

Selected Biological Agent Characteristics

| Agent Type                                     | Disease/Condition<br>Causative Agent/<br>Pathogen  | Description of Agent   | Transmissible<br>Person to<br>Person | Infectivity/<br>Lethality                                    | Incubation<br>Period                                  | Duration<br>of<br>Illness    | Persistence/<br>Stability                                      | Vaccination/<br>Toxoids | Rate of Action  | Symptoms  | Treatment  | Possible Means of<br>Delivery   |
|--|--|--|--------------------------------------|--|---|------------------------------|--|-------------------------|---|---|--|---|
| B<br>A<br>C<br>T<br>E<br>R<br>I<br>A           | Anthrax (inhalation)<br><i>Bacillus anthracis</i>  | Rod-shaped, gram-positive, aerobic spore-forming micro-organism. Individual spores ~ (1-12)x(3-5) μm                                       | No                                   | Moderate/High  | 1-7 days  | 3-5 days                     | Spores are highly stable                                       | Yes                     | Symptoms in 2-3 days; Shock and death occurs with 24-36 hrs after symptoms  | Fever, malaise, fatigue, cough and mild chest discomfort, followed by severe respiratory distress with dyspnea, diaphoresis, stidor, and cyanosis   | Usually not effective after symptoms are present, high dose antibiotic treatment with penicillin, ciprofloxacin, or doxycycline should be undertaken. Supportive therapy may be necessary.   | Aerosol.  |
|  | Brucellosis<br><i>Brucella suis, melitensis &amp; abortus</i>                                | All non-motile, non-sporulating, gram negative, aerobic bacterium; ~ (0.5-1)x(1-2) μm  | No                                   | High/Low   | Days to months  | Weeks to months              | Organisms are stable for several weeks in wet soil and food.   | Yes                     | Highly variable, usually 6-60 days.   | Chills, sweats, headache, fatigue, myalgias, arthralgias, and anorexia. Cough may occur. Complications include sacroiliitis, arthritis, vertebral osteomyelitis, epididymo-orchitis, and rarely endocarditis.   | Recommended treatment is doxycycline (200 mg/day) plus rifampin (900 mg/day) for 6 weeks.  | Aerosol. Expected to mimic a natural disease.   |
|  | Cholera<br><i>Vibrio cholerae</i>  | Short, curved, motile, gram-negative, non-sporulating rod. Strongly anaerobic, these organisms prefer alkaline and high salt environments. | Negl.                                | Low/Moderate-High  | 1-5 days  | 1 or more weeks              | Unstable in aerosols and pure water, more so in polluted water | Yes                     | Sudden onset after 1-5 day incubation period.   | Initial vomiting and abdominal distension with little or no fever or abdominal pain. Followed rapidly by diarrhea, which may be either mild or profuse and watery, with fluid losses exceeding 5 to 10 liters or more per day. Without treatment, death may result from severe dehydration, hypovolemia, and shock.   | Therapy consists of fluid and electrolyte replacement. Antibiotics will shorten the duration of diarrhea and thereby reduce fluid losses. Tetracycline, ampicillin, or trimethoprim-sulfamethoxazole are most commonly used.   | 1. Sabotage (food/water supply)<br>2. Aerosol   |
|  | Glanders<br><i>Burkholderia mallei</i>   | Gram-negative bacillus primarily noted for producing disease in horses, mules, and donkeys   | Negl.                                | Moderate-High  | 10-14 days  | N/A                          | N/A  | No                      | N/A   | Inhalational exposure produces fever, rigors, sweats, myalgia, headache, pleuritic chest pain, cervical adenopathy, splenomegaly, and generalized papular/pustular eruptions. Almost always fatal without treatment.  | Few antibiotics have been evaluated in vivo. Sulfadiazine may be effective in some cases. Ciprofloxacin, doxycycline, and rifampin have in vitro efficacy. Extrapolating from melioidosis guidelines, a combination of TMP-SMX + ceftazidime ± gentamicin might be considered.   | Aerosol.  |
