

Table 2-22, Phosgene oxime (CX) continued

Decontamination	Use large amounts of water or DS2 on equipment. Because of the rapid reaction of CX with the skin, decontamination will not be entirely effective after pain occurs. Nevertheless, decontaminate as rapidly as possible by flushing the area with large amounts of water to remove any agent that has not reacted with the skin.
Persistency	About two hours in soil. Relatively nonpersistent on surfaces and in water.
Use	Rapidly-acting casualty agent.

Section III. Incapacitating Agents

Incapacitating agents are chemicals that cause physiological or mental effects that lead to temporary disability. Unlike riot control agents with effects lasting only a few minutes, incapacitating agents produce effects that may last for hours or days after exposure to the agent has ceased. Incapacitating agents differ from other chemical agents in that the lethal dose is many times greater than the incapacitating dose. Thus, they do not seriously endanger life except in cases exceeding many times the effective dose, and they produce no permanent injury. Medical treatment, although not required, may speed recovery.

Many compounds show potential as incapacitating agents. However, in actual use the term refers to those agents that-

- Produce their effects mainly by altering or disrupting the higher regulatory activity of the central nervous system (CNS).
- Have effects that last hours or days rather than being momentary or fleeting, as with tear agents.
- Do not seriously endanger life except at concentrations greatly exceeding the effective dose. They do not produce permanent injury.
- Allow recovery without treatment and without any permanent effects.
- Are highly potent and logistically feasible. Incapacitating agents specifically do not include the following:
 - Lethal agents that are incapacitating at sublethal doses, such as the nerve agents.
 - Substances that cause permanent or long-lasting injury, such as blister agents and choking agents, and those that cause eye injury.

- Medical drugs that exert marked effects on the central nervous system, such as barbiturates, belladonna alkaloids, tranquilizers, and many of the hallucinogens. These drugs, although effective and relatively safe, are logistically infeasible for large-scale use because of the high doses required.
- Agents of temporary effectiveness that produce reflex responses that interfere with performance of duty. These include skin and eye irritants that cause pain or itching (vesicants or urticants), vomiting or cough-producing compounds (sternutators), and tear compounds (lacrimators).
- Agents that disrupt basic life-sustaining systems of the body and thus prevent the carrying out of physical activity. Examples include agents that lower blood pressure; paralyzing agents, such as curare; fever producing agents; respiratory depressants; and blood poisons. Although theoretically effective, such agents almost invariably have a low margin of safety between the effective doses and the possible lethal doses. Thus, they affect the basic purpose of an incapacitating agent, which is to reduce military effectiveness without endangering life.

Despite restrictions imposed by the above definition, a great variety of mechanisms remain that could in theory disrupt CNS regulation and maintenance of performance. Only two general types of incapacitating agents are likely to be encountered in military use: the CNS depressants and the CNS stimulants.

Central Nervous System Depressants

CNS depressants are compounds that have the predominant effect of depressing or blocking the activity of the central nervous system, often by interfering with the transmission of information across synapses. An example of this type of agent is BZ, which appears to block the action of acetylcholine in the same way that atropine does. BZ, however, has far greater relative potency than atropine on the CNS.

Cannabinols and phenothiazine-type compounds are other potential incapacitating agents that seem to act basically as CNS depressants. The primary effects of these agents are to sedate and destroy motivation rather than disrupt the ability to think.

Other types of CNS depressants that could contain potential incapacitating agents are narcotics such as fentanyl or hypnotics

BZ.

BZ, an odorless, white, crystalline solid, is a CNS depressant. BZ is usually disseminated as an aerosol with the primary route of entry into the body through the respiratory system; the secondary route is through the digestive tract. Skin absorption is possible with proper solvents.

