) NBC reconnaissance and conventional assets.

The simulation supports smoke via smoke pots, artillery, mortar, and ground-mounted generators, both motorized and mechanized smoke systems from fixed positions. Chemical agent detection is replicated for the M8A1 alarm, chemical agent monitor, M256A1 detector kit, and M8/M9 detector paper.

The battle simulation system allows for flexibility of the MOPP system to include open MOPP variations. The system includes significant aspects of weather, such as temperature, humidity, air stability, wind direction and speed, precipitation, day/night, and illumination. Future fielding of an upgraded version which includes radiological detection and nuclear weapons effects (other than blast) completes the picture.

The Dragon Warfighter Center's CPXs reinforce the understanding and application of the tactical decisionmaking process, effective employment of combat systems and multipliers, battlestaff integration, and NBC doctrine to best prepare our chemical officers and NCOs for the demanding positions awaiting them in the field.

Emphasis is placed on integration and synchronization of NBC assets and operations to support combat operations. The Dragon Warfighter Center training complex provides for technical and tactical training of the next generation of Chemical Corps leaders with tough, realistic challenges.

Chemical Corps soldiers will lead the way to success on the integrated battlefield through effective application of NBC doctrine based on their training in the Dragon Warfighter Center.

Environmental Awareness Word Search

How many environmentally related words can you find?
Words can be horizontal, vertical, diagonal (backwards and forwards)

ENVIRONMENT
CONSERVATION
CLEAN AIR ACT
CHLOROFLUOROCARBONS
STEWARDSHIP
CARCINOGEN
RESTORATION
LISTED WASTE
NONCOMPLIANCE
ENDANGERED
SUPERFUND
RECYCLE
PREVENTION
CLEAN WATER ACT
HAZARDOUS WASTE
NOTICE OF VIOLATION
DRMO *(Defense Reutilization Marketing Office)*
NEPA *(National Environmental Policy Act)*
RCRA *(Resource Conservation Recovery Act)*
SWDA *(Safe Water Drinking Act)*
EIS *(Environmental Impact Statement)*
CHEMDEMIL *(Chemical Demilitarization)*
FFCA *(Federal Facility Compliance Act)*
TSCA *(Toxic Substances Control Act)*
CERCLA *(Comprehensive Environmental Response Compensation and Liability Act)*

R H Y T M R D N U F R E P U S G B I E C
E N N O I T A L O I V F O E C I T O N H
S X O F F K U D P S L I M E D M E H C E
T C N V G F I H W L E D R C R N E P A M
O H C L E C C M N S E N D A N G E R E D
R L O M W L Q A I N O T I C L C N C T E
A O M P R E V E N T I O N S I L V R S M
T R P C D A Y O T C E R C L S E I W A I
I O L V P N P I R L S G R N T A R S W N
O F I S A W S T E E T E A P E N O T S O
N L A G E A E A S A E L T E D O N E U I
O U N L C T N R T N W C L R W T M W O T
N R C R A E D O O A A Y V F A I E A D A
C O E P F R A T R I R C B R S C N R R V
O C T S C A N S A R D E C B T E T D A R
R E S N O C G E W A S R Y Z E O Y S Z E
N E G O N I C R A C E R C L A F W H A S
S T E W A R D O S T E W A R D S H I H N
U V C L E A N W A T E R C T B C P Y O
W S N O B R A C O R O U L F O R O L H C

Solution on page 38

Directorate of Training

Director	DSN 865-4522
Ch, Chem Defense Trainng Facility	DSN 865-3796
Ch, Technical Training Department	DSN 865-5006
Ch, Reserve Components Tng Mgt Div	DSN 865-5005
Ch, Course Development Division	DSN 865-3451
Ch, Tng Devices & Simulations Div	DSN 865-5780
Ch, Training Support Division	DSN 865-5854
Ch, Chemical Training Dept	DSN 865-5962

The restructuring of the Chemical School expanded the scope of the directorate's mission in ways that make sense and will enhance the overall quality of our product. The addition of the Reserve Component Training Management Division ensures a Total Army approach to all we do.

By bringing the Course Development Division into the directorate, the lines of communication between trainers (CTD) and training developers will be cleaner and more effective.

Training Devices and Simulations (TDAS) is the third new division within the Directorate of Training. They will work hand in hand with trainers and training developers to ensure that devices, simulants, and simulations support a fully integrated training package. The overall effect is a directorate more responsive to the needs of units in the field, both in the active Army and the Reserve Components.

