

Chapter 5

Other Tactical Operations

Other tactical operations cover a wide range of special-purpose operations undertaken routinely during offensive and defensive operations. While these operations are not the main focus of the commander at the tactical level of war, smoke may support these operations as well. These operations include—

- Retrograde operations.

- Relief-in-place operations.
- Passage of lines.
- Linkup operations.
- Breakout from encirclement.
- River crossings.
- Obstacle breaching.

In addition, there are special conditions and environments we must consider:

- Mountains.

- Jungles.
- Urban terrain.
- Deserts.
- Winter zones.
- Nuclear, biological, and chemical (NBC) conditions.

Finally, because smoke draws attention, we must consider smoke support for tactical deception.

Tactics

Smoke and obscurants integrated throughout the battlefield and operational continuum provide major contributions to combat power in deep, close, and rear operations. In other operations, the major contributions are the same as those in offensive smoke tactics. See Chapter 3.

Smoke and obscurant use in other tactical operations requires the same careful planning and execution as with the offense and defense. In addition to the general

techniques listed in Chapter 3, special techniques to minimize interference include—

- **Know the limitations of your delivery systems.** Smoke munitions do not behave the same in all conditions or environments (for example, the jungles of Central America versus the woodlands of Europe). Plan for differences in coverage. Some munitions combinations such as HE and WP are not effective under certain environments or conditions

such as winter zones with deep snow.

- **Use smoke to mask terrain from aerial observation.** With the exception of jungles, much of the terrain described in this chapter affords good aerial observation. By masking key terrain features you reduce your vulnerability as targets of opportunity for high-performance aircraft.

Retrograde

A retrograde operation is a movement to the rear or away from the enemy.

Retrograde operations gain time, preserve forces, avoid combat under undesirable conditions, or draw the enemy into an unfavorable position. In retrograde operations—

- Use smoke to support maneuver by—
 - Concealing maneuvering forces from enemy observation.
 - Concealing disengaging and moving forces.

- Providing tactical surprise and allowing the commander to set the terms of combat.

- Allowing the commander to mass forces unobserved.

- Defeating enemy surveillance efforts.

- Supporting the deception story.

- Slowing and disrupting enemy movement.

- Isolating attacking echelons.

- Concealing engineer operations defensive preparations to the rear

- Use smoke to provide additional firepower by—

- Defeating enemy counterreconnaissance efforts.

- Disrupting enemy command and control.

- Disrupting enemy maneuver and reinforcement.

- Disrupting the enemy's ability to communicate.

- Forcing the enemy to mass, thus providing a lucrative target.

- Changing friendly to enemy force ratios by using thermal imagers and

millimeter wave acquisition devices such as radars to see through visual smokes and using smoke to isolate defending and second-echelon forces.

– Enhancing friendly target acquisition efforts by silhouetting enemy vehicles with smoke and using smoke and obscurants we can see through but the enemy cannot.

- Use smoke to protect the force. (See Chapter 3 under Offensive Smoke Tactics.)

Delay

In delays, units give ground to gain time. Delaying units inflict the greatest possible damage on the enemy while preserving their freedom of action.

In the delay, use smoke to–

- Conceal movement of maneuver and support forces, allowing the commander to mass forces unobserved.
- Provide tactical surprise, allowing the commander to seize the initiative and set the terms of combat.
- Defeat enemy reconnaissance and counterreconnaissance efforts.
- Conceal obstacle emplacement, breaching, or crossing.
- Conceal designated withdrawal routes.
- Maintain contact with the enemy but preclude decisive engagement.

Smoke employment tactics in the delay are the following:

- ▣ **Screening smoke.** Use screening smoke to conceal maneuver and obstacle emplacement. Use smoke along withdrawal routes and along the flanks to conceal movement. Begin making smoke prior to departing your existing position to confuse the enemy as to the actual location and size of

In a relief in place, a unit in contact is replaced by another that assumes the missions of the outgoing unit. Use smoke to–

- Fix the enemy reconnaissance force.

the force. Use projected means to deliver smoke between the delaying unit and the enemy force. Use smoke to conceal obstacle breaching or crossing. The priority of effort is to mobility operations; therefore, carefully control the smoke to prevent slowing or silhouetting your units.

- **Protecting smoke.** Use protecting smoke as required to defeat enemy ATGMs and air defense systems. Use protecting smoke to avoid decisive engagement.
- **Obscuring smoke.** Use obscuring smoke to defeat enemy reconnaissance and counterreconnaissance efforts. Use projected smoke means to deliver smoke mixed with high-explosive rounds before the enemy can pinpoint your units. Attempt to force the enemy into early deployment.
- **Marking smoke.** Use marking smoke to mark enemy targets for rapid destruction or to reduce the potential for firing on friendly forces.
- **Smoke for deception.** Use supporting smoke to draw attention to areas of little or no importance. Create large-area smoke away from the delaying force. Consider using smoke mixed with high-explosive rounds to conduct preparatory fire of dummy objectives.

Withdrawal

In withdrawals, a force in contact disengages from the enemy. The force may be assisted by another force or unassisted. In the withdrawal, use smoke to–

- Conceal movement of maneuver and support forces, allowing the

Relief in Place

- Mark the enemy reconnaissance force for destruction with direct and indirect fire weapons.
- Deny the enemy reconnaissance force information about the disposition,

commander to mass security forces unobserved.

- Defeat enemy reconnaissance and counterreconnaissance efforts.
- Conceal obstacle emplacement, breaching, or crossing and hinder pursuit by the enemy.
- Conceal designated withdrawal routes, traffic control points, and on-order assembly areas.
- Create opportunities to disengage the force.

Smoke employment tactics in the withdrawal include the following:

- **Screening smoke.** The tactics are the same as those under Delay. Additionally, use projected means to deliver smoke between the security force and the enemy force.
- **Protecting smoke.** The tactics are the same as those under Delay.
- **Obscuring smoke.** The tactics are the same as those under Delay.
- **Marking smoke.** The tactics are the same as those under Delay.
- **Supporting smoke for tactical deception.** Use supporting smoke to draw attention to areas of little or no importance. Create large-area smoke away from the main body.

Retirement

In a retirement, a force not in contact moves away from the enemy in an organized manner. In a retirement, a heavy rear guard will conduct delaying actions to slow the advance of the enemy and allow the main body to increase the distance between itself and the enemy. In general, use smoke to support the rear guard in its delaying operations. The tactics for employment of smoke in support of the rear guard are the same as for the delay.

tion, composition, or intent of friendly forces.

- Conceal the movement of relieving forces. This is critical as dispersion of forces in a relief is difficult. The enemy may exploit the massing

as a time to attack with NBC weapons.

A special consideration for reliefs is to maintain the illusion the force has not changed. Obtain the relieved force's smoke annex. In planning the relief, attempt to duplicate patterns of employment for a brief period.

Smoke employment tactics in a relief in place are the following:

- Screening smoke. Use screening smoke to conceal maneuver. Use smoke in the reserve force area and along the flanks to conceal move-

A passage of lines is a coordinated movement of one or more units through another unit. Units conduct passage of lines to continue an attack or counterattack, envelop an enemy force, pursue a fleeing enemy, or withdraw a security or main battle force. Synchronization is the overriding imperative. Use smoke to—

- Conceal movement of maneuver and support forces, allowing the commander to mass forces unobserved.
- Provide tactical surprise, allowing the commander to seize the initiative and set the terms of combat.
- Defeat enemy reconnaissance and counterreconnaissance efforts.

Two friendly forces are joined in linkup operations. Units conduct linkup operations to complete an encirclement of an enemy force, assist in breakout of an encircled friendly force, or to join an attacking force with a force inserted into the enemy rear.

Use smoke to—

- Mark the coordinated fire line (CFL) or the restrictive fire line (RFL) to prevent fires being set by friendly forces.
- Conceal movement of the linkup force.

ment. Use smoke forward of the FLOT to allow the relieved force to disengage. You must carefully control the smoke to prevent silhouetting your units.

- Protecting smoke. Use protecting smokes to defeat enemy antitank and air defense systems.
- Obscuring smoke. Use projected smoke means to deliver smoke mixed with high-explosive rounds before the enemy can pinpoint your units. Plan obscuring fire based on decision points for the enemy, isolating and confusing their reconnais-

Passage of Lines

- Conceal obstacle breaching or bypass.

Smoke employment tactics in passage of lines are the following:

- Screening smoke. Use screening smoke to conceal maneuver and obstacle breaching. Use smoke at the contact point, along passage lanes, and along the flanks to conceal movement. Use smoke forward of passage points. You must carefully control the smoke to prevent silhouetting your units.
- Protecting smoke. Use smoke to defeat enemy antitank and air defense systems.
- Obscuring smoke. Use projected smoke means to deliver smoke mixed with high-explosive rounds before the enemy can pinpoint your

Linkup Operations

- Deny the enemy information concerning when and where the linkup will occur.

Smoke tactics for linkup operations are the following:

- Obscuring smoke. The tactics are the same as those for the exploitation phase of offensive operations (Chapter 3).
- Screening smoke. Use screening smoke to conceal maneuver and support forces and defeat enemy target acquisition and guidance systems. Use self-defense and generated-smoke means to conceal maneuver

sance forces. Plan obscuring fire during the relief to allow the relieved force to disengage and pass through friendly lines unobserved.

- Marking smoke. Use marking smoke to mark enemy targets for rapid destruction or to reduce the potential for firing on friendly forces. Use aviation reconnaissance assets to spot the enemy reconnaissance force and mark it with smoke rockets.

- Supporting smoke for tactical deception. The tactics are the same as in the withdrawal phase.

units. Plan obscuring fire based on decision points for the enemy, isolating and confusing their reconnaissance forces. Plan obscuring fire during the passage of lines to allow the force to pass through friendly lines unobserved.

- Marking smoke. The tactics are the same as those under Relief in Place.
- Supporting smoke for tactical deception. Use supporting smoke to draw attention to areas of little or no importance. Create large-area smoke away from the main body. Consider using smoke mixed with high-explosive rounds to conduct preparatory fire of dummy objectives.

units as they bypass or harass enemy forces.

- Marking smoke. Use marking smoke to mark the CFL or RFL, mark targets for destruction, identify bypass routes, and signal for battlefield activities. Use projected smoke means to deliver smoke onto identified enemy strongpoints or larger formations and to signal forces to consolidate on a particular objective or rally point.
- Protecting smoke. If the enemy has known or suspected nuclear or directed-energy weapon capability,

concealing your logistics activities in oil smokes may attenuate some of the energy.

- Smoke for deception. Use this smoke to keep the enemy off-

balance and to draw attention away from critical sustainment activities.

Breakout from Encirclement

A breakout from encircled forces differs from other attacks only in that units must maintain a simultaneous defense of other areas of the perimeter.

Use smoke to—

- Aid in establishing a deception story.
- Isolate and segregate enemy forces to create gaps or weaknesses in the encircling force.
- Conceal movement of maneuver and support, allowing the commander to mass the rupture force and main body unobserved.
- Defeat enemy reconnaissance and counterreconnaissance efforts.
- Conceal obstacle emplacement, breaching, or crossing and hinder pursuit by the enemy.
- Create opportunities to disengage the force.

Smoke employment tactics in breakout from encirclement include—

- Obscuring smoke. Use obscuring smoke to isolate the rupture objective, defeat enemy target acquisition and guidance systems, and defeat reconnaissance and counterreconnaissance efforts. Use projected smoke means to deliver smoke mixed with high-explosive rounds in front of the objective; between enemy formations; and on identified forward observer, ATGM, and tank unit positions before the enemy can pinpoint your units as targets.
- Screening smoke. Use screening smoke to conceal maneuver as you bypass, breach, or cross obstacles or small pockets of resistance, along the flanks to protect the force, and in the rear to conceal disposition and composition of both the reserves and rear guard. Use self-defense and generated-smoke means to deliver smoke across danger areas and to the flanks of

the force to limit enemy observation and engagement.

- Marking smoke. Use marking smoke to mark enemy targets for rapid destruction or to reduce the potential for firing on friendly forces.
- Protecting smoke. If the enemy has known or suspected directed-energy weapon capability, concealing your force in a blanket of oil smoke will attenuate some of the energy.
- Smoke for deception. Use this smoke to draw attention away from the main effort to areas of little or no importance. Since the diversionary force is critical to the breakout, consider making it the priority for smoke support. Use generated-smoke means to create small- to large-area smokes away from the main body.

River Crossings

Units conduct river crossings as part of a higher headquarters scheme of maneuver. The commander's objective is to project his combat power to the exit side of the river quickly to maintain the unit's momentum. The overriding imperative is synchronization. Effective command and control are critical for success. Apply all techniques to minimize the interference caused by smoke. Use smoke to—

- Conceal the movement of the initial assault force.
- Isolate the exit bank of the river for rapid occupation by maneuver forces.
- Conceal emplacement of crossing means such as engineer bridges.
- Isolate follow-on objectives to allow the commander to rapidly

project combat power across the river.

Smoke employment tactics in river crossings include—

- Screening smoke. Use screening smoke to conceal maneuver and actual river crossing sites. Use smoke in the main body area and along the flanks to conceal movement. You must carefully control the smoke to prevent silhouetting your units. Begin making smoke prior to conducting the initial assault to confuse the enemy as to the actual location and size of the force. Use projected-smoke means to deliver the initial screening smoke to isolate the exit bank objectives and give other smoke delivery means time to build effective smoke.

- Protecting smoke. Use protecting smoke as required to defeat enemy ATGMs and air defense systems.

- Obscuring smoke. The tactics are the same as in the preparation phase for offensive operations (Chapter 3).
- Marking smoke. Use marking smoke to mark enemy targets for rapid destruction or to reduce the potential for firing on friendly forces. Aviation assets can deliver smoke onto identified enemy positions for destruction by indirect fire or the follow-on force.
- Smoke for deception. The tactics are the same as in the preparation phase for offensive operations (Chapter 3).

Obstacle Breaching

Units breach obstacles when they cannot bypass them at an advantage. The commander's objective is to project his combat power to the exit side of the obstacle quickly to maintain the unit's momentum. The overriding imperative is initiative. In general, platoons and larger formations breach obstacles, with most smoke planning consisting of immediate fire requests for covert or hasty breaches or detailed planning for all potential smoke assets in deliberate breaches.

Use smoke to—

- Isolate the exit side objective.

- Conceal movement of the breaching, initial assault, and support forces.