|  | Plague (pneumonic, bubonic)<br><i>Yersinia pestis</i>  | Rod-shaped, non-motile, non-sporulating, gram-negative, aerobic bacterium; ~ (0.5-1)x(1-2) μm  | High                                 | High/Very High in untreated personnel, the mortality is 100% | 2 to 6 days for bubonic and 3 to 4 days for pneumonic | 1-2 days                     | Less important because of high transmissibility.               | Yes                     | Two to three days   | High fever, chills, headache, hemoptysis, and toxemia, progressing rapidly to dyspnea, stupor, and cyanosis. Death results from respiratory failure, circulatory collapse, and a bleeding diathesis.  | Early administration of antibiotics is very effective. Supportive therapy for pneumonic and septicemic forms is required.  | May be delivered via contaminated vectors (fleas) causing bubonic type, or more likely, via aerosol causing pneumonic type. |
|  | Shigellosis<br><i>Shigella Dysenteriae</i>   | Rod-shaped, gram-negative, non-motile, non-sporulating bacterium   | Negl.                                | High/Low   | 1-7 days (usually 2-3)                                | N/A                          | Unstable in aerosols and pure water, more so in polluted water | No                      | Symptoms usually within 2-3 days, however, known to demonstrate in as little as 12 hours or as long as 7 days.  | Fever, nausea, vomiting, abdominal cramps, watery diarrhea, and occasionally, traces of blood in the feces. Symptoms range from mild to severe with some infected individuals not experiencing any symptoms.  | The antibiotics commonly used for treatment are ampicillin, trimethoprim/sulfamethoxazole (also known as Bactrim® or Septin®), nalidixic acid, or ciprofloxacin. Persons with mild infections will usually recover quickly without antibiotic treatment. Antidiarrheal agents such as loperamide (Imodium®) or diphenoxylate with atropine (Lomotil®) are likely to make the illness worse and should be avoided.  | Contaminated food or water  |
|  | Tularemia<br><i>Francisella tularensis</i>   | Small, aerobic, non-sporulating, non-motile, gram-negative coccobacillus ~ 0.2x(0.2-0.7) μm  | No                                   | High/Moderate if untreated                                   | 1-10 days   | 2 or more weeks              | Not very stable  | Yes                     | Three to five days  | Ulceroglandular tularemia with local ulcer and regional lymphadenopathy, fever, chills, headache, and malaise. Typhoidal or septicemic tularemia presents with fever, headache, malaise, substernal discomfort, prostration, weight loss, and non-productive cough.   | Administration of antibiotics with early treatment is very effective. Streptomycin - 1 gm I. M. q. 12 hrs x 10-14 d. Gentamicin - 3-5 mg/kg/day x 10-14 d.   | Aerosol.  |
| R<br>I<br>C<br>K<br>E<br>T<br>S<br>I<br>A<br>E | Q-Fever<br><i>Coxiella burnetii</i>  | Bacterium-like, gram-negative organism, pleomorphic 300-700 nm   | No                                   | High/Very low  | 10-20   | 2 days to 2 weeks            | Stable   | Yes                     | Onset may be sudden   | Chills, retrobulbar headache, weakness, malaise and severe sweats.  | Tetracycline or doxycycline are the treatment of choice and are given orally for 5 to 7 days.  | May be a dust cloud either from a line source or a point source (downwind one-half mile or more).                           |
|  | Typhus (classic)<br><i>Rickettsia prowazekii</i>   | Non-motile, minute, coccoid or rod-shaped rickettsiae, in pairs or chains, 300 nm  | No                                   | High/High  | 6-15 days   | Weeks to months              | Not very stable  | No                      | Variable onset, often sudden. Terminates by rapid lysis after about 2 weeks of fever  | Headache, chills, prostration, fever, and general pain. A macular eruption appears on the fifth to sixth day, initially on the upper trunk, followed by spread to the entire body, but usually not the face, palms, or soles.   | Tetracyclines or chloramphenicol orally in a loading dose of 2-3 g, followed by daily doses of 1-2 g/day in 4 divided doses until ind. becomes afebrile (usually 2 days) plus 1 day.   | May be delivered via contaminated vectors (flea or lice).   |
| V<br>I<br>R<br>U<br>S<br>E<br>S                | Encephalitis   | Lipid-enveloped virions of 50-60 nm dia., icosahedral nucleocapsid w. 2 glycoproteins  | Negl.                                | High/High  | 5-15 days   | 1-3 weeks                    | Relatively unstable  | Yes                     |   | Inflammation of the meninges of the brain, headache, fever, dizziness, drowsiness or stupor, tremors or convulsions, muscular incoordination.   | No specific treatment; supportive treatment is essential   | Airborne spread possible.   |