The directorate has also undertaken an initiative to capitalize on the unique training opportunities that result from having four branches of service conducting NBC training at the same installation. The Joint Training Steering Group (JTSG) is an informal working group hosted by the DOT that will meet quarterly to exchange ideas. Representatives of the Navy, Marines, and Air Force participate.

The *Chemical Defense Training Facility (CDTF)* has made an important addition to its student base, and adapted new training to prepare that base better for future missions it may face. Sixteen soldiers from the United Kingdom conducted toxic agent training at the CDTF 11-13 October 1994. The students used British chemical defense equipment in accordance with their doctrine to detect, identify, and decontaminate toxic chemical agents. The training was tremendously successful, and we hope it will serve as the basis for increased multi-national efforts.

The CDTF continues to ensure that each group within its increasing student base receives relevant and mission-focused training. Chemical Officer Advanced Course students began training on a new scenario in October 1994. The scenario requires sampling and collection operations in support of chemical agent first-use verification. This training will prepare graduates for a new and rapidly growing mission within the Chemical Corps.

The *Technical Training Department* is responsible for functional courses and the technical portions of the professional courses. The department is composed of several elements: Edwin R. Bradley Radiological Laboratories, Tactical Radiation Branch, NBC Reconnaissance Branch, Dragon Warfighting Center, Computer Training Branch, and the Environmental Office.

The Radiological Laboratories staff consists of two active duty military and three civilians. Four formal courses are taught: Radiological Safety (three weeks), Operational Radiation Safety (one week), Calibrator Custodian (one week), and On-Site Inspection Agency (OSIA) (one week). The Rad Lab is also involved in development of a Depleted Uranium Training Support Package and provides instructional support for Chemical Officer Basic Course (COBC), Chemical Officer Advanced Course (COAC), Basic Noncommissioned Officer Course (BNCOC), Advanced Noncommissioned Officer Course (ANCOC), and 54B basic courses. In addition, the lab and its specialized facilities support the installation Health Physics Office.

The Tactical Radiation Branch consists of five military officers and NCOs who teach the tactical and operational impacts of tactical radiation on military operations. This block is taught to all students and is often cited as being one of the most challenging phases of their instruction. The instruction includes radiological hazard plotting, instrumentation, monitoring and survey, and combat operations on a radiation-contaminated battlefield. Practical exercises abound in this instruction which will soon implement computer simulations into training.

The NBC Reconnaissance Branch provides instruction for OSUT, BNCOC, ANCOC, COBC, and COAC students in NBC reconnaissance operations. In addition to introducing NBC reconnaissance and the M93 Fox NBC Reconnaissance System to professional courses taught at the Chemical

School, the 12-member branch teaches the NBC Reconnaissance Course (L5), a 5-week ASI-producing course dedicated to the Fox NBC recon specialist. In this fiscal year, the branch will begin to instruct the three-week Master Fox Scout Course for NCOs and officers in Fox units and already possessing ASI L5.

The mission of the Dragon Warfighter Center is to reinforce students' cognitive skills pertaining to combined arms and NBC defense. Students plan and execute tactical missions in an operational setting through the application of the tactical decision-making process and the Brigade-Battalion Simulation System. Battle staff functions are practiced in tactical operations centers preparing soldiers in their roles as staff officers and noncommissioned officers. Students learn to synchronize NBC assets into the tactical operation, apply the intelligence preparation of the battlefield process, and conduct NBC vulnerability analysis. The exercise also introduces students to military simulations. After-action reviews using high resolution television monitors facilitate lessons learned for each battle. The Dragon Warfighter Center has one captain and six civilians to facilitate each exercise.

The Computer Training Branch consists of four military and civilian instructors who teach computer literacy to COBC, COAC, BNCOC, ANCOC, and the USACMLS faculty. Their four computer labs house one hundred 386 computers which are used in the basic instruction and for student assignments. The staff trains basic concepts and techniques in word processing, graphic presentations, spreadsheets, databases, and operating systems. The major software tools are Harvard Graphics, Enable, Windows, DOS, and specialized programs such as ANBACIS.

The Environmental Office supports and promotes the U.S. Army Environmental Strategy. This strategy states: "The Army will be a national leader in the environmental and natural resource stewardship for present and future generations as an integral part of our mission." The President's national security strategy recognizes that environmental factors weigh heavily in protecting our nation. Thus this office focuses on compliance, prevention, and conservation, and provides a mechanism for identifying new opportunities and defining ways to meet this responsibility as part of the Chemical Corps' mission to maintain an NBC-trained and ready Army. The Environmental Office implements this through classroom instruction to all chemical personnel, doctrinal publications, and by ensuring environmental considerations are integrated into all aspects of NBC training.