- Conceal emplacement of crossing means such as engineer bridges or demolitions.

- Isolate the exit side of the obstacle for rapid occupation by maneuver forces.

- Isolate follow-on objectives to allow the commander to rapidly project combat power across the obstacle.

Smoke employment tactics for breaching include—

- Screening smoke. The tactics are the same as those under River Crossings.

- Protecting smoke. Use protecting smokes as required to defeat enemy ATGMs and air defense systems.

- Obscuring smoke. The tactics are the same as in the preparation phase for offensive operations (Chapter 3).

- Marking smoke. The tactics are the same as those under River Crossings.

- Smoke for deception. The tactics are the same as in the preparation phase for offensive operations (Chapter 3).

Special Conditions or Environments

Weather and terrain have a significant impact on smoke employment as previously stated. The following paragraphs present special climate considerations, employment tactics, and techniques to overcome difficulties under these conditions:

- Mountains.
- Jungles.
- Urban terrain.
- Deserts.
- Winter zones.
- Nuclear, biological, or chemical (NBC) conditions.

Mountains

In combat operations, mountains generally are characterized by rugged, compartmented terrain; steep slopes; and few natural or man-made lines of communication. The weather spans the entire spectrum from extreme cold, with ice and snow during winter, to extreme heat in some areas during summer. Although these extremes are important planning considerations, the variability of weather over short periods of time, and from area to area, also significantly influences maneuver, fire support, and smoke support operations.

Delivery Means

Mountainous terrain is generally hard and rocky in the summer with intermittent areas of deep snow. In the winter, the terrain is mostly covered with deep snow.

- Snow. The phosphorus in WP can burn undetected in snow for up to four days.

- Rocky terrain. Smoke is effective to deny the enemy the use of narrow passages, valleys, roads, and usable terrain.

- Winds. Swirling winds make smoke employment very difficult to adjust and maintain. Close coordination is required with adjacent elements to ensure that their vision is not obscured or they are not highlighted.

- Adjusting fire. Distances are difficult to judge. Observers tend to underestimate upslope distances and overestimate downslope distances.

Problems

Mortars are ideal because of their high-angle fire. They can deliver fire on reverse slopes and over intermediate crests.

Position observers on high ground and spread them to overcome terrain masks and compartments. Ob-

servers may require mountaineering equipment to get to the best positions, or they may be airlifted. Terrain sketches and visibility diagrams are essential to deliver fast, accurate fire and to identify blind spots.

Use ground surveillance radars and remote sensors to acquire targets. Use smoke to—

- Deny enemy use of narrow passages, valleys, roads, and usable terrain.

- Isolate enemy formations for piecemeal destruction.

- Obscure routes that can be used by the enemy to attack, withdraw, and resupply.

- Obscure likely position areas for indirect fire assets, command and control elements, CSS assets, and observation posts.

- Conceal terrain that is subject to snowslides, flash floods, and rockslides.

Jungles

Usually, jungle operations are carried out by light forces that can get into and out of areas by helicopter. Fire support may be limited to indirect fire and air support. Because small-unit operations are com-

monplace, greater challenges accrue to the chemical officers and fire support coordinators (FSCOORDs) at lower levels such as the company FSO and the battalion chemical officer.

Delivery Means

In jungle terrain, most contact with the enemy will be at extremely close ranges. If the friendly force has a substantial advantage in fire support, the enemy will most likely try to come in as close as possible and maintain that close contact so that the friendly force cannot employ their fire support advantage without inflicting casualties on their own troops.

In the triple-canopy jungle, HC smoke is ineffective. WP is effective as a marking round and in initial adjustments. ICM and FASCAM will hang up in the trees and endanger friendly forces that later move through the area. Illumination rounds are ineffective because the chutes get caught in the upper canopy.

The triple-canopy jungle makes observation beyond 25 to 50 meters very difficult. The jungle also makes map reading and self-location, target location, and friendly unit location determinations very difficult.

Problems

Experience from World War II and Vietnam showed that observers and smoke control officers must be able to adjust smoke and mortar and field artillery (FA) fire by sound because they often cannot see the rounds to adjust them. This sound adjustment is very difficult and requires wide experience.

By taking the recommended adjustments of two or more observers in different locations, some accuracy can result. The battery fire direction center (FDC) can help by announcing SPLASH to let the observer know when the round should impact. The observer then counts the seconds until he hears the round detonate. Multiplying the seconds by the speed of sound, the

observer can estimate the range to impact. The speed of sound is approximately 350 meters per second. The speed of sound varies according to temperature, wind speed and direction, relative humidity, and air density; but 350 meters per second should be used as a start point.

The observer and smoke control officer must determine their locations and ensure that the TAC CP and FDC have them plotted. If the observer or smoke control officer's initial position locations are way off, the smoke will be way off too. Use the initial smoke to determine the observer's own location.

Vietnam and World War II also showed that the first projected round in adjustment must be WP smoke. Because the observers are not sure of their own location or that of other friendly elements, WP was always fired first to avoid inflicting casualties on friendly personnel.

Creeping fire was also used extensively in Vietnam and World War II. The observer adds 300 to 400 meters to his target location in case his own position location is wrong. Then he makes corrections of no more than 50 meters until the fire is on target. In Vietnam, this process sometimes started with an aerial observer and was taken over by the ground observer once he was able to see the rounds. The aerial observer was often required to relay fire requests from the ground because the terrain severely limited the ranges of radio communications.

Because of the close combat, laser range finders may not be of great use; however, night vision devices are extremely critical. Avoid using projected smokes during limited visibility periods to preclude degradation of these devices. Aerial observers help direct CAS assets against enemy targets. Because ground observers cannot see the whole battlefield, the aerial observer marks targets for the CAS sortie (flares, WP, smoke). Radars are extremely effective in the jungle, since most indirect fire is high-angle

fire. Ground surveillance radars and remote sensors must be used.

Use smoke—

- To conceal maneuver to the front, flanks, and rear.
- Along roads and trails to deny enemy use.
- At likely ambush sites to obscure enemy observation and fields of fire.

Urban Terrain

In urban terrain, ranges are drastically reduced. There are three major types of terrain in nearly every built-up area:

- Obstructions, such as buildings and heavily wooded parks.
- Flat, open terrain over water, such as rivers and lakes.
- Flat, open terrain over concrete or asphalt, such as parking lots, multiple-lane roads and highways, and open lots.

Air currents are unpredictable. Obstructions tend to break up smoke streamers, which re-form into a more uniform cloud. Convection currents over open areas cause smoke to rise. There are many observation points at multiple levels, which allows an enemy to observe from either above or below smoke.

Delivery Means

Downwind coverage is often less due to obstructions breaking up the smoke, unpredictability of air currents, and smoke following street patterns. The Berlin Brigade observed that open areas in cities tend to cause smoke to rise and obscure key observation points. This is a particular problem over water, garden plots, and wide expanses of concrete.

Smoke diffuses well at night but tends to rise to rooftop level about one hour after sunrise until one hour after sunset. Burning rubble degrades the screening efficiency of smoke. Smoke pots weigh between 27.5 and 33 pounds (M4/M5), making it difficult for infantry squads to employ without transportation assets to move them forward first.

Smoke hand grenades make smoke for only 60 to 150 seconds. Squads need to carry four to six per person for concealment. Because of the height and closeness of buildings and other obstructions, CAS and artillery fire is degraded. Mortars and high-angle artillery are still effective.

Problems

Smoke and obscurant use in military operations on urbanized terrain (MOUT) requires careful planning and execution to prevent interference with movement, assault operations, or target acquisition; to retain the element of surprise; and to avoid silhouetting or drawing undue attention to friendly forces.

Time smoke delivery with decision points. Conduct a thorough IPB and time your use of smoke to key decision points in your tactical plan: for example, "When we reach Sector A1, use grenade launchers to smoke the open area and conceal movement of B Company as they emplace smoke pots.") Ensure you target key terrain to deny the enemy the use of it.

Use unobscured weapons to overwatch. The overwatching elements should have target acquisition devices such as thermal imagers that can see through our own smoke and engage the enemy. This prevents surprise and enhances your ability to suppress enemy fire during the assault. This is particularly important for observers in upper floors of buildings, enabling them to observe enemy movements while friendly forces move unobserved.

Limited visibility positions, preplanned and previously prepared, will minimize degradation caused by friendly or Threat use of smoke. Rehearsal of displacement under smoke will help you avoid confusion and disorientation. It will also rapidly restore engagement capability.

The best tactical application of smoke in urban areas is smoke blankets for concealment. Use smoke blankets prior to assaults.

Sweep and clear operations to eliminate enemy forces acquiring our soldiers as targets. This is exceptionally effective in reducing or eliminating sniper activity and in breaching obstacles. However, your soldiers must be careful to avoid burning debris since this tends to reduce concealment.

Plan for enemy countermeasures. Enemy forces will counter your smoke use. Plan to intensify your counterreconnaissance and air defense efforts. The enemy may use countersmoke to confuse our command and control so avoid reliance on visual signals.

The enemy will increase use of indirect fire weapons when direct fire target acquisition is ineffective. Therefore, plan artillery counterbattery or countersmoke fire after crossing the LD/LC.

Reconnaissance must verify enemy locations. The enemy can use both our smoke and theirs to conceal movement to alternate positions or to break contact. Aggressive reconnaissance before and during the engagement will allow you to shoot and remain in contact.

Understand that smoke compresses the battlefield by limiting visibility. Smoke drastically reduces engagement ranges. Training your soldiers to operate in smoke reduces the degradation caused by smoke. It also reduces psychological impact on troops such as confusion, fear, and isolation. The Israeli Army successfully used phosphorous rounds in Beirut to screen their forces and isolate the enemy (enemy forces tended to congregate in the city). The use of smoke produced enemy casualties and generated the psychological effects of fear and isolation.

Urban terrain causes smoke streamers to break up quickly, creating the uniform phase closer to the smoke source. You can place smoke sources closer to target areas.

Ensure the entire squad, section, or platoon uses the smoke simultaneously to preclude drawing attention to a lone vehicle or element.

Smoke pots and smoke grenades are effective for concealing movement of small units. An example of an employment scenario follows:

Squad members come under fire from snipers in upper floors. They use a grenade launcher to fire smoke and HE rounds into upper floors, blinding enemy observation. They emplace HC smoke pots or several smoke hand grenades downwind of and in between themselves and the target area or building. Concealed by the smoke, they maneuver to assault the target. Upon reaching the target area, they cease to make smoke to allow them to operate undegraded.

Start the smoke mission prior to operation start time and continue well beyond the end of the operation. For example, you have planned a canal crossing for 0500 to 0700 hours. Start smoke at 0400. Stop smoke at 0800 to confuse the enemy as to the exact crossing time and size of the force.

Built-up areas nearly always have civilians/noncombatants occupying them. When planning the type of smoke weapon system, and you suspect noncombatants are present, give consideration to the lethality of the system before employment. For example, artillery-delivered smoke is useful around the periphery of a city. However, you should switch to less devastating systems in the center of the city, such as smoke munitions from grenade launchers, smoke pots, and smoke hand grenades.

Smoke units are extremely vulnerable in urban areas due to smoke generator signature. In addition, stationary smoke positions need to be closer to the target than over other terrain, bringing smoke generator elements within range of enemy small arms weapons. Mobile smoke systems are best. Stationary smoke systems make large volumes of smoke but require additional security support. Employ smoke generator vehicles in groups of three, with two vehicles making smoke and one vehicle overwatching.

Deserts

There are three types of deserts:

- Rocky plateau deserts.
- Sandy or dune deserts.
- Mountain deserts. (Munitions effectiveness for mountain deserts is the same as for any mountainous region except that the considerations of snow are usually not applicable.)

It is important to recognize the specific terrain of each, because munitions effects will vary according to desert type. Desert battles tend to be more centralized. Brigade and battalion commanders often personally coordinate the interaction of maneuver and firepower. Engagements are often fought at long ranges.

In rocky plateau deserts, projected smoke and illumination rounds may be degraded by high winds, but may be used to silhouette the enemy. HE/PD is extremely effective, creating extra shrapnel by splintering rocks. FASCAM is very effective and should be employed with smoke and the natural terrain to force the enemy into unnavigable terrain.

In sandy or dune deserts projected smoke and illumination rounds are effective and can be used to silhouette the enemy. HE, PD, ICM, FASCAM, and delay are smothered by deep sands, making them ineffective.

Location determination is often very difficult in rocky plateau and sandy or dune deserts. Maps are often inaccurate, dunes shift, and heat waves hamper distance estimations. The Israelis help forward elements determine their own location by using artillery survey teams at two or more points, putting searchlights on those points, and, upon request, shooting a beam of light into the air. The forward observer can then shoot an azimuth to the beams of light and perform a map resection. The beam of light must project straight up, and the observer must shoot an azimuth at the lowest visible point on the beam. With this system, pyrotechnics may

also be shot into the air. The use of marking rounds as discussed for jungle operations also can help forward units self-locate.

Laser range finders must be used, especially when heat waves degrade distance estimating by conventional means. Observers can detect targets by observing dust clouds created by moving enemy forces. Employ smoke behind the enemy to silhouette them. The similarity of colors in the desert makes specific targets hard to spot. At night, illumination rounds burning on the ground behind the enemy have the same effect.

Usually, air observation is highly productive; however, the absence of landmarks in some areas degrades this capability. This problem is enhanced because aerial observers tend to see the battlefield in a two-dimensional perspective.

Lack of trees and hills makes aircraft more vulnerable to enemy air defenses. Use smoke to force enemy aircraft to fly higher, making acquisition easier. Radars are highly effective in the desert. Use them to aid in adjusting smoke onto targets.

Use smoke to—

- Complement ICM and FASCAM for obstructing and denying enemy use of roads.
- Silhouette the enemy, complement illumination fire at night, and increase the background contrast for sensors to acquire targets.

Priority targets for HC and WP smoke munitions and for generator smoke are likely enemy OPs, ATGM systems, and enemy air defense systems.

Winter Zones

The extreme weather conditions in arctic and subarctic regions are dramatic and severely impact on observation, mobility, and delivery of fire. Specific weather phenomena with which the smoke and fire support personnel must be concerned include whiteout, greyout, and ice fog.

Whiteout. The observer appears to be in a uniformly white glow.