BZ affects the victim's ability to remember, solve problems, pay attention, and understand instructions. Small doses of BZ cause sleepiness and decreased alertness. BZ also affects circulation of the blood, digestion,

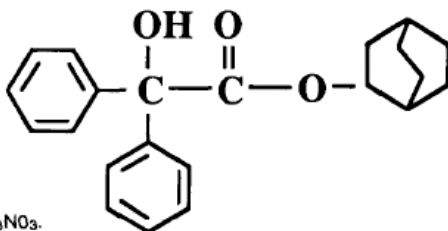
sweating, and vision. General symptoms from agent BZ are fast heartbeat, dry skin and lips, blurred near vision (increased pupil size), flushed skin, urinary retention, constipation, and sedation progressing to stupor and interference with ordinary activity. High doses produce extreme excitement, delusions, and hallucinations; high doses completely destroy the ability to perform any military task. An untreated casualty requires from three to four days to reach full recovery from the effects of BZ intoxication. See Table 2-23

Table 2-23. BZ.

Alternate designation:	Oksilidin.
Chemical name:	3-Quinuclidinyl benzilate.
Synonym:	1-azabicyclo (2.2.2)octan-3-ol, benzilate (ester).
CAS registry number:	13004-56-3 (C ₂₁ H ₂₃ NO ₃ •HCl).
RTECS number:	VD6300000 (C ₂₁ H ₂₃ NO ₃ •HCl).

Chemical and Physical Properties

Structural formula:

Molecular formula: C₂₁H₂₃NO₃.

Molecular weight: 337.41.

Physical state	White, crystalline solid (20°C).
Odor	None.
Melting point	164°C to 167°C.
Boiling point	320°C.
Solid density	0.51 g/cm ³ (bulk); 1.33 g/cm ³ (crystal).
Vapor density	11.
Vapor pressure	Negligible.
Volatility	Negligible.
Latent heat of vaporization	62.9 calories per gram between 170°C and 194°C.
Flash point	246°C.
Decomposition temperature	Begins to decompose at about 170°C in air under prolonged heating; is almost completely decomposed after one to two hours at 200°C. Rate is both temperature- and purity-dependent.
Solubility	Slightly soluble in water; soluble in dilute acids, trichloroethylene, warm dimethylformamide, and most organic solvents, such as alcohol and chloroform; insoluble in aqueous alkali. Salts formed with inorganic and organic acids are soluble.
Rate of hydrolysis	Half-life at 25° C is 6.7 hours at pH 9.8; 1.8 minutes at pH 13 and 3 to 4 weeks in moist air. life at 37°C is 95 hours at pH 7.4 and 10 hours at pH 9.
Hydrolysis products	3-Quinuclidinol and benzoic acid.
Stability in storage	Stable in most materials.
	continued

Table 2-23, HZ continued

Action on metals or other materials	No effect on steel or stainless steel after three months at 71°C. Aluminum and anodized aluminum are lightly attacked after three months at 71°C.
Toxicity Data	
LC ₅₀	High; estimated to be 200,000 mg-min/m ³ .
IC ₅₀	112 mg-min/m ³ .
Inhalation threshold dose	2 mg/m ³ individual.
Rate of detoxification	From an IC ₅₀ dose severe effects last 36 hours; mild effects last 45 hours.
Rate of action	Delayed. Usual onset of symptoms occurs approximately two hours after aerosol exposure. Depending on inhaled or ingested dosage, symptoms may appear at times ranging from 30 minutes to 20 hours after exposure. Effects from skin contact may appear 36 hours later. Dimethylsulfoxide as a "carrier" increases the percutaneous effect by a factor of at least 25.
Other Data	
Protection required	The principles applied to the nerve agents apply equally as well to the incapacitating agents. It is possible that such agents will be disseminated by smoke-producing munitions or aerosols, using the respiratory tract as a route of entry. The use of the protective mask, therefore, is essential. The skin is usually a much less effective route.
Decontamination	Complete cleansing of the skin with soap and water at the earliest opportunity. If washing is impossible, use the M258A1, M258, or M291 skin decontamination kit. Symptoms may appear as late as 38 hours after contact exposure, even if the skin is washed within an hour. In fact, a delay in onset of several hours is typical. Use this time to prepare for the possibility of a widespread outbreak 6 to 24 hours after the attack. Decontaminate bulk quantities of BZ with caustic alcohol solutions. If BZ or other belladonnoids are used as free bases, decontamination will require a solvent, such as 25-percent ethanol, 0.1N hydrochloric acid, or 5-percent acetic acid.
Persistency	Very persistent in soil and water and on surfaces.
Use	Delayed-action incapacitating agent.