The *Reserve Component Training Management Division* is a combination of what was once the Nonresident Training Branch and the Deputy Assistant Commandant for Reserve Component Affairs. The division has responsibility for the development and maintenance of the Army Correspondence Course Program and Reserve Component Configured Courseware. It manages the Individual Mobilization Augmentee Program for the Chemical School, oversees the Joint Senior Leader/Chemical Officer Course and the Chemical General Officer Conference. The Joint Senior Leader/Chemical Officer Course is normally conducted in November and March and the Chemical General Officer Conference in October.

The *Course Development Division* is responsible for all test development, including the Self-Development Test, lesson plan development, and program of instruction management for all courses trained at the Chemical School. The Chemical Weapons Convention multi-national training is also managed by the division. Additionally, the Course Development Division provides interface for Air Force, Navy, and U.S. Marine Corps courses conducted in the Chemical School.

Current projects in the Course Development Division include: TRADOC accreditation of the Noncommissioned Officers Academy (May 1995), revision of the COBC program of instruction, development of the Biological Integrated Detection System (BIDS) course, development of depleted uranium (DU) training packages for all soldiers as well as a 54B-specific DU training, development of the Advanced NBC Reconnaissance Course (sometimes referred as the Master Fox Scout Course), and the 1995 version of the 54B Self-Development Test.

The mission of the *Training Devices and Simulations Division* is to oversee the development and life cycle management of all chemical training devices, simulants, and simulations. The division represents the Chemical School on Army and joint technical panels which develop plans and procedures for new training devices, simulants, and simulations. They also manage the contractual requirements for maintenance of the Dragon Warfighter Center, Fox's Den, and the planned Biological Integrated Detection System Burro.

The *Training Support Division* has two new areas of responsibility. In addition to scheduling, ammunition, reference materials, and equipment support to the school, the Training Support Division now provides oversight for the Instructor Training Course and Academic Records.

Directorate of Chemical Branch Readiness

Director	DSN 865-3855
Proponency	DSN 865-4036
Threat	DSN 865-8454
Doctrine Development Center	DSN 865-4080/5531
Analysis	DSN 865-5071
TAQ/E	DSN 865-3787
Media	DSN 865-5928
Library	DSN 865-4414

Greetings from the newest directorate in the Chemical School! As of 1 October 1994 the Directorate of Chemical Branch Readiness (DCBR) took its place alongside the Directorate of Combat Developments and the Directorate of Training as an operational directorate.

Absorbing part of the old Directorate of Training and Doctrine, the Directorate of Evaluation and Standardization and elements that previously reported directly to the Assistant Commandant, the DCBR consists of seven divisions.

- Personnel Proponency (LTC James Ewing)
- Threat (CPT George Hodgson)
- Doctrine (MAJ Rodney Alston)
- Analysis (Mrs Judy Carter)
- Media (Dr Jo Jo Corkan)
- Total Army Quality/Evaluation (Ms Priscilla Jones)
- Library (Mr Richard Pastorett)

The directorate's mission is to serve as the bridge between the future and today. Combat Developments produces the operational concepts, materiel need requirements, and organizational structure. The DCBR turns those items into doctrine (our FMs), and through the analysis phase of the Systems Approach to Training (SAT), defines the what and how for chemical units and individuals in the form of ARTEP Mission Training Plans and Soldier Training Publications.

Through its *Personnel Proponency Division* it provides the Chief of Chemical Perspective and Policy to all personnel functions at PERSCOM. Everything from selection criteria for promotion to Regimental policy and procedures is processed by this office.

The *Threat Division* provides support to the combat developers and training directorates as well as to the other divisions of DCBR. They are the people who publish the monthly classified threat message which goes to corps and division chemical officers. This division provides an overwatch for any developments worldwide which impact the Chemical Corps mission area.

Our *Doctrine Division* manages the process of turning operational concepts, such as the new biological defense concept into doctrinal field manuals. They are well-wired into the combat training centers (BCTP, National Training Center, Joint Readiness Training Center, CMTC) which serve to validate or synchronize tactics, techniques, and procedures.

The *Analysis Division* turns doctrine into standards of performance by defining the tasks units (collective) and soldiers (individual) perform. They are the people who produce ARTEP Mission Training Plans for chemical units, common NBC collective tasks for all units, individual tasks for officers (was Military Qualification Standards [MQS], becoming Officer Foundation Standards [OFS]) and soldiers (Soldiers Training Publications).