|  | -Eastern/Western Equine Encephalitis (EEE, WEE)  |  | Low                                  | High/Low   | 1-5 days  | Days to weeks                | Relatively unstable  | Yes                     | Sudden  | Inflammation of the meninges of the brain, headache, fever, dizziness, drowsiness or stupor, tremors or convulsions, muscular incoordination.   | No specific treatment; supportive treatment is essential   | Airborne spread possible.   |
|  | Hemorrhagic Fever  |  | Moderate                             | High/High  | 7-9 days  | 5-16 days                    | Relatively unstable  | No                      |   | Malaise, myalgias, headache, vomiting, and diarrhea may occur with any of the hemorrhagic fevers  | No specific treatment; intensive supportive treatment is essential   | Airborne spread possible.   |
|  | -Ebola Fever   | Filovirus  | Moderate                             | High/High  | 3-6 days  | 1-2 weeks                    | Relatively unstable  | Yes                     | Sudden  | May also include a macular dermatologic eruption.   |  |   |
|  | -Marburg   | Filovirus  | Negl.                                | High/High  | 3-6 days  | 1-2 weeks                    | Relatively unstable  | Yes                     | Sudden  |   |  |   |
| -Yellow Fever                                  | Filovirus. Icosahedral nucleocapsid 37-50 nm diam., lipoprotein env. w/ short surface spikes |  |                                      |  |   |                              |  |                         |   |   |  |   |
| Variola Virus (Smallpox)                       | Asymmetric, brick-shaped, rounded corners; DNA virus   | High   | High/High                            | 7-17 days  | 1-2 weeks   | Stable                       | Yes  | 2-4 days                | Malaise, fever, rigors, vomiting, headache, and backache. 2-3 days later lesions appear which quickly progress from macules to papules, and eventually to pustular vesicles. They are more abundant on the extremities and face, and develop synchronously. | No specific treatment; supportive treatment is essential  | Airborne spread possible.  |   |
| T<br>O<br>X<br>I<br>N                          | Botulinum Toxin  | any of the seven distinct neurotoxins produced by the bacillus, <i>Clostridium botulinum</i>   | No                                   | NA/High  | Variable (hours to days)                              | 24-72 hours/Months if lethal | Stable   | Yes                     | 12-72 hours   | Initial signs and symptoms include ptosis, generalized weakness, lassitude, and dizziness. Diminished salivation with extreme dryness of the mouth and throat may cause complaints of a sore throat. Urinary retention or ileus may also occur. Motor symptoms usually are present early in the disease; cranial nerves are affected first with blurred vision, diplopia, ptosis, and photophobia. Bulbar nerve dysfunction causes dysarthria, dysphonia, and dysphagia. This is followed by a symmetrical, descending, progressive weakness of the extremities along with weakness of the respiratory muscles. Development of respiratory failure may be abrupt. | (1) Respiratory failure—tracheostomy and ventilatory assistance; fatalities should be <5%. Intensive and prolonged nursing care may be required for recovery (which may take several weeks or even months).<br>(2) Food-borne botulism and aerosol exposure—equine antitoxin is probably helpful, sometimes even after onset of signs of intoxication. Administration of antitoxin is reasonable if disease has not progressed to a stable state. Use requires pretesting for sensitivity to horse serum (and desensitization for those allergic). Disadvantages include rapid clearance by immune elimination, as well as a theoretical risk of serum sickness. | 1. Sabotage (food/water supply)<br>2. Aerosol   |
|  | Ricin  | Glycoprotein toxin (86,000 daltons) from the seed of the castor plant  | No                                   | NA/High  | Hours   | Days                         | Stable   | Not effective           | 6-72 hours  | Rapid onset of nausea, vomiting, abdominal cramps and severe diarrhea with vascular collapse; death has occurred on the third day or later. Following inhalation, one might expect nonspecific symptoms of weakness, fever, cough, and hypothermia followed by hypotension and cardiovascular collapse.   | Management is supportive and should include maintenance of intravascular volume. Standard management for poison ingestion should be employed if intoxication is by the oral route.   | Aerosol   |