Neither shadows, horizon, nor clouds are discernible. The sense of depth and orientation is lost. Only very near, dark objects can be seen. Whiteouts occur over an unbroken snow cover and beneath a uniformly overcast sky. Blowing snow can cause the same effect.

Greyout. This is similar to whiteout except the horizon is distinguishable under greyout conditions. It occurs over a snow-covered surface during twilight conditions or when the snow is close to the horizon. There is an overall greyness to the surroundings. When the sky is overcast with dense clouds, there is an absence of shadows, resulting in a loss of depth perception.

Ice fog. This is common around inhabited areas during cold weather below 35 degrees Fahrenheit. Water vapor created by humans and vehicle exhausts may appear around soldier and equipment concentrations. Ice fog obscures vision and discloses locations by presenting a visible cloud to the enemy.

In winter zones, HC smoke and generator smoke are effective, and colored smoke may be used to silhouette the enemy. However, some of the canisters may be smothered in the deep snow. WP is effective; however, phosphorus may burn undetected in the snow for up to three to four days and may be a hazard to friendly troops subsequently moving through the area. HE/PD, HE/delay, ICM, and FASCAM are ineffective in deep snow. At least 40 percent of the blast from these munitions is smothered by the snow.

Weather and terrain conditions cause disorientation; changing terrain and poor maps make self-location difficult. Use marking rounds or searchlights and pyrotechnics from surveyed positions to help observers and smoke control officers orient themselves. Bright sunlight reflecting off snow-covered landscape causes snow blindness. Amber filters on binoculars and ob-

servation devices reduce the incidence of snow blindness.

Use of laser range finders is extremely critical because of lack of depth perception due to weather and terrain conditions. Use limited visibility positions to prevent degrading these systems. Use aerial observers because they can see deep and are not as prone to disorientation as are ground observers. Frequent poor weather reduces availability of CAS. Plan smoke use from CAS aircraft during windows of opportunity for good weather.

Employed smoke draws attention to the area it covers. This characteristic makes smoke use significant in supporting the deception story. However, never plan to use smoke by itself for deception.

Tactical deception draws the enemy's attention from the area of the main attack. The object is to make the enemy commit forces to the deception and not the main attack.

Smoke supports tactical deception operations by—

- Drawing attention to the deception activity.
- Limiting the enemy's ability to identify the deception for what it is: a ruse, feint, or demonstration.

NBC Conditions

The physiological and psychological effects of NBC conditions impact on all elements of combat power. These conditions, documented in FM 3-100, create special problems when either the enemy or friendly force use smoke and obscurants. Encapsulation in full, individual protective equipment significantly reduces a soldier's ability to—

- **See.** Peripheral vision and visual acuity are restricted. Observers and smoke control officers are not able to accurately judge smoke on target

or to estimate ranges for adjustments.

- **Hear.** Hearing is degraded. This is a significant problem on certain terrain, such as jungles, where fire and smoke are adjusted by Sound.

- **Communicate.** Communication is more difficult, as speakers and listeners often perceive that they cannot enunciate or hear as well. This has significant impact on adjusting fire or positioning smoke units.

- **React to stress.** Sustained operations are much more difficult, as encapsulation severely taxes human bodies. Leaders are at the greatest risk of combat ineffectiveness.

Deception

- Protecting the force performing the deception.

- Making two-dimensional decoy material look real.

Planners must provide enough resources so that smoke support for the deception mission lasts as long as the deliberate mission. The key to a successful smoke deception is to make the enemy believe that the smoke support is for the main effort. However, smoke support for the deception force should not be so large that it divides or degrades the effectiveness of support for the main effort.

Plan to attack the deception target just as you would in any other operation. The standard battlefield applications of smoke—screening,

obscuring, protecting, or marking—all apply. Use smoke to obscure, screen, protect, or mark a dummy or imaginary tactical smoke target area. Both the deliberate and deception mission should have the same visibility requirement and resources. Plan to use projected smoke extensively.

Planning considerations include—

- Ensure you place smoke on similar targets for both the main effort and deception. Deception and main effort smoke target areas should be similar in size.

- Shift smoke assets to the main effort only when assaulting the objective and when immediate smoke is required to protect an element of the main effort.

Chapter 6

Sustainment Planning

Sustainment planning for smoke use in tactical operations must focus on the sustainment imperatives: anticipation, integration, continuity, responsiveness, and improvisation. There are several critical factors planners must consider to sustain smoke support in any given operation:

- Number and types of smoke delivery systems and the quantity of available resources.

- The commander's priorities for support.

- consumption factors of the delivery system and large-area smoke assets for the type of operation you are planning.

- Critical smoke delivery systems, whose continuous operation is crucial to the battle's success.

- Major tactical contingencies such as exploitation, pursuit, and withdrawal.

- Real estate management (for example, the location of delivery systems and combat service support [CSS] assets). This involves resolving conflicts in unit/base positions of several units in the same area or sector.

Commanders and their planners must plan to sustain all smoke delivery means that are in their tactical plan. Planners must consider the following:

- Plan for continuous support.

- Forward positioning of essential CSS, such as ammunition and petroleum, oil, and lubricants (POL). Execute this at night if pos-

sible. Artillery and mortar basic loads of smoke ammunition are limited. If your plan calls for sustained projected smoke, you may need to pre-position ammunition forward to sustain the operation.

You may also want to pre-position smoke pots or WP main gun rounds.

- Use preplanned or preconfigured push packages (LOGPAC) of essential items. For missions where smoke requirements exceed existing assets, the commander should consider tailoring the LOGPAC to obtain the required items of ammunition or fuel.

- Plan for rapid resupply. If pre-positioning is not possible, plan to rapidly resupply artillery and mortar units. Configure ammunition in the ammunition supply point (ASP) for rapid sling load or truck transport to user units. Coordinate with the division or corps support command for dedicated transportation assets for a specific period of time to support the operation.

- Upload as much materiel as possible on unit transportation assets. Use existing assets to carry specific mission needs, and down load items that can be brought forward later.

- Plan real estate management. Ensure the pre-positioned stocks are earmarked for the user unit. The division support command (DISCOM), corps support command (COSCOM), or area support group (ASG) is the focal point for resolving conflicts in unit/base positions.

- Plan direct delivery from supply to user. When you expect very high rates of ammunition or POL consumption, coordinate for direct delivery from the COSCOM CSS asset to the user unit. This requires intensive coordination to ensure transportation assets are in place at the critical time, as well as coordination for delivery locations.

Chemical companies, smoke generator companies, and platoons in particular do not have sufficient organic logistics assets to sustain combat operations. Because of this, chemical units heavily rely upon the supported unit for CSS. When organized under a chemical battalion or brigade, the parent headquarters acts as an intermediary between the chemical company and the division or corps support command for sustainment support.

Both the chemical unit and the supported unit conduct planning to sustain large-area smoke. Planning for smoke operations must ensure the smoke element has the following:

- Maintenance, supply, and recovery support (fixing and supplying).

- Transportation assets available (transporting).

- Tactical resupply of Class III (for example, fog oil, packaged POL, and MOGAS) (fueling).

- Sufficient personnel (manning).

- Fire support, to include tactical resupply of Class V, and security (arming and protecting).

Maintenance, Supplies, and Logistics

Smoke generators are very limited in number on the battlefield. Smoke generators are also resource-intensive items of equipment. Chemical brigades and battalions do not have a support platoon to manage, pick up, and deliver supplies. Chemical units, and smoke units in particular, are very dependent upon the supporting CSS structure to configure and deliver "push" packages of supplies. Appendix E outlines smoke sustainment planning guidance.

It is essential that commanders and planners consider logistical support for smoke units in the overall tactical plan for an operation. The plan must specify—

- Support relationship between the supported unit and the smoke unit.
- Which activities (TAACOM, COSCOM, ASG, support group, DSA, BSA, or field trains) provide what type(s) of support for the smoke unit:
 - Class I, II, IV, VI, and VII.
 - Class III package (fog oil and other packaged POL).
 - Class III bulk (MOGAS, diesel).
 - Class V (small arms, mines, grenades, and explosives).
 - Class VIII and general medical support.
 - Class IX intermediate level maintenance support, less smoke generator specific parts.
- Consumption rates for the specified mission such as amount of fog oil and other POL needed to sustain smoke operations.
- "Push" packages to support committed units (for example, delivery times and locations, quantities, and frequency).
- Transportation support:
 - Availability of transportation assets.
 - Preplanned deliveries to provide the "push" package.
 - Priorities for support of units or areas.

Supporting Units

The smoke unit commander specifies the items for inclusion into a "push" package. The CSS unit specified in the plan will configure supplies for rapid distribution to the smoke unit. Normally, support to smoke units is on an area basis. When providing this support, support units use varying combinations of unit distribution such as long-range patrol (LRP) and supply point distribution procedures.

Unit distribution is the preferred method for resupplying smoke units. The supporting unit delivers supplies to the smoke unit's area using preplanned or dedicated transportation assets. The supporting unit generally arranges this transportation, although the transportation assets may be dedicated to resupplying the smoke unit for a particular mission only. The supporting unit should plan for throughput whenever possible.

An alternate means of resupply is supply point distribution. The supporting unit issues supplies from a supply point to the smoke unit. The smoke unit uses its own limited transportation assets to move the supplies to its area of operations.

When determining the type of distribution to be used to support smoke units, logistics planners at all levels should consider—

- Availability of personnel and equipment to deliver and pick up supplies.
- Missions of the supported forces.
- Adequacy of road networks in the area of operations.
- Priorities for use of the roads.
- Anticipated distances between supporting and supported forces.
- Locations of the supported forces.
- Threat to road and rail networks.

Basic Load

Basic load is the amount of equipment and supplies required by a unit to sustain itself until resupply

can be effected. The basic load is approved by the commander. The basic load is not a fixed quantity; it may be altered as situations dictate. For example, a smoke unit conducting a prolonged smoke operation may have its basic load of smoke pots increased for that particular operation.

One method of easing the resupply requirements of smoke units is tailoring of the basic loads. Extended smoke operations away from the main force can be given larger or different basic loads of fuel, parts, or other necessary supplies. Use the consumption tables in Appendix E as a guide for preparing unit basic loads.

Fog Oil Resupply

Fog oil is a packaged POL product arriving in 55-gallon drums. Support units can bulk fog oil by transferring the fog oil from the 55-gallon drums to fuel pods or tank and pump units. The fog oil used in smoke operations comes through the corps and division support areas. It may be delivered as far forward as the brigade support area by the supporting CSS unit. From here the smoke unit's fuel supply elements pick up the fog oil. Based on the type and duration of the smoke mission, the fuel supply element either establishes a forward fuel supply point or keeps stocks uploaded on organic vehicles. For rear area missions the smoke-fuel supply point may be supported from existing Class III or other supply activities.

There are two methods for fog oil resupply on-line resupply and off-line resupply.

On-line resupply. Stationary smoke points are resupplied on line during a smoke mission. This requires the fog oil and MOGAS resupply squad to move to each point as needed. The resupply squad or section will move tank and pump units (TPUs) to the line,

drop the drums of fog oil at the smoke point, or pre-position drums at a follow-on smoke point. This increases the vulnerability of the

resupply squad or section and the smoke point.

Off-line resupply. Mobile units are resupplied by rotating individual systems through a fuel resupply point

1 to 2 kilometers to the rear of the smoke line. You can also resupply stationary units that are displacing in this manner.

Fire Support and Security

When planning for the use of smoke in support of combat operations, it is essential commanders and operational planners recognize the vulnerability of smoke units. Smoke generator units conducting smoke operations leave a very recognizable signature on the battlefield. Smoke by its very essence attracts attention. An observer only needs to follow the smoke streamer to its source to target the individual smoke-producing device. Smoke generator operators and smoke unit commanders are acutely aware of this and utilize every measure available to reduce this signature.

Some of these steps include –

- Making maximum use of natural cover and concealment.
- Using reverse slope positioning.
- Using self-protecting smoke (for example, smoke pots upwind of generator positions).
- Continuously moving mobile systems within designated areas to minimize effective targeting.
- Staggering positions of generators.
- Digging in or hardening.
- Making smoke from flanks and stand-off positions whenever possible.

While the above actions will enhance the smoke unit's survivability, proper employment by the supported unit is essential. As an example, mechanized smoke systems provide some small-arms protection

for the crew and are less vulnerable to indirect fire than wheeled smoke systems.

Lessons learned at the NTC consistently demonstrate that mechanized smoke systems suffer high-loss rates when they are among the lead elements of armored assaults. While improper employment at the NTC serves as a valuable training aid for commanders, the same mistake in combat will result in the loss of a significant and scarce combat multiplier.

Reconstitution of battlefield losses will be slow. They may not occur at all based on the availability and priority of distribution for such a limited asset. In a rapidly moving armor assault, the commander may wish to plan for additional smoke support from his indirect fire artillery using WP or HC smoke projectiles integrated into preparatory fire. This fire placed on or in front of the objective may accomplish the desired result and not expose mechanized systems to unnecessary risk.

Fire Support

Supporting smoke assets coordinate with the supported unit for fire support.

Fire support is based on artillery availability and the coordination that takes place among the smoke unit, chemical staff office, S3/G3,

and FSO. Integrate the smoke unit fire plan with the supported unit fire plan. Fire support planning must consider—

- Priorities of fire support.
- Availability of smoke rounds (mortar and artillery).
- Named areas of interest (NAI) and target areas of interest (TAI) of the maneuver unit.
- Coordination with fire support assets for the primary, alternate, and supplemental smoke operations areas or points.
- On-call targets (nominated by the smoke unit).

Security

Plan for the security for smoke units based upon availability of the supported unit's assets and priorities. When security forces are provided for smoke assets, coordination measures include –

- Determining needed duration of security support.
- Determining size of security element.
- Locating overwatch positions for security elements.
- Determining smoke and security element leaders understand the commander's concept, fire support plan, and communication procedures, and are aware of smoke tactical resupply locations.

Smoke support occurs in many types of terrain under different weather conditions. Operations may occur in NBC-contaminated areas. Leaders balance mission requirements against protection require-

ments. They consider visibility constraints and heavy work rates during smoke missions. Specifically, it is difficult to see in smoke. It is more difficult to see in smoke when in full individual protective equipment

(IPE). Heat buildup becomes critical to the welfare of the soldier. This is especially true when the operator of the M157 smoke generator set is "buttoned-up" inside the M1059 mechanized smoke gener-

ator in full IPE in support of a mechanized or armored division.