Cannabinols and Phenothiazines.

Cannabinols and phenothiazine compounds are other potential incapacitating agents that seem to act basically as CNS depressants. The primary effects of these agents, however, are sedation and destruction of motivation rather than disruption of the ability to think.

Cannabinol is an active substance contained in hashish and in marijuana (Cannabis). Substances derived directly

from Cannabis and synthetic substances related to these parent materials have potential as incapacitants. Tetrahydrocannabinol (THC) is the principal active compound in marijuana. Table 2-24 shows the structure of the basic THC molecule.

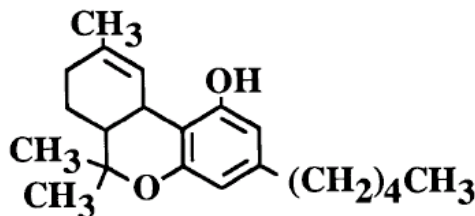
Synthetic analogues contain longer or more complex side chains and may involve the displacement of a double bond in one of the rings.

Table 2-24. THC.

CAS registry number: 33086-25-8.

RTECS number: HP8200000.

Structural formula:



Molecular formula: C₂₁H₃₀O₂.

Molecular weight: 314.51.

Inhaled natural cannabis produces effects within a few minutes. These effects peak at about one hour and subside after three to four hours. Ingested compound produces delayed, more prolonged effects. Some synthetic materials reportedly produce significant effects for up to several days. Signs and symptoms include feelings of unreality, intensification of sensations, difficulty in concentrating, lethargy, and sedation. No treatment is ordinarily required, and the effects subside spontaneously within a few hours.

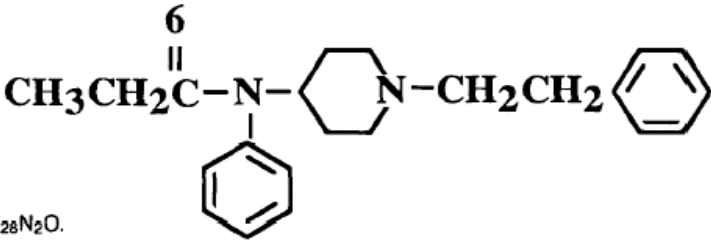
Phenothiazine-like compounds have a very high safety index and would not be likely to involve any special medical care. The onset of action for phenothiazines is about five minutes, and effects last about one hour.

Fentanyl.

Fentanyls interact at the opiate receptor; that is, they act like morphine and are narcotics. Fentanyls are the most

potent painkillers therapeutically available. One analogue is 10,000 times as potent as morphine. Fentanyls depress respiration and heart rate and cause lethargy, sedation, and immobilization. Large doses produce muscle rigidity. They would probably be disseminated as aerosols. As a potential class of agents they have a rapid onset of action (10 to 90 seconds) and are extremely potent in producing incapacitation without loss of consciousness. Estimated effective intravenous doses range from 3 to 100 micrograms per kilogram ($\mu\text{g}/\text{kg}$). Effects last from minutes to several hours, depending on the structure. They can be disseminated as an aerosol. Decontamination would involve washing with water (acidified with acetic acid). Table 2-25 shows the basic structure for fentanyls.

Table 2-25. Fentanyl.

Synonyms:	NCI-C56371; N-(1-phenethyl-4-piperidyl)propionanilide; N-phenyl-N-[1-(2-phenylethyl)-4-piperidinyl]propanamide; N-phenethyl-4-(n-propionylanilino)piperidine; 1-phenethyl-4-N-propionylanilinopiperidine.
CAS registry number:	437-38-7.
RTECS number:	UE5550000.
Structural formula:	
Molecular formula:	$\text{C}_{22}\text{H}_{28}\text{N}_2\text{O}$.
Molecular weight:	336.48.