Media Division includes the people who brought you this superb publication. They are the editors, visual information specialists, and audiovisual production specialists who turn rough drafts into finished products to include FMs, GTAs, movies, TV tapes, and *CML, Army Chemical Review*.

Total Army Quality/Evaluation Division is the old Directorate of Organization and Standardization. They are focused on improving the processes and procedures used by the USACMLS. They maintain contact with the field through the hotline and the Commandant's Periodic Memorandum. They conduct of our end-of-course survey program, do unannounced instructor evaluations, and serve as accreditation team members for the Reserve Component Training Institution Accreditation Program.

The *Library* provides information services for students, staff, faculty, contractors, and researchers. They are the Chemical Corps Library and hold a wide collection of historically significant publications.

As you can tell, the DCBR has a wide-ranging mission which includes the synchronization of USACMLS products. A matrix management structure is employed to task force priority efforts. We believe in the tenets of AR 5-1; we work for continuous process improvement, let the customer set the standard, and strive for total involvement of the work force.

Directorate of Combat Developments

Director	DSN 865-6476
Ch, Concepts & Studies Div	DSN 865-6556
Ch, Material Systems Div	DSN 865-6603
Ch, Battle Lab Integration Ctr	DSN 865-6549

The Directorate of Combat Developments (DCD) at the United States Army Chemical School, Fort McClellan, Alabama, is the Department of the Army's agency responsible for identifying, designing, and integrating future nuclear, biological, and chemical defense requirements, as well as future requirements in the smoke and obscurants arena.

In order to project such requirements, DCD is continually assessing the growing worldwide threat for potential use of weapons of mass destruction. Additionally, and as importantly, DCD also keeps abreast of developing technological trends that may have an impact on the capabilities and design of new NBC requirements. In short, DCD's mission is to predict the future of NBC warfare and to ensure that the United States soldier is prepared to survive and fight on that battlefield.

The directorate accomplishes its mission by studying and analyzing NBC issues in light of their impact on the Army as a whole. This often requires extensive modeling efforts and coordination with other Department of the Army, Department of Defense, and allied agencies. DCD examines the doctrinal, training, leadership, organizational, and materiel dimensions of these issues to determine the best approach to satisfy identified requirements. Requirements satisfied by changes in doctrine, training methods, or leadership emphasis are often more cost effective and more rapidly implemented. Those requirements satisfied by changes to the force structure or equipment are usually most costly and take more time.

The *Office of the Director* provides the senior leadership and vision which coordinates and directs the efforts of the subordinate divisions. The Program Management Office provides administrative support to the directorate. The roles of the three operational divisions in the combat development process and their current main efforts are discussed below.

The *Concepts, Studies, and Organizations Division* is comprised of three teams. The Studies Team recently received approval of TRADOC PAM 525-63, *The U.S. Army Operations Concept for Biological Defense*. This publication will help create a tighter biological defense net. The Modeling and Analysis Team's recent efforts have concentrated on updating and improving the Automated Nuclear, Biological, and Chemical Information System (ANBACIS). This should help the force limit the effects of enemy use of NBC weapons. The Force Development Team completed the TO&E and basis of issue plan for the new Biological Integrated Detection System (BIDS) Company and presented the chemical functional area assessment to the Vice Chief of Staff of the Army.

The *Materiel Systems Division* is comprised of two teams. The Contamination Avoidance Team is currently conducting operational testing of BIDS as well as the Long-Range Standoff Biological Detection System. They are also evaluating Fox Vehicle and Remote Sensing Chemical Agent Alarm (RSCAAL) test data to support type-classification decisions for these systems. The Physical Protection, Smoke, and Decon Team accomplished type classification of the new M56 Smoke System and is planning an operational test of the XM58 Smoke System for the third quarter. Other current team efforts include development and testing of the Joint Service Light Integrated Suit Technology (JSLIST) and the Modular Decon System.

The *Battle Lab Integration Center* is concentrating on coordinating and integrating USACMLS efforts with those of the TRADOC Battle Labs. This involves supporting Louisiana Maneuvers Issues and accomplishing horizontal integration of the TRADOC domains as well as other wargaming efforts intended to help pave the way to Force XXI. Included in these efforts are five center of gravity Army Warfighting Experiments and various advanced concepts and technological demonstrations.

In summary, DCD at the USACMLS continues to design and build future U.S. Army NBC defense and smoke/obscurant capabilities. One of our best resources in this endeavor is input from the field. We welcome ideas and suggestions from all Dragon Soldiers throughout the Army.

A pre-positioned M157 can provide a quick smoke screen over a checkpoint. *Page 21.*

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