Smoke generator crews may be difficult to replace in future conflicts. Therefore, you must focus on maintaining the available force at peak combat effectiveness. Leadership is the key to maintaining the strength and spirit of the fighting force. Leaders must assemble, transport,

and distribute their units as the commander requires in his task organization, yet conserve their fighting strength. Leaders must give special consideration to—

- Health services.
- Administrative support.
- Morale and welfare activities.
- Discipline.
- Stress management.

- Replacement planning.

Limited visibility has a significant impact on sustainment operations. It increases the time and decreases sustainment responsiveness. Support and smoke units should thoroughly rehearse sustainment activities prior to execution of the plan.

Chapter 7

VISUAL-INFRARED OBSCURANTS

Today virtually every nation and non-state organization has access to—

- advanced tactical sensors for target acquisition (thermal imagers) and intelligence gathering surveillance systems (ground and air reconnaissance).
- precision-guided munitions delivered by artillery, missiles, and aircraft that operate in the IR region of the electromagnetic spectrum.

These capabilities are available through internal manufacturing or purchase on the world market.

These thermal imaging sights allow them to acquire and engage targets through visual smoke, at night, and under adverse weather conditions. To counter the increasingly sophisticated sensor threat, the M56 and M58 smoke generator systems provide maneuver commanders the capability to control and dominate the visual through far infrared (IR) portions of the electromagnetic spectrum using visual (fog oil) and infrared (graphite) obscurants.

VISUAL-INFRARED
OBSCURANT GENERATOR
SYSTEMS

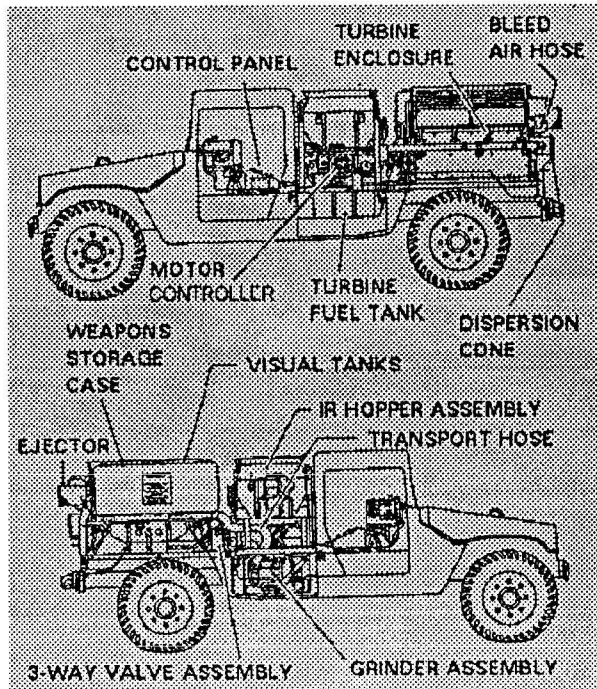


Figure 7-1. M56 Smoke Generator System.

The M56 Smoke Generator System (Figure 7-1) mounted on an M113 HMMWV is organic to motorized smoke units and dual-purpose smoke/decontamination units. The M56 can produce 90 minutes of visual/near infrared obscurant and 30 minutes of infrared obscurant without resupply. This system can produce obscurants while mobile or stationary.

The M58 Smoke Generator System (Figure 7-2) mounted on the M113A3 APC is organic to mechanized smoke units. The M58 can operate mobile or stationary. It can produce 90 minutes of visual/near infrared obscurant and 30 minutes of

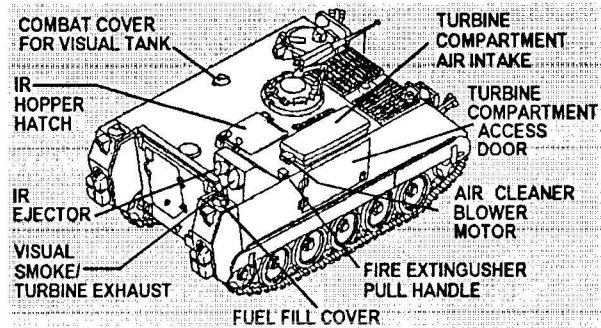


Figure 7-2. M58 Smoke Generator System.

infrared obscurant without resupply. Chassis improvements allow the M58 to keep pace with mechanized and armor units. The systems are equipped with a driver's thermal imager and an NBC contamination particulate filter unit.

Each system can selectively produce visual obscurants (vaporized fog oil) to defeat acquisition in the visual, and near infrared and infrared obscuration (graphite flakes) to defeat target acquisition devices that operate in the mid and far infrared. The two obscurants may be employed simultaneously or separately. If employed simultaneously, the threat force's capability to acquire targets with day sights and thermal imagers will be degraded. If employed separately, the visual obscurant will degrade day sights and the IR obscurant will degrade the thermal imagers.

OBSCURANT EFFECTS
ON SENSORS/SEEKERS

Visual and infrared obscurants have distinctly different effects on friendly and threat force sensors.

Therefore, commanders and staffs must understand the opportunities and limitations associated with each. Employment of infrared obscurants is a double-edged sword. A maneuver commander may want the added concealment offered by an infrared obscurant (graphite), but must accept the fact it will also degrade his own systems. Commanders and staffs must identify the threat sensor/seeker systems to be countered, determine the obscurant to be employed, and identify impacts on their own systems. Table 7-1 depicts the types of sensors and seekers found on today's battlefields and the relative degree of degradation caused by various natural and man-made obscurants.

VISUAL-INFRARED OBSCURANT CONCEPTS

Intelligence preparation of the battlefield (IPB) determines how the threat arrays sensors and seekers on the battlefield. After the IPB process has been accomplished, the chemical battle staff develops a

plan to integrate smoke and obscurant assets into the operational plan. The goal of the obscurant plan is to defeat critical threat sensors and seekers. For example, the IPB process has determined that the threat possesses a significant thermal imagery capability located with his reconnaissance assets. The smoke plan would likely focus on employing IR obscurants whenever and wherever the threat might attempt to utilize his reconnaissance assets.

The doctrine for IR obscurants is different from the doctrine for visual obscurants. IR obscurants provide the capability to defeat a significant threat asset—thermal imagers. Visual obscurants are used primarily to provide force protection from a threat having limited electro-optical capabilities such as first generation FLIR or with an even lesser capability such as systems that can only operate in the visual region of the electromagnetic spectrum. Overall, IR obscurants will be employed directly on the threat or between the threat and friendly forces. Visual obscurants are employed on friendly forces to provide

Table 7-1. Sensors and Seekers.

		DAY SIGHT	IMAGE INTENSIFIER	LASER	THERMAL IMAGERS	MMW
Fog oil, HC TA, TiO ₂ , phosphorus	M157/M1059, M56/M58, LVOSS, LB, M82, M19, M825, M884, M8	MAJOR	MAJOR	MAJOR	MINOR	MINOR
Graphite Brass	M56/M58, M76, M81	MAJOR	MAJOR	MAJOR	MINOR	MINOR
Graphite	M56/M58, F31, M81	MODERATE	MODERATE	MAJOR	MAJOR	MINOR
		MINOR	MINOR	MINOR	MINOR	MAJOR
		MODERATE	MODERATE	MAJOR	MINOR	MINOR
		MAJOR	MAJOR	MAJOR	MODERATE	MINOR
		MAJOR	MAJOR	MAJOR	MODERATE	MAJOR

DEGRADATION

- MAJOR
- MODERATE
- MINOR

protection while still allowing for the ability to maneuver within the obscurant cloud.

Offense

Employment of an infrared obscurant in offensive operations gives the maneuver commander an additional element of combat power. IR obscurants are able to defeat threat sensors and seekers. Two missions should be considered. One is to utilize the IR obscurant as a screen to prevent thermal ground sensors from detecting and identifying friendly forces. Another is to utilize the IR obscurant to obscure threat sensors. In this mission, given favorable weather conditions, the smoke plainer would employ the IR obscurant directly on the threat sensors.

Defense

IR obscurants in the defense will provide protection from smart weapons and prevent those weapons from acquiring their targets. Although the employment of IR obscurants reduces the friendly ability to maneuver, the commander may choose this option to increase the survivability of his forces in the event that other resources are unavailable to defeat the threat's smart weapons. For example, IR obscurant would provide considerable protection from smart weapons for rear area operations such as port facilities, logistical sites, and airfields.

Cloud Dynamics

Infrared obscurants are subject to the same weather and terrain considerations as visual obscurants. For planning purposes, the IR obscurant cloud will travel approximately the same distances as a visual cloud and will cover the same size target area. Visibility criteria in terms of *haze*, *blanket*, and *curtain* are not true for IR obscurants. Infrared clouds are defined in terms of transmittance value in relationship to percentage of probability of detection. Given wind speed, source strength, and downwind distance (Annex H), chemical staffs are able to estimate probability of friendly forces being detected when screened or protected by infrared obscurants.

Smoke Control

Generally, smoke control is the function of the smoke platoon leader or the smoke company commander under the direction of the maneuver commander, a breach or river crossing site commander, or a facility commander. Smoke control procedures will be

essentially the same for visual and infrared screens. However, at *night*, actual observation of the infrared cloud requires a thermal viewer. Without an IR sensor, smoke control officers will rely on the fog oil cloud to adjust target coverage or on information provided by the supported maneuver unit.

Coordination Measures

Infrared obscurants offer additional options to the commander: visual only, IR only, or visual/IR obscurants. The chemical battle staff must assist the commander in recommending the appropriate type obscurant based on IPB. Limiting factors may be based on planned friendly activity, the need to prevent signaling a friendly presence to the threat force, or danger inherent to friendly operations that might result in increased fratricide.

Smoke Control Graphics

Smoke target numbering systems and graphic control techniques will be increasingly important as commanders and staffs come to rely more heavily upon digitization. Battle staffs will maintain electronic overlays of planned smoke missions (similar to trafficability overlays) to allow for coordination of mission planning with adjacent and higher organizations. With the fielding of large-area infrared smokes, graphic control aids must be developed to portray *no smoke* areas, *visual only* smoke targets, *visual-infrared* smoke targets, and *infrared only* targets. Target numbering procedures should be standardized to enable adjacent units to recognize immediately smoke missions that may adversely affect their operations due to wind shifts, the cloud traveling farther than anticipated, or flank units perhaps being silhouetted. Although subject to local SOPs, visual only smoke target numbers should begin with a V followed by five digits. IR only smoke target numbers should begin with IR followed by four digits. Visual-infrared target numbers should begin with VIR followed by three digits.

Troop Safety

The same masking requirements and procedures for fog oil employment apply for infrared (graphite) obscurants. Overall, carry the mask when participating in operations that include the use of infrared obscurants. Mask when passing through or operating in a dense cloud. If duration of exposure will exceed 4 hours or breathing difficulties occur, masking is required.

LOGISTICAL SUPPORT

Logistical support for chemical smoke units requires special consideration with the addition of infrared smoke material (graphite). One 5-ton truck is capable of carrying the weight (and volume) of 9 barrels of fog oil and up to 4,350 pounds of IR obscurant simultaneously. If two 5-ton trucks are used to resupply 6 generators, the travel time to a supply point, reloading with fog oil and IR obscurants, and returning to the mission site must not exceed 75 minutes. When consecutive infrared missions are desired to support maneuver operations, the chemical staff with the G4/S4 anticipates resupply requirements and ensures that the smoke plan is supportable. Use the consumption table (Table 7-2) as a logistical planning tool for visual infrared smoke operations. Planners should keep in mind the M56 and M58 smoke generator systems have a variable setting capability for both IR (graphite) and fog oil modules. This allows the operator to control the rate graphite and fog oil is consumed. For example, at a

consumption rate of 5 pounds per minute, the system can produce 1 hour of IR obscurant. If the consumption rate is 10 pounds per minute, the system can produce 30 minutes of IR obscurant.

CONCLUSION

The M56/M58 smoke generator systems provide commanders and staffs an additional element of combat power. IR obscurants in any operation can be employed to *protect* the force, *screen* friendly maneuvers, or to *obscure* and attack threat sensors and seekers. IPB is critical in planning infrared missions by identifying threat sensors and seekers and how they are arrayed in theater. The chemical battle staff, by participating in the IPB process, war gaming, and rehearsals will facilitate an effective obscurant plan to support the commander's intent. The IPB process, focusing on how the threat arrays his sensors and seekers on the battlefield, are critical steps in planning the employment of IR obscurants.

Table 7-2. Consumption Table.

CONSUMPTION TABLE
M56 / M58 SMOKE GENERATOR SYSTEM

COMPONENT	1 HR	2 HR	6 HR	24 HR	48 HR
GAS TURBINE ENGINE (12 gal/hr)	12	24	72	288	576
VISUAL SMOKE MODULE (1.33 gal/min)*	80	160	479	1915	3830
IR MODULE**	600	1200	3600	14,400	28,800

* FOG OIL CONSUMPTION IS BASED ON MAXIMUM VARIABLE SETTING.

** IR OBSCURANT MODULE IS FED AT A VARIABLE RATE FROM 5 TO 10 lbs/min. CONSUMPTION IS BASED ON MAX SETTING.

M56 CAPACITIES: FOG OIL TANK 120 gal, IR MODULE 300 lbs, GAS TURBINE ENG 26 gal.

M58 CAPACITIES: FOG OIL TANK 120 gal, IR MODULE 300 lbs, GAS TURBINE ENG 95 gal.

Appendix A

Smoke Planning

Chapter 1 describes the general considerations for planning smoke support. This appendix provides procedures for preparing smoke planning documents and gives some examples. The smoke planning document examples include a smoke es-

timate format (Figure 11), smoke target list work sheet (Figure 12), and a smoke annex format (Figure 13). In addition, Figure 14 shows a coordination checklist for chemical unit commanders to use when they receive orders for a smoke mission.

Chemical staff officers must coordinate all smoke support with the G3/S3, FSCoord, and lateral units. These planning document examples contain several mechanisms to help staff officers verify such coordination.

Target Analysis Procedures

Coordinate with the commander or G3/S3 to determine obscurant requirements for the unit. Coordinate with the FSO, and nominate targets for obscuration. Identify targets within the FSO's capability. Also identify targets not within the FSO's capability.

Record targets on the target list work sheet.

Identify smoke delivery means to support the operation:

- Smoke generator unit(s).
- Mortars.
- Maneuver combat vehicles.
- Field artillery unit(s).