Central Nervous System Stimulants

CNS stimulants cause excessive nervous activity, often by boosting or facilitating transmission of impulses that might otherwise be insufficient to cross certain synapses. The effect is to flood the brain with too much information, making concentration difficult and causing indecisiveness

First Aid for Incapacitating Agents

Effects of small amounts of most incapacitating agents are entirely temporary. However, large doses of some, especially BZ compounds in tropical environments, can be serious and require first aid. The most important considerations are the following:

and inability to act in a sustained, purposeful manner. A well-known drug that appears to act in this manner is d-lysergic acid diethylamide (LSD). Large quantities of the amphetamines sometimes produce similar effects.

- If the casualty has a loss of sense or feeling (stupor) or is in a coma, be sure that respiration is unobstructed and turn him or her on the stomach with the head to the side to avoid strangulation should vomiting occur.

- Regard ambulatory casualties as potentially capable of resisting, and approach them with this possibility in mind. To prevent them from injuring themselves or others, confine them and isolate them, if possible, in a safe area. If no other means are available, restrain them by tying them each to a tree.
- Remove weapons and other potentially harmful materials from suspected casualties. This includes cigarettes, matches, medications, and small items they might ingest accidentally. Delirious casualties have tried to eat items bearing only a superficial resemblance to food.
- The most important single medical consideration with BZ is the possibility of heatstroke because the casualty cannot sweat. Remove excessive clothing if the temperature is more than 70°F. There is usually no danger of severe dehydration in the first 12 hours, despite dryness and coating of the lips and tongue, unless persistent vomiting occurs. Give fluids only when the casualty can drink unassisted. Check for bladder distention if voiding does not occur within 12 hours.
- Reassurance and a firm but friendly attitude by personnel providing first aid will help if the casualties appear to comprehend what is being said to them. Conversation is a waste of time, however, if a casualty is incoherent or cannot understand what is being said. In such cases, the less said the better; the casualty benefits more from prompt and vigorous restraint and evacuation to a treatment facility.

Unfamiliar agents or mixtures of agents may be encountered in future field situations. In such an instance the general principles of restraint, close observation, and supportive medical care remain valid. The judgment of the medical officer remains the only useful guide to action in these complex and unforeseeable circumstances.

See TM 8-285 for diagnosis and treatment for incapacitating agents. Symptoms and possible agent families are shown in Table 2-26.

Table 2-26. Correlation of symptoms and incapacitating agent family.

Signs and symptoms	Possible agent family
Dryness of the mouth; slow pulse; elevated temperature; flushed face; blurred vision; dilated pupils; slurred or nonsensical speech; hallucinations; disrobing; mumbling and picking behavior; stupor and coma.	Anticholinergics (BZ).
Restlessness, dizziness, or giddiness; failure to obey orders; confusion; erratic behavior; stumbling or staggering; vomiting. See note.	Anticholinergics (e.g., BZ); Indoles (e.g., LSD); Cannabinols (e.g., marijuana); Other intoxications (e.g., alcohol, bromides, barbiturates, lead, etc.)
Inappropriate smiling or laughing; irrational fear; distractibility; difficulty in expressing self; perceptual distortions; labile increase in pupil size, heart rate, and blood pressure; stomach cramps and vomiting may occur.	Indoles. (Schizophrenic psychosis may mimic in some respects.)
Euphoric, relaxed, unconcerned daydreaming attitude; easy laughter; low blood pressure and dizziness on sudden standing.	Cannabinoids.
Respiratory depression; slow pulse; lethargy; sedation; immobilization.	Fentanyls.
Tremor, clinging, or pleading; crying; decrease in disturbance with reassurance; history of nervousness or immaturity. See note.	

Note: Although these signs and symptoms can appear from an agent family, they may also appear from an anxiety reaction.