- Close air support assets.
- Naval gunfire.
- Other delivery means.

Plan targets, to include the following considerations:

- Which delivery means to use. For guidance, see the employment matrixes.
- Which obscurant to use. For guidance, see Appendix B, Figure 16, page 73.
- Duration of smoke on each target.
- Time to fire or make smoke.

Coordinate with the G3/S3 for the final target list and schedule of

smoke engagement with other than fire support assets.

Coordinate with the FSO for the final target list and schedule of fire. Designate the person, event, or time that will initiate the smoke mission. Coordinate with adjacent units, and check weather conditions.

Add or delete smoke missions on the basis of available assets and weather and terrain factors. Coordinate with any adjacent units not previously affected, but which may now be affected by smoke.

Prepare the smoke support annex to the OPLAN/OPORD.

Planning Documents

Smoke Estimate Format

After receiving the restated mission and planning guidance from the commander, the chemical officer prepares a smoke estimate (Figure 11).

Smoke Target List Work Sheet

Mandatory entries in a smoke target list work sheet include —

- **Smoke target number.** Assign a control number to identify the smoke target. The smoke control number contains five characters. The first character is a letter; the following four are numbers. A local SOP will establish how to assign these numbers. They are not the tar-

get number for fire support purposes. Fire support target numbers may be recorded in the remarks column. Smoke target numbers are five characters in length. The first character is a letter; the final four are numbers. Divisions and higher field headquarters may assign a specific group of numbers to organizations (for example, 1st Bde is A1001 through A1999; 2d Bde is B2001 through B2999). These numbers provide the chemical staff officer with a brevity code for smoke

- **Target description.** Write a brief description of the target (for example, combat reconnaissance patrol).

- **Target location.** Enter the center of mass UTM grid coordinates for the target.

- **Size.** Give the dimensions of the target in meters.

- **EO system.** This is the system you will attack with smoke/obscurants.

- **Delivery means.** Identify potential delivery means for the smoke.

- **Type of smoke.** Identify the type of smoke/obscurant to employ.

- **Priority.** This is the priority of attack based on fire support's target value analysis.

- **Remarks.** Self-explanatory.

Smoke Annex to OPLAN or OPORD

The smoke annex to a plan or order implements the commander's decisions concerning how to use smoke in the **operation**. The chemical staff officer prepares and coordinates the smoke annex. He or she, as a minimum, provides copies to subordinate and adjacent units (if affected by the smoke), the

G3/S3 and G4/S4 officers, FSCOORD, and smoke unit leaders.

Smoke Mission Coordination Checklist

Smoke unit commanders or leaders use this checklist to verify coordination with the supported unit and any adjacent units that might be affected by the smoke. The chemical staff officer provides most of the information (such as visibility criteria and target location); but, the smoke unit leader must personally finalize coordination, whenever, possible.

Employment Matrixes

Use the seven employment matrixes (Tables 4 through 10, pages 65 through 71) to determine

the appropriate delivery means for specific smoke targets. The tables cover general, hasty attack,

deliberate attack, defense, retrograde, special operations, and MOUT situations.

CLASSIFICATION

Copy ___ of ___ Copies
Issuing Headquarters: _____
Date-Time Group: _____
Message Reference Number: _____

SMOKE ESTIMATE

References: Map, charts, smoke overlays, and relevant documents.

Time zone used throughout the order: _____

1. Mission. This is the mission statement from the commander's estimate.
2. The Situation and Courses of Action.
 - a. Considerations Affecting the Possible Courses of Action.
 - (1) Operations to be supported.
 - (2) Characteristics of the area of operations.
 - (a) Weather.
 - (b) Terrain.
 - (c) Other pertinent factors.
 - b. Enemy Situation. Include potential weaknesses we wish to exploit and nominate potential targets.
 - c. Own Situation. Include smoke production asset status.
 - (1) Tactical situation.
 - (2) Smoke assets (projected, generator, self-defense) availability.
 - (3) Personnel, logistics, and CMO.
 - (a) Smoke munitions.
 - (b) Fog oil.
 - (c) MOGAS.
 - (d) Smoke generator unit readiness.
 - (e) Available transportation support.

CLASSIFICATION

Figure 11. Sample format for a smoke estimate. (Part 1 of 2)

CLASSIFICATION

d. Anticipated Difficulties or Difficulty Patterns.

e. Own Courses of Action.

3. Analysis of Courses of Action. Analyze each in light of critical incidents, times, areas, and significant difficulties.

4. Comparison of Courses of Action. Evaluate deficiencies from a smoke delivery and target defeat perspective. List advantages and disadvantages including methods to overcome deficiencies.

5. Conclusions. Indicate if mission is supportable and which course of action best supports the mission.

(Chemical Officer)

Annexes (as required)

Distribution: Must include G2/S2, G3/S3, and FSO at a minimum.

CLASSIFICATION

Figure 11 continued. (Part 2 of 2)

Smoke Target List Worksheet

Smoke Target No.	Target Description	Target Location (UTM Grid)	Size (in Meters)		EO System	Delivery Means	Type of Smoke	Priority	Remarks
			L	x W					

SAMPLE

Figure 12. Target list worksheet example.

CLASSIFICATION

Copy ___ of ___ Copies
Issuing Headquarters: _____
Date-Time Group: _____
Message Reference Number: _____

Annex __ (Smoke Support) to OPLAN (or OPORD)

REFERENCES: (Map, charts, smoke overlays, and relevant documents.)

Time zone used throughout the order (or plan): _____

1. SITUATION.

a. Enemy Forces. See Annex __ (Intelligence) to OPLAN/OPORD No. _____. (Add any items identified in the smoke estimate but not included in the intelligence annex. Ensure you cover weather and terrain factors.)

b. Friendly Forces. (Include information concerning smoke assets, not covered by the operation order, that are available in higher, adjacent, supporting, and reinforcing units.)

c. Attachments and Detachments. (List assets supporting the smoke mission, attached to or detached from the issuing headquarters.)

d. Assumptions. (OPLAN only)

2. MISSION. (State the mission for smoke delivery means.)

3. EXECUTION.

a. Concept of Operation. (Describe the concept for employment of smoke assets, to include the commander's intent and support priorities. Cover the role of smoke in support of the deception plan.)

b. (In subsequent lettered subparagraphs, give the specific tasks to be accomplished by smoke assets.)

(1) Generator smoke. (List specific missions, targets, and tasks for smoke generator organizations.)

(2) Projected smoke. See Annex __ (Fire Support).

(3) Other smokes. (List specific missions for units to use VEES, smoke pots, or other smoke production means.)

CLASSIFICATION

Figure 13. Sample smoke annex to an OPLAN or OPORD. (Part 1 of 3)

CLASSIFICATION

c. Coordinating Instructions. (State coordination or control applicable to two or more elements of the command.)

- (1) (Designation of smoke control officer.)
- (2) (Key person, time, or location to initiate smoke.)
- (3) (Smoke target list and overlay.)
- (4) (Schedule of smoke delivery.)

4. SERVICE SUPPORT

a. Material and Services. (Include information pertaining to availability; procedure for distribution; prestock points; and transportation of smoke munitions, bulk or packaged smoke generator fuels, and other supplies, to include—

● Which activities (TAACOM, COSCOM, ASG, support group, DSA, BSA, or field trains) provide what type(s) of support for the smoke unit:

- Class I, II, IV, VI and VII?
- Class III package (fog oil and other packaged POL)?
- Class III bulk (MOGAS, diesel)?
- Class V (small arms, mines, grenades, and explosives)?
- Class VIII and general medical support?
- Class IX intermediate level maintenance support, less smoke generator specific parts?

● Consumption rates for the specified mission (for example, amount of fog oil and other POL needed to sustain smoke operations).

● Push packages to support committed units (for example, delivery times and locations, quantities, and frequency).

● Transportation support:

- Availability of transportation assets.
- Preplanned deliveries to provide the push package.

● Priorities for support of units or areas.)

b. Miscellaneous.

CLASSIFICATION

Figure 13 continued. (Part 2 of 3)

CLASSIFICATION

5. COMMAND AND SIGNAL

a. Command. (State procedures for control of smoke assets and location of primary and alternate command posts.)

b. Signal. (CEO reference.)

(Commander)

(Authentication)

ENCLOSURE (If operation overlay is enclosed, describe enclosure.)

DISTRIBUTION:

CLASSIFICATION

Figure 13 continued. (Part 3 of 3)

CLASSIFICATION

1. Grid coordinates of the smoke mission (target location): _____
2. Start and stop date/time/event of smoke mission:
START Date/Time/Event: _____
STOP Date/Time/Event: _____
3. On/off-station date/time for the smoke unit(s):
ON-STATION date/time: _____
OFF-STATION date/time: _____
4. Type of visibility in the smoke required: _____
(Blanket: less than 50 meters.) (Haze: 50 to 150 meters.)
5. Enemy location(s)/activity: _____
6. Communications:
 - (a) Supported unit's frequencies and callsign:
Primary Frequency: _____ Alternate: _____
Callsign: _____
 - (b) Supporting unit's frequencies and callsigns:
Primary Frequency: _____ Alternate: _____
Callsign: _____
7. Supporting unit's command relationship to the supported unit (DS, GS, attached, OPCON):

CLASSIFICATION

Figure 14. Sample smoke mission coordination checklist. (Part 1 of 2)

CLASSIFICATION

8. Supported units' responsibilities to the supporting unit (for example, maintenance, transportation, fuel, and feeding): _____

9. Required staff coordination for the mission: (Check applicable staff sections.):

S2 ___ S3 ___ S4 ___ FSE ___ ALO ___ ENG ___

10. Location of supported unit's TOC: _____

11. Challenge, password(s), and code word(s): _____

12. Coordination effected with subordinate units, DATE/TIME: _____

13. Coordination effected with adjacent units, DATE/TIME: _____

14. Designate supply route(s) in/out of area: _____

15. Determine local weather conditions and peculiarities: _____

16. Determine any additional security requirement (for example, supporting unit requirement(s) for security forces): _____

17. Liaison information (between supported unit and supporting unit): _____

18. Smoke operation overlay: _____

19. After action report (AAR) to division NBCC: _____

Date/Time Mission Started: _____

Duration of Mission: _____

Fog Oil/ MOGAS Consumption: _____

Mission Issues/Problems: _____

Mission Results (success or failure): _____

CLASSIFICATION

Figure 14 continued. (Part 2 of 2)

Table 4. Smoke target matrix for general use.

Weapon Target	Artillery Smoke	Mortar Smoke	Smoke Pots	Smoke Generators	Smoke Hand Grenades	Smoke Rockets	Grenade Launchers	VEESS
Obscure Objective	X	X			A	X	X	
Conceal Breaching	A	A	X	X				
Conceal Movement	A	A	A	X	A		A	A
Blind Snipers	A	A			A	X	X	
Hide Vehicle From ATGM	A	A			X		X	X
Screen Bridging Operations	A	A	X	X	A	A	A	A
Segregate Enemy	X	X				A	A	
Support Deception	A	A	A	X				A
Screen Facilities			X	X				
Counter-smoke	X	X	A			X	A	

X = Primary System
A = Alternate or Secondary System

Table 5. Smoke target matrix for hasty attack.

Weapon Target	Artillery Smoke	Mortar Smoke	Smoke Pots	Smoke Generators	Smoke Hand Grenades	Smoke Rockets	Grenade Launchers	VEESS
Obscure Objective	X	X		A		A	A	
Conceal Breaching	A	A	X	X		A		A
Conceal Movement	A	A	X	X	A		A	A
Blind Recon	X	X			A	X	A	
Hide Vehicle From ATGM							X	X
Screen Bridging Operations	A	A	X	X	A	A	A	A
Segregate Enemy	X	X			A	A	A	
Support Deception	A	A	X	X				A
Silhouette Enemy		X	A	A	A		A	
Isolate Enemy Aviation	X	A	A	A				

X = Primary System
A = Alternate or Secondary System

Table 6. Smoke target matrix for deliberate attack.

Weapon Target	Artillery Smoke	Mortar Smoke	Smoke Pots	Smoke Generators	Smoke Hand Grenades	Smoke Rockets	Grenade Launchers	VEESS
Obscure Objective	X	X						
Conceal Breaching	A	A	X	X		A		A
Conceal Movement	A	A	X	X	A		A	A
Blind Recon	X	X			A	X	A	
Hide Vehicle From ATGM				A			X	X
Screen Bridging Operations	A	A	X	X	A	A	A	A
Segregate Enemy	X	X					A	
Support Deception	A	A	X	X				A
Silhouette Enemy		X	A	A	A		A	
Conceal Assembly Area			X	X			A	

X = Primary System
A = Alternate or Secondary System

Table 7. Smoke target matrix for defense.

Weapon Target	Artillery Smoke	Mortar Smoke	Smoke Pots	Smoke Generators	Smoke Hand Grenades	Smoke Rockets	Grenade Launchers	VEESS
Silhouette Enemy	X	X	A			X		
Conceal Obstacles/ Emplacement			X	X				A
Conceal Movement	A	A	X	X	A	A	A	A
Blind Recon	X	X			A	X	A	
Hide Vehicle From ATGM			A	A	A		X	X
Isolate Enemy Aviation	X	A	A	A				
Segregate Enemy	X	X				A		A
Support Deception		A	A	X				A
Screen Facilities			A	X				
Counter- smoke	X	X				A		

X = Primary System
A = Alternate or Secondary System

Table 8. Smoke target matrix for retrograde.

Weapon Target	Artillery Smoke	Mortar Smoke	Smoke Pots	Smoke Generators	Smoke Hand Grenades	Smoke Rockets	Grenade Launchers	VEESS
Obscure Positions	A	A	X	A		A		
Conceal Mobility Operations			X	X				A
Conceal Movement			A	X	A		A	X
Blind Recon	X	X			A	X	A	
Hide Vehicle From ATGM			A	A	A		X	X
Isolate Enemy Aviation	X	X	A	A				
Segregate Enemy	X	X	A		A	X	A	
Support Deception		A	X	X				A
Screen Facilities			A	X				A
Counter- smoke	X	A				X		
Isolate Pursuing Forces	A	A				X		
Silhouette Enemy	X	X	A			X		

X = Primary System
A = Alternate or Secondary System

Table 9. Smoke target matrix for special operations.

Weapon Target	Artillery Smoke	Mortar Smoke	Smoke Pots	Smoke Generators	Smoke Hand Grenades	Smoke Rockets	Grenade Launchers
Obscure Objective	X	X		A	A	X	X
Conceal Breaching		X	A		A		
Conceal Movement				X	A	A	A
Blind Snipers	A	A			A	A	X
Conceal Infiltration			A		A	X	A
Screen Exfiltration			A		X		
Segregate Enemy	X	X				X	A
Support Deception	A	A	A	X	A	A	A
Screen Facilities			A	X			
Counter- smoke	A	A				X	

X = Primary System
A = Alternate or Secondary System

Table 10. Smoke target matrix for MOUT.

Weapon Target	Artillery Smoke	Mortar Smoke	Smoke Pots	Smoke Generators	Smoke Hand Grenades	Smoke Rockets	Grenade Launchers	VEESS
Obscure Objective	X	X		A	A	X	X	
Screen Breach Operations			X	X				A
Conceal Movement	A	A		X	A		A	X
Blind Snipers					A	X	X	
Hide Vehicle From ATGM	A	A			A		A	X
Screen Bridging Operations	A		A	X				
Segregate Enemy	X	A				A	A	
Support Deception	A	A	A	X				A
Screen Facilities				X				
Counter- smoke	X	A				X	A	

X = Primary System
A = Alternate or Secondary System

Appendix B

Electro-Optical Systems

Smoke and obscurants influence the visual portion of the electromagnetic spectrum. They also provide protection for our forces by influencing frequency ranges we do not normally perceive with our senses.

All sensory equipment (to include the human eye, viewers, vision enhancement devices, trackers, and seekers) requires a certain amount of energy (a minimum threshold) before they can perform their functions. A sensor will also fail to function if the level of energy, in the frequency range the device is designed to work within, is too great (a maximum threshold). Smoke and obscurants provide us a means to render sensors ineffective, by decreasing or increasing the amount of energy available to the device or sensor (Figure 15).

There are three categories of obscurants: natural, by-product, and artificial. We can use natural obscurants advantageously if we correctly forecast the weather. Darkness, fog, sandstorms, and precipitation are examples of

natural obscurants. By-product obscurants on the battlefield result from combat actions. Examples include the smoke caused by the burning of buildings and equipment, dust raised by maneuvering units, and the airborne dust and particles thrown by exploding artillery and mortar fire.

We produce artificial obscurants with smoke production equipment

or munitions as described in Chapter 1 and Appendixes D and E. We use these specifically to attack enemy electro-optical (EO) systems.

Figure 16, on the next page, shows the effect obscurants have on target acquisition and guidance systems from the visible through the millimeter wavelengths of the electromagnetic spectrum.

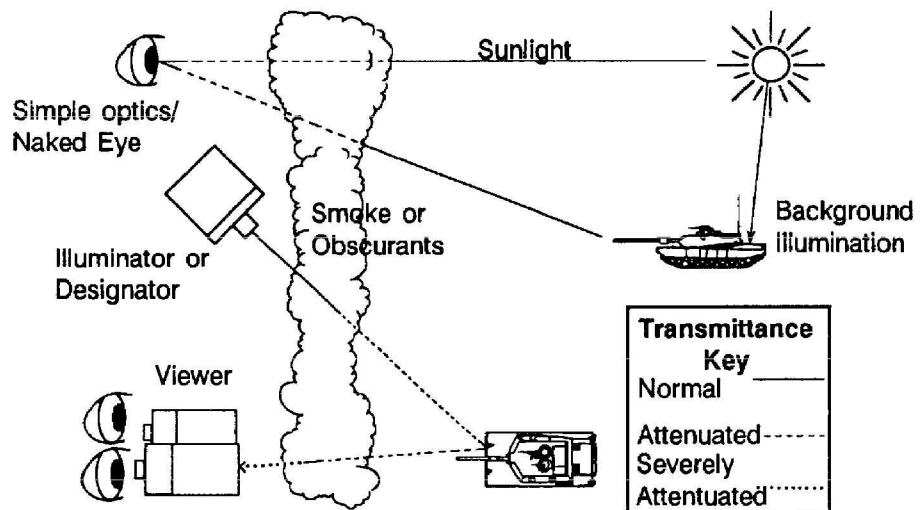


Figure 15. Obscurant effects on vision and viewers.

Sensors and Effects

Target Visibility

When you conceal an object by smoke, a number of factors determine the degree of obscuration. Physical properties of the object, such as size, shape, color, brightness, and reflecting properties of various parts of the surface, determine the density of the smoke required for effective obscuration.

The degree of illumination of the area, the background setting, and angle of observation have an important effect.

The overriding factor in smoke screen effectiveness is the total concentration of smoke and the path and length of the smoke cloud between the observer and the target. Thus, one observer may detect the

target, while a second observer may not, because of extended line of sight through the smoke to the target.

When considering target visibility, it is important to distinguish between the sighting of an object and identifying that object as an enemy target. The prevention of detection is the severest test of a smoke cloud. Although most detection efforts in the past were in the visible spectrum, modern technology has extended the useful spectrum beyond the visible wavelengths.

Infrared (IR) rays have properties similar to those of visible light. However, IR rays may readily pass through materials that lessen visible light (for example, IR rays pass more readily through the atmosphere than visible light, even

through light rain, snow, and fog). Night vision devices use the IR rays produced by or reflected from an object. Active IR is radiation produced by an illumination source and then reflected from an object; heat radiates from an object. IR radiation depends on the type of radiating material and its temperature. With an increase in temperature there is an increase in radiation. In hazy weather, IR devices can give a two- to four-fold increase in range over visible spectrum devices. In foggy weather, IR devices suffer a marked decrease in range, but are still superior to visual devices. Many of the restrictions noted for IR also apply to military laser range finders and seekers.

Sensors and Viewers

As a result of the development of IR and radar devices during World War II and subsequent technical advances, electronic sensors have supplemented conventional visual methods of target acquisition and aiming. The introduction of electronic techniques has also enhanced our ability to detect and attack targets at night and in adverse weather.

We can degrade the performance of electronic sensors by using obscurants (smoke and dust). Some of these devices can be rendered ineffective; others can be degraded significantly; still others will not be affected at all. However, to effect sensors we must use the right kind of obscurant at the right place, at

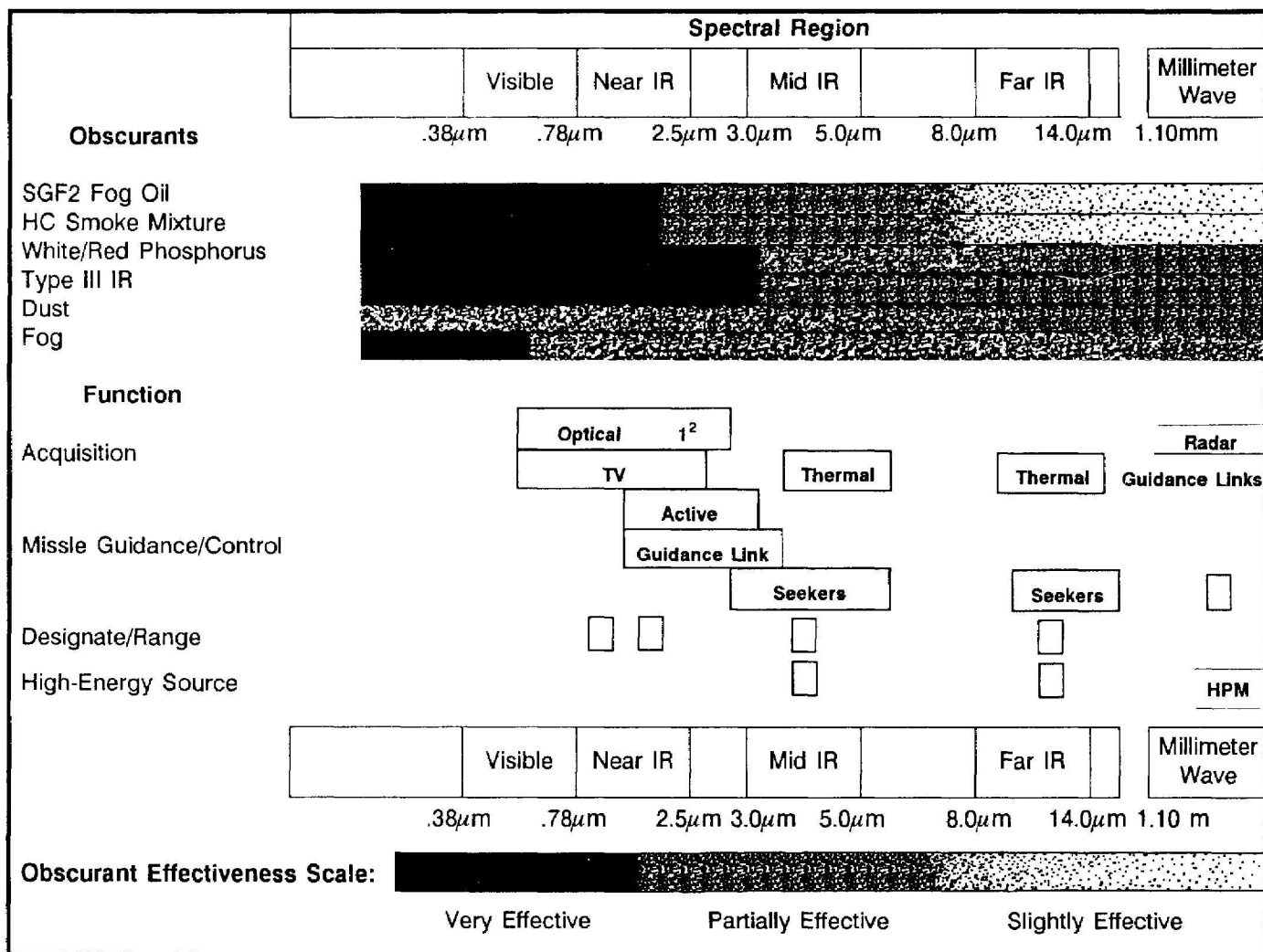


Figure 16. Obscurant effects on battlefield electro-optical devices.

the right time, and in sufficient quantity.

The eye is the basic receiver for several types of EO sensors. Four sensors that rely on the eye are the naked eye itself, the telescope, the television viewer, and the image intensifier. Sensors can be active or passive depending on the mechanism they use to detect and intensify the images.

Operational Considerations

The eye, the telescope, the television viewer, and the image intensifier all require illumination of the target and its background. The sun, moon, stars, or illumination rounds may provide this illumination. The eye detects reflected light and is dependent upon the contrast between the brightness of the target and its background. The telescope improves the capability of the eye by enlarging the target image.

Television viewers are used to provide viewpoints from distant, hostile, or awkward positions. Television viewers can also function as image intensifiers or to enhance contrast. Image intensifiers electronically magnify the light received, increasing it to a level the eye can see. Contrast enhancement electronically increases the brightness of the target, making it easier to see.

Passive sensors use available natural light. We use passive systems when the available light is sufficient to illuminate the target. An active viewer system consists of a viewer and an illuminator, which floods the target with light. Illuminators for different active viewing sensors include lasers, searchlights, or flares. We use active sensors when there is not enough light to illuminate the target.

Effects of Obscurants

Placing obscurants between the target and the viewer will degrade the performance of these sensors. Target acquisition and identification depend on the contrast between the target and its background and the brightness of the target. Smoke and

dust will decrease this contrast and brightness by attenuating light reflected from the target. Rain, snow, fog, and haze will also degrade the performance of these systems. To use an obscurant against these sensors, place the obscurant in the line of sight between the target and the observer. Obscuration use in moonlight can also degrade the contrast of target and background. We can further degrade the contrast of a target with its background by the light from the sun that falls directly onto the obscurant and is then scattered into the line of sight. The amount of degradation depends on the position of the sun and the depth of the obscurant cloud. Degradation is greatest when both sun and target have about the same line of sight to the observer or viewer. Considerable degradation can also occur when the sun is directly behind the observer or viewer.

Thermal Viewers

Passive thermal viewers use the natural thermal radiation differences between target and background to form an image – hence the name thermal viewer. Another name for a thermal viewer is forward looking infrared (FLIR). These thermal viewer systems require no external source of radiation and can successfully operate on a dark night if the targets are sufficiently warmer or cooler than the background. The thermal viewer is used in fire control systems, in some thermal homing missiles, and for surveillance purposes.

Reducing the apparent contrast between the target and its background may degrade the effectiveness of the thermal viewer. Obscurants degrade sensor performance by attenuating the target radiation signature reaching the viewer. The thermal radiation produced by the cloud may also degrade performance of the sensor. The initial burst of a munition will also produce a hot spot of thermal radiation, possibly saturating or blinding

the viewer for a few seconds. Such hot spots may also divert or decoy thermal-tracking missiles.

Most smoke attenuates thermal radiation less effectively than visual radiation, so more smoke is required to degrade thermal viewers; the relative amount depends on the agent employed. However, some smoke (for example, HC and fog oil) is not very effective against thermal viewers. High concentrations of WP and RP and black smoke are more effective against thermal viewers.

Command-Guided Missiles

Most command-guided missiles are command to line of sight (CLOS) missiles, which operate in one or more spectral regions. The oldest of CLOS missiles are visually and manually controlled, requiring the operator to track both the missile and its target, while simultaneously guiding the missile to the target (for example, the Soviet Sagger). Tracking the missile can be aided by putting a beacon on the missile. This guidance scheme has been relatively easy to defeat, since either the target or the missile can be obscured, and a miss results. In addition, the flash from an exploding HE or smoke munition could serve to distract the gunner, again resulting in a miss.

The next type of missile control is semiautomatic CLOS (for example, the Dragon). In this case, the operator or gunner only tracks the target; the missile is automatically guided. This reduces the burden on the gunner and increases the accuracy. However, to cause a miss it is only necessary to obscure either the missile beacon or the target; further, the sensor tracking the missile may be blinded for a short period of time by the flash of an exploding munition. Many systems using this type of guidance use a beacon and tracking sensor that operate in the near IR. With visual target tracking this presents no difficulty. However,

with the advent of thermal imagers a situation known as spectral mismatch can occur. In this case, and under obscured condition, it may be possible to see a target with the thermal imager but not to hit the target because of obscuration of the missile beacon.

A third type of guidance is automatic CLOS. Both target and missile are tracked automatically, usually by different sensors. This type of CLOS guidance is the most sensitive to obscuration, especially with sensors operating in the shorter wavelengths.

A more recent type of guidance command for CLOS missiles is beamrider guidance. Here, a gunner tracks the target either manually or automatically while illuminating the target with a beam of light. Usually this beam is provided by a laser, and most beamriders operate in the near and far IR spectrums. Most do not use the visible portion to prevent exposing the firing position. Sensors on the rear of the missile look back at the beam projector. These sensors track the beam, and the missile guides itself to the target. Beamrider guidance suffers from the same obscuration limitations as conventional CLOS missiles with a beacon. As a rule, the lasers used in beam projectors have more power than the equivalent beacon on a CLOS missile. As a result, the laser beam is harder to obscure.

Beamrider missiles are built so that the spectral mismatch is not the weak link in terms of susceptibility to obscuration. If you track a target using the visible portion of the spectrum, guidance is performed using either the IR or millimeter wavelengths. Similarly, if target track is carried out with a thermal imager, the missile is guided using a far IR or millimeter wavelength. In effect, the target-tracking element of the beamrider system is usually the most vulnerable to obscuration.

Most CLOS missiles receive guidance commands by a wire connecting the launcher and the mis-

sile. The wire is not susceptible to obscuration; however, severing the wire (for example, by shell fragments) will result in a miss. Some CLOS missiles receive guidance commands by a radio link in the radar or millimeter portions of the spectrum. These commands are difficult to degrade using conventional obscurants. Of more importance is the effect of the electromagnetic radiation emitted during an HE detonation. This radiation may cause the missile to miss its target. As a rule, it is easier to obscure the target tracker of a beamrider system than the laser beam that guides the missile. This target tracker is usually a viewer or a thermal viewer.

Obscuring the target tracker (viewer or thermal viewer) usually causes a miss and may even prevent the gunner from launching the missile if the target cannot be seen. The flash of an exploding munition behind the missile may blind the tracking sensors on the rear of the missiles, causing the missiles to miss the target.

Terminal Homing Missiles

This guidance is characterized by a missile with a seeker at the front that tracks the target and guides the missile to the target. There are two categories of terminal homing missiles: those that lock on the target before launch and those that lock on the target after launch. Missiles that lock on after launch are generally more susceptible to obscuration effects than missiles acquiring lock before launch. Terminal homing seekers operate in one or more of three modes: active, passive, or semiactive.

Most active seekers operate in the radar and millimeter wavelength regions. These seekers are not, as a rule, adversely affected by obscuration, although they may be blinded momentarily by the detonation of an HE or smoke munition. Passive seekers may operate in any spectral

region. The most common seekers operate in the IR. Passive seekers operating in the visible or IR regions may be either imaging or nonimaging.

Passive imaging seekers have essentially the same susceptibility to obscuration as any imaging sensor, although far IR imaging seekers may look on a WP cloud that is hotter than the target and track the cloud as the target. This type of seeker may also be blinded by the flash from a detonating munition and therefore miss its target.

Nonimaging IR seekers often use two spectral bands. These two bands are used to discriminate between real and false targets (such as fires or hot rocks). These seekers can be decoyed by the difference in obscuration effects upon the two spectral regions. This difference may cause the seeker to think the target is a rock (and ignore the target) or to think a fire is the target (and attack the fire). Semiactive seekers use energy reflected from the target for tracking. Usually, the target is illuminated by a laser operating in the IR. Target illumination does not have to come from the launch point or site. This type of seeker may be defeated by obscuring the beam, either before or after it is reflected from the target. If obscuration is placed closer to the laser than to the target, sufficient laser energy may be scattered by the cloud to cause the missile to track the obscurant cloud rather than the real target.

Radar and Millimeter Wave Sensors

We can use radar and millimeter wave sensors to determine the position and/or velocity of the target. Since these form only poor images of the target, we do not get recognition and identification in the usual manner.

Dust and conventional smokes do not effectively degrade radar and millimeter wavelength sensors. However, other highly effective counter-

measures exist. A munition dust cloud does produce obscuration for a few seconds when the burst is in,

or very near, the line of sight. In the far term, we will use millimeter wave obscurants, projected onto

enemy positions, to degrade radar and millimeter wave sensors.

Directed-Energy Weapons

Directed-energy weapons differ in operation and effect from all other weapons. They include lasers; high-power microwaves; particle beams; and non-nuclear, directed electromagnetic pulse (EMP). Except for lasers and high-power microwaves, directed-energy weapons are in the early stages of development.

Directed-energy weapons transmit energy at or near the speed of light in the form of subatomic particles or electromagnetic waves. This energy impacts on the target as heat or shock. Directed-energy weapons can damage soft targets and soft components of hard targets, such as lenses, electrical and electronic components, and eyes. New equipment will have built-in defenses against known directed-energy weapons. We will fit older equipment with protective devices. In the near term, we will use smoke and obscurants to reduce the impact of attack by directed-energy weapons.

Lasers

As of 1990, no army is known to have laser devices fielded for use specifically as weapons. However, laser target designators and range finders are in the inventories of all major armies, and their numbers are increasing. Any of these laser devices can be used as a weapon. Laser weapons are effective against optical and EO systems: specifically, eyes and fire-control sights.

Laser range finders are used on the M60A2, M60A3, and M1 series tanks and our artillery units. Artillery fire support teams for airborne, ranger, and special forces units use the lightweight target designator; fire support teams for mechanized, infantry, and air-assault units use the ground-locating laser designator in either the ground-mounted or

vehicle-mounted mode; and all fire support team members use the GVS-5, binocular-type, laser range finder.

Additionally, artillery survey parties use laser devices for surveying gun positions. Scout platoons are equipped with GVS-5 laser range finders. USAF and Navy aircraft (F4, A7, F111, F105, F16, and A6 aircraft) may also carry laser target designators. Although these are not intended as weapons, accidental eye damage can occur if someone moves into a laser beam path and looks directly at the beam, or a laser beam reflects off a shiny surface into someone's eyes. A high-power laser beam striking in front of an EO device such as night vision devices or thermal imaging systems may also damage components and electrical circuits or cloud the lens.

To avoid engagement by laser weapon systems, use artillery, mortars, or direct-fire weapons to suppress known or suspected laser device locations. Smoke can temporarily defeat some laser devices. When operating within the enemy's line of sight, protect vulnerable systems by providing them cover or concealment. Cover sensor systems when not in use. If the mission requires movement, block the line of sight between friendly forces and enemy location with smoke, and/or use routes with minimal exposure time. Shoot-and-move tactics help prevent friendly positions from being pinpointed and targeted by laser devices. When searching with optical or EO devices, use as few as possible. Protect unused devices until they are needed.

High-Power Microwaves

Electric ammunition fuzes and many missile electronic guidance systems can be damaged by microwaves. Unprotected soldiers may experience warmth, pain, headaches, fatigue, weakness, and dizziness.

Terrain masking offers some protection from microwaves. The high-power microwaves operate in the millimeter wave spectrum; thus, smoke and dust have virtually no effect and should not be used solely to degrade their performance. A munition dust cloud does produce obscuration for a few seconds when the burst is in, or very near, the line of sight. In the far term, we will use projected millimeter wave obscurants onto known or suspected enemy microwave weapon locations to block or absorb the energy at its source.

Particle Beams

A particle beam is a directed flow of atomic or subatomic particles transmitted in a series of short pulses; it delivers large quantities of energy to targets in millionths of a second. The beam penetrates bad weather and smoke better than a laser beam and is much more destructive. The particle energy impacts in the form of heat, which melts or fractures the target. Particle beams may also create gamma and X ray when they strike metal.

Millimeter wave obscurant and type 3 IR obscurant may lessen some of the energy but will not be more than slightly effective. If a particle beam weapon is developed for ground combat, use the defensive measures taken against other direct fire weapons.

Electromagnetic Pulses

An EMP is a surge of electromagnetic radiation generated by a nuclear detonation or a pulse generator. An EMP travels hundreds of miles in a fraction of a second and

can damage or destroy unshielded electrical equipment.

To protect electronic equipment against EMPs and microwaves, all cable and entry points must be shielded. The equipment should be completely encased in metal. Extra equipment or equipment not

needed at the moment should be disconnected; small, electronic items should be placed in empty ammunition cans. Millimeter wave obscurant and type 3 IR obscurant may lessen some of the energy but will not be more than slightly effective.

Appendix C

Means of Delivery

Smoke can be delivered to the target in numerous ways, from artillery and aircraft to grenades and gener-

ators. Your choice of delivery means will be determined by the amount of smoke needed, the dis-

tance to the target, and the availability of resources.

The field artillery provides effective systems for rapidly placing smoke on distant targets. They use HC, WP, and RP projectiles.

Use artillery-delivered smokes to:

- Obscure enemy observers and target acquisition and guidance systems (for example, CLOS ATGMs).
- Isolate or segregate enemy formations.

In projecting smoke onto the battlefield, the field artillery uses three types of missions: quick smoke, immediate smoke, and special smoke.

Quick Smoke

The objective of a quick smoke mission is to obscure the enemy's vision or to conceal maneuver elements. The quick smoke mission equates to the normal HE adjust fire mission. Obscuring the enemy is required, but the urgency of the situation does not require immediate smoke procedures. Use a quick

Artillery Munitions

smoke mission to screen a small area of 150 to 600 meters for a period of 4 to 15 minutes.

Immediate Smoke

The objective of an immediate smoke mission is to obscure the enemy's vision immediately. Use an immediate smoke mission to obscure a point of 150 meters or less within 30 seconds for 1 1/2 to 5 minutes.

Special Smoke

The objective of a special smoke mission is to conceal a large area to protect or conceal maneuver forces for an extended period of time. Consider a special smoke mission when the size of the cloud makes a quick smoke mission impractical. This type of screen can vary from 400 to 2,400 meters in length.

Table 11 lists characteristics of artillery smoke munitions.

Table 11. Characteristics of artillery smoke munitions.

Type Round	Delivery System	Time to Build Effective Smoke	Average Burn Time	Range
WP	155 mm	1/2 min	1 to 1 1/2 min	18,000 m
HC		1 to 1 1/2 min	4 min	
WP	105 mm	1/2 min	1 to 1 1/2 min	11,200 m
HC		1 to 1 1/2 min	3 min	

Mortar Munitions

Mortars can provide good initial smoke coverage because of their high rate of fire, but their small basic load limits the size and duration of the cloud they can provide. They are the most rapid and effec-

tive indirect smoke delivery means available to the maneuver commander.

Use mortar-delivered smokes to obscure enemy observers and target acquisition and guidance systems,

such as CLOS ATGMs, and to isolate or segregate enemy formations.

Table 12, on the next page, lists characteristics of mortar-delivered smoke munitions.

Table 12. Characteristics of mortar-delivered smoke munitions.

Type Round	Delivery System	Time to Build Effective Smoke	Average Burn Time	Range Min/Max
WP	4.2 in	½ minute	1 minute	920/5,650 m
WP	81 mm	½ minute	1 minute	70/4,595 m
WP	60 mm	½ minute	1 minute	75/1,629 m

Rockets

AH/1S and AH-60 helicopters can deliver smoke munitions using the Hydra 70 rocket launcher system. The Hydra 70 fires a 2.75-inch rocket, which has a WP warhead (M156).

Use helicopter-delivered rockets to—

- Identify/mark targets for CAS aircraft and artillery.

- Obscure enemy observers and ATGM and air defense (AD) systems.

Table 13 lists characteristics of attack helicopter-delivered smoke rockets.

Table 13. Characteristics of helicopter-delivered smoke rockets.

Munition	Cloud Width	Cloud Duration
M156 WP Warhead	50 m	1 to 1½ minutes

Aircraft-Delivered Smoke

The M52 helicopter smoke generating system is still in the US Army inventory, but in January 1982 the Army Materiel Command (AMC) type classified it as Standard B. However, it is a very effective smoke delivery method against a low-technology enemy or one with

limited air defense assets. The system contains a fog oil tank, an electrical pump to transfer fog oil to the spray apparatus, and jets on a spray ring to direct the fog oil into a hot exhaust. There, the oil is vaporized into a thick, dense, white smoke.

The UH1 helicopter is the airframe for this system. It is effective when the UH1 flies at speeds less than 90 knots and at heights not to exceed 50 feet; this makes the helicopter extremely vulnerable to air defense systems. This system has application for uses in various low-intensity conflict operations (for example, counternarcotics operations, peacetime contingency operations, and counterinsurgency operations) when the enemy has relatively few air defense systems.

Table 14 lists the characteristics of aircraft-delivered smoke.

Table 14. Aircraft-delivered smoke characteristics.

System	Type Aircraft	Cloud Length	Cloud Duration
M52 Smoke Device	Low Performance	40 m x 6,580 m	3 to 10 minutes

Rifle grenades can deliver smoke to point and area targets up to 350 meters away from individual soldiers. The M203 and M79 grenade launchers and the MK19 automatic grenade launcher all can fire smoke grenades. The smoke cartridges include the M713 red smoke, M715

green smoke, and M716 yellow smoke cartridges.

Use rifle grenades to—

- Obscure snipers, enemy fighting positions, and heavy weapon emplacements.

- Provide immediate suppressive smoke to degrade enemy weapon guidance links or tracking.

- Conceal the movement of small tactical units (squad or smaller).

Table 15, on the next page, lists the characteristics of the 40-millimeter grenade launcher.

Table 15. Characteristics of 40-mm grenade launcher.

Cartridge for 40-mm Grenade Launcher	Type	Color	Burn Time
M676	Canopy	Yellow	60 to 90 seconds
M680	Canopy	White	60 to 90 seconds
M682	Canopy	Red	60 to 90 seconds
M713	Marking	Red	17 to 30 seconds
M715	Marking	Green	17 to 30 seconds
M716	Marking	Yellow	17 to 30 seconds

Smoke Pots and Smoke Hand Grenades

Smoke Pots

Smoke pots produce large volumes of white or grayish-white smoke for extended periods. They are the small-unit commander's primary means of producing small-area screening smoke. Pots are necessary for employing smoke on water, as the M4A2 floating HC smoke pot is the only smoke-producing system that floats.

Emplace smoke pots by hand, drop them from vehicles or helicopters, use them as a field expedient, or fasten them to the outside of armored vehicles. Ignite smoke pots

either manually (M4A2 and ABC-M5) at the emplacement site or electrically from remote positions (ABC-M5 only). The pots can be fired individually, simultaneously, or in a long-burning chain. Smoke pots are used by all services.

Table 16 lists the characteristics of US Standard A smoke pots.

Smoke Hand Grenades

Smoke hand grenades produce either white smoke or colored smoke for short periods of time. Because they only produce small amounts of smoke, smoke hand

grenades are not effective for screening smokes for units larger than one or two squads. Emplace smoke hand grenades by hand or manually ignite them with a trip wire. This technique is effective to deceive the enemy with a diversion.

The average soldier can throw a grenade 30 to 35 meters. White smoke grenades are most often used to conceal individual vehicles; colored smoke grenades are used to mark or spot positions. All services have and use smoke grenades

Table 17, on the next page, lists current smoke hand grenades and their characteristics.

Table 16. Characteristics of Standard A smoke pots.

Type	NSN	Ignition	Burn Time (Min)	Weight (lb)		Possible Uses	Duration (Minutes)
				Filling	Total		
ABC-M5 30-1b HC	1365-00-598-52077	Ignite by manual matchhead or electrical squib	12	31	33	Small-area screens Small smoke curtains (Ground-based only)	12 to 22
M4A2 HC Floating	1365-00-598-5220	Ignite by manual fuze only Issued w/M207A1 fuze	10	27½	11	Small area screen. Small smoke curtains (ground based or over rivers, small streams, and other operations that require floating capability): may be helicopter-delivered	10 to 15

Warning

The M4A2 smoke pot must be vented for five minutes within 24 hours prior to ignition. Vent each M4A2 pot by folding back the tape from at least two of the emission holes.

Table 17. Smoke hand grenade characteristics.

Type	Smoke Color	NSN	Weight (lb)	Possible Use	Duration (Sec)
AN-M8 HC	White	1330-00-219-8511	1.6	Marking or Small-Area Screens	105 to 150
M18	Red	1330-00-289-6852	1.2	Marking	50 to 90
	Green	1330-00-289-6851			
	Yellow	1330-00-289-6854			
	Violet	1330-00-289-6853			

Generators

The mechanical smoke generator is a device that vaporizes smoke generator fog oil number 2 (SGF2). The vapor released condenses in the air as a white smoke. Currently, mechanical smoke generators are the only large-area smoke devices type classified Standard A. Table 18 lists generator systems and their characteristics.

Table 18. Smoke generator characteristics.

System	Prime Mover	Mobility	Obscuration Spectrum	On-Board Duration
M3A4	M998 HMMWV	Static	Visual, Near IR	1 hr
M157	M1037 HMMWV M1059 SG Carrier	Mobile	Visual, Near IR	48-96 min
XM56	M1037 HMMWV	Mobile	Multispectral	Developmental
LAMPSS	Developmental (Fully Tracked)	Mobile	Full Spectrum	Developmental

Armored Vehicle Grenade Launchers

Three types of launchers for tanks and armored reconnaissance vehicles are designed to rapidly generate small amounts of smoke to conceal or screen individual vehicles. The vehicle commander launches the grenades as soon as he is fired upon, so the driver can take evasive action behind the smoke. The launchers fire either AN-M8 HC and M34 WP grenades (M176 launchers) or L8A1 RP and M76 IR grenades (M239 launchers).

Table 19 gives the characteristics of these self-defense grenades.

Table 19. Vehicle self-defense grenade characteristics.

Type		Total Grenades	Distance From Vehicle	Firing Arc	Time To Build Effective Smoke	Average Burn Time
Launcher	Grenade					
M176	HC, WP	8	30-40 m	90°	5 sec	90 sec
M226	HC	8	30-40 m	90°	6 sec	90 sec
M239	RP and Type III IR	12	24-30 m	110°	2 sec	1-3 min

Vehicle Engine Exhaust System

The VEES is a vehicle-mounted smoke system that produces smoke by vaporizing fuel with the exhaust system. Vehicles that currently have the VEES include the AVLB, CEV, M88A1, M60, M1, M2, and M3 families of combat vehicles.

In a heavy brigade-size combined arms force scenario, the VEES provides a significant reduction (up to 20 percent) in the vulnerability of M1s, M2/3s, and Improved Tow vehicles. When our forces use the VEES, the lethality of BMPs from

the 1- to 2-kilometer range decreases as much as 80 percent. In summary, the lethality of enemy tanks decreases about 20 percent at close range. Self-defense smoke provides significant protection in the close battle.

Safety

Safety with smoke and smoke delivery systems depends primarily on two things: characteristics of the

smoke and safety for the weapon or delivery systems. Tables 20 and 21 identify safety constraints and

measures for US smoke and delivery systems.

Table 20. Smoke safety constraints.

Smoke Agent	Problem/Concern	Response/Prevention
SGF2	Can cause pneumonia	Wear respiratory protection (mask) when in high concentrations of oil smoke or after 4 hours in low concentrations of oil smoke (haze)
HC	Carcinogenic	Wear respiratory protection at all times when exposed to HC smoke
WP, RP	Explosive; Can cause severe burns; Causes respiratory irritation	Do not use near friendly troops
Violet Smoke	Carcinogenic	Same as for HC

Table 21. Smoke delivery systems safety.

System	Problem	Response/Prevention
Artillery, Mortars, Rockets	Munitions are explosive. All can produce friendly casualties	Do not use near friendly troops
M239 Grenade Launcher	RP and IR grenades explosive	Safety radius of 50 meters for exposed troops in combat, 100 meters in training
M203 Grenade Launcher	Grenades explosive	Do not use near friendly troops
M18 Grenade AV-M8 HC Grenade	Burning device	Do not pick up or move when lit; wear gloves and eye protection when igniting; safety radius of 5 meters from friendly troops
M5, M5 Smoke Pots	Burning device	Same as M18 grenades. Plus: When igniting, keep head well to one side of the top of the pot and out of the way of sparks or flame. DO NOT use the pull ring or safety pin to lift a pot. Vent M4A2s. Safe distance for electrical ignition of M5 is 50 feet.
Smoke Generator	Vaporized SGF2 (See Table C-10)	Exhaust of smoke is very hot. Safety radius of 5 meters. No smoking around generator. Keep fire extinguisher within arm's reach; always add fuel from the fuel tank side; store gas can at least 15 feet from running generator. DO NOT touch engine head with bare hands.

Appendix D

US Smoke Organizations and Capabilities

Most chemical command and control headquarters are Reserve Component organizations. In the active Army, there are few battalion-level chemical organizations. Most corps and division-level smoke assets are

company-sized elements or smaller. Task organizing platoons from these companies provide the commander a mission-tailored mix of assets normally associated with battalion and higher levels.

This appendix describes the capabilities, limitations, and structure of chemical command and control headquarters, smoke units, and chemical unit task organizations.

Chemical Command and Control Headquarters

The two major chemical command and control headquarters are the corps chemical brigade (HHD) (TOE 03-4721) and the corps chemical battalion (HHD) (TOE 03-476L).

Chemical Brigade

Chemical brigades normally are assigned one to each corps. Each chemical brigade is composed of a headquarters and headquarters detachment (HHD) and two to five chemical battalions. The brigade

can provide limited administrative support, logistics, mission/operations planning, and execution supervision for the chemical battalions. The chemical brigade does not have organic supply and transportation assets for sustaining its assigned battalions.

Chemical Battalion

Chemical battalions usually are assigned to a chemical brigade at corps, or one per TAACOM. Each chemical battalion is composed of a

headquarters and headquarters detachment and two to five chemical companies. The battalion can provide limited administrative support, logistics, mission/operations planning, and execution supervision for the chemical companies. The chemical battalion does not have a support platoon; therefore, it has no organic supply and transportation assets for sustaining its assigned companies.

Smoke Generator Units

The major smoke generator unit tactical organizations are—

- Corps Chemical Company (SG) (Motorized) (TOE 03-067J).
- Corps Chemical Company (Smoke/Decon) (TOE 03-257J).
- Corps Chemical Company (SG) (Mechanized) (TOE 03-077J).
- Heavy Division Chemical Company (Mechanized Smoke Platoon) (TOE 03-387).
- Division Chemical Company (Airborne/Air Assault) (TOE 03-027J500/03-057L).
- Chemical Company (Smoke/Reconnaissance/Decon), Ar-

mored Cavalry Regiment (TOE 03-377L).

There are two different types of motorized systems and one mechanized smoke generator system. The M3A4 and the M157 are motorized, and the M1059 is mechanized.

Motor smoke units equipped with the M3A4 have 36 to 48 smoke generators mounted on 18 to 24 M998 series HMMWVs or M151 series 1/4-ton trucks with trailers. These smoke systems provide stationary smoke only. Depending on terrain,

the company is 100-percent mobile and is completely air-transportable.

Motor smoke units equipped with the M157 have 36 to 48 smoke generators mounted on 18 to 24 M1037 HMMWVs. This company, also, is 100-percent mobile and is completely air-transportable.

Mechanized smoke units equipped with the M1059 smoke generator carrier have six (heavy division company) or seven (mechanized smoke company) M1059s per platoon. This element is 100-percent mobile on any terrain and is completely air-transportable.

**Corps
Chemical Company
(SG) (Motorized)**

The motorized smoke generator company provides large-area smoke support for tactical and rear operations. The two platoons of the motorized smoke company have three squads each. There are 24 smoke generators per platoon. Each platoon (if weather, terrain, and the situation are favorable) can support up to a maneuver brigade.

**Corps
Chemical Company
(Smoke/Decon)**

The corps smoke/decon chemical company or dual-purpose company provides smoke and decontamination support to the light infantry division or units located in the division or corps rear area. This company has four dual-purpose platoons. Each of the four platoons can provide both smoke and decontamination support. However, the platoon can do only one mission at a time. Each platoon has two dual-purpose squads and one resupply squad. The company has 48 smoke generators — 12 per platoon.

The most difficult task of this company is the transition from decontamination to smoke support (or the reverse). This transition can be carried out at the company CP or in the BSA.

**corps
Chemical Company
(SG) (Mechanized)**

The mission of the chemical company (smoke generator-mechanized) is to provide smoke concealment for maneuver units and other critical areas. This company was developed because motorized companies lack the necessary armor protection and mobility to operate forward to support close operations in mid- and high-intensity conflict. It is organized into three smoke platoons. Each platoon has 14 smoke generators. (Two generators are mounted on each armored vehicle.) The seven vehicles form seven mobile point sources.

**Heavy Division
Chemical Company
(Mechanized
Smoke Platoon)**

The smoke platoon of the chemical company (heavy division) gives the division a large-area smoke capability. It also provides limited site selection for decontamination squads. The platoon has six M1059 smoke generator systems. Each of the two smoke squads has three M1059s with six smoke generators per squad.

**Division
Chemical Company
(Airborne/Air Assault)**

This company provides smoke and decontamination support to the airborne or air assault division. This company has three dual-purpose platoons. Each of the three platoons can provide both smoke and decontamination support. However, the platoon can do only one mission at a time. Each platoon has two dual-purpose squads and one resupply squad. The company has 36 generators — 12 per platoon.

The most difficult task of this company is the transition from decontamination to smoke support (or the reverse). This transition can be carried out at the company CP or in the BSA.

**Chemical Company
(Smoke/Recon/Decon)
Armored Cavalry
Regiment**

This company provides smoke and decontamination support to the armored cavalry regiment. The company has one dual-purpose platoon. Unlike other dual-purpose platoons, this platoon has seven M1059 smoke generator systems. The platoon can provide both smoke and decontamination support. However, the platoon can do only one mission at a time. The platoon has two dual-purpose squads and one resupply squad, with a total of 14 smoke generators.

Chemical Unit Task Organizations

The three unique chemical unit task organizations are—

- Chemical-engineer task force.
- Chemical company team.
- Chemical battalion task force.

**Chemical-Engineer
Task Force**

The chemical-engineer task force attaches one or more smoke or dual-purpose chemical platoons to the division engineer battalion. This provides a habitual association for logistical support for the chemical

platoons and is particularly useful when the platoon is supporting obstacle emplacement or covering force operations.

Chemical Company Team

The chemical company team attaches one or more platoons to a chemical company for specific missions. For example, a smoke platoon from a corps motorized smoke company could be attached to a heavy division chemical com-

pany for command and control during a particular mission.

Chemical Battalion Task Force

The chemical battalion task force attaches one or more platoons or companies to a chemical battalion for specific missions. Every smoke company in a corps chemical

brigade could be attached to a particular chemical battalion when that battalion is supporting the corps main effort. For example, if a division had to conduct a river crossing as part of the corps scheme of maneuver. The corps commander might task organize most of his smoke generator companies under one battalion for direct support of this mission.

Capabilities

Tables 22 and 23 show smoke platoon area coverage based on the type of platoon and the number

and types of generators or point sources.. The coverage is given in

kilometers; and the prime movers are listed for the generators.

Table 22. Smoke platoon coverage—mobile.

Type of Unit	SG & Prime Mover	No. of Point Sources	Average Smoke Cloud Coverage (in Meters)			
			Crosswind Width		Downwind Depth	
			Haze	Blanket	Haze	Blanket
Corps Mechanized Smoke Plt	M1059	7	600–1,500	550–1,300	100–3,600	50–1,400
Division Mechanized Smoke Plt	M1059	6	550–1,400	550–1,200	100–3,600	50–1,400
Corps Smoke/Decon Plt	M157 & M1037	6	550–1,400	550–1,200	100–3,600	50–1,400
ACR Smoke/Decon Plt	M1059	6	550–1,400	550–1,200	100–3,600	50–1,400
Corps Motor Smoke Plt	M157 & M1037	12	1,100–2,800	1,00–2,400	100–3,600	50–1,400

Table 23. Smoke platoon coverage—stationary.

Type of Unit	SG & Prime Mover	No. of Point Sources	Average Smoke Cloud Coverage (in Meters)			
			Crosswind Width		Downwind Depth	
			Haze	Blanket	Haze	Blanket
Corps Motor Smoke Plt	M3A4 & M151	24	1,000–3,400	500–1,700	600–10,000	600–10,000
	M3A4 & M998	12	500–1,700	300–900	600–10,000	600–10,000
Corps Smoke/Decon Plt	M3A4 & M988	6	300–900	100–500	600–10,000	600–10,000
Div (Abn) Smoke/Decon Plt	M3A4 & M988	6	300–900	100–500	600–10,000	600–10,000
Div (AA) Smoke/Decon Plt	M3A4 & M151	6	300–900	100–500	600–10,000	600–10,000