|  | Staphylococcal enterotoxin B   | One of several exotoxins produced by <i>Staphylococcus aureus</i>  | No                                   | NA/Low   | Days to weeks   | Days to weeks                | Stable   | Not effective           | 30 min-6 hours  | Fever, chills, headache, myalgia, and nonproductive cough. In more severe cases, dyspnea and retrosternal chest pain may also be present. In many patients nausea, vomiting, and diarrhea will also occur.  | Treatment is limited to supportive care. No specific antitoxin for human use is available.   | 1. Sabotage (food/water supply)<br>2. Aerosol   |
|  | Trichothecene (T-2) Mycotoxins   | A diverse group of more than 40 compounds produced by fungi.   | No                                   | NA/High  | Hours   | Hours                        | Stable   | Not effective           | Sudden  | Victims are reported to have suffered painful skin lesions, lightheadedness, dyspnea, and a rapid onset of hemorrhage, incapacitation and death. Survivors developed a radiation-like sickness including fever, nausea, vomiting, diarrhea, leukopenia, bleeding, and sepsis.   | General supportive measures are used to alleviate acute T-2 toxicoses. Prompt (within 5-60 min of exposure) soap and water wash significantly reduces the development of the localized destructive, cutaneous effects of the toxin. After oral exposure management should include standard therapy for poison ingestion.   | 1. Sabotage<br>2. Aerosol   |

Chemical Warfare Agent Characteristics

| Agent Type  | Chemical Agent; Symbol<br>Chemical Structure  | Molecular Weight          | State @ 20°C                    | Odor                                      | PHYSICAL AND CHEMICAL PROPERTIES |                               |                             |                            |   |                                   |                              |                                |  |  | PHYSIOLOGICAL ACTION                                |  |   |   |  | CWC<br>base  |                              |       |
|---|---|---------------------------|---------------------------------|---|----------------------------------|-------------------------------|-----------------------------|----------------------------|---|-----------------------------------|------------------------------|--------------------------------|--|--|---|--|---|---|--|--|------------------------------|-------|
|   |   |                           |                                 |   | Vapor Density (Air = 1)          | Liquid Density (g/cc)         | Freezing/Melting Point (°C) | Boiling Point (°C)         | Vapor Pressure (mmHg)                   | Volatility (mg/m <sup>3</sup> )   | Heat of Vaporization (cal/g) | Decomposition Temperature (°C) | Flash Point  | Stability                                    | Median Lethal Dose (LD <sub>50</sub> ) (mg/minim)   | Median Incapacitating Dose (ID <sub>50</sub> ) | Eye & Skin Toxicity                                     | Rate of Action  | Physiological Action   |  | Detoxification Rate          |       |
| NERVE   | Tabun; <b>GA</b><br>C <sub>4</sub> H <sub>9</sub> OP(=O)CN(CH <sub>3</sub> ) <sub>2</sub>   | 162.3                     | Colorless to brown liquid       | Faintly fruity; none when pure            | 5.63                             | 1.073 @ 25°C                  | -5                          | 240                        | 0.037 @ 20°C                            | 610 @ 25°C                        | 79.56                        | 150                            | 78°C   | Stable in steel at normal temperatures       | 15,000 by skin (vapor) or 1500 (liquid); 70 inhaled | <50 inhaled                                    | Very high   | Very Rapid  | Cessation of breath – death may follow   | Slight, but definite   | 1A(2)                        |       |
|   | Sarin; <b>GB</b><br>CH <sub>3</sub> PO(F)OCH(CH <sub>3</sub> ) <sub>2</sub>   | 140.1                     | Colorless liquid                | Almost none when pure                     | 4.86                             | 1.0887 @ 25°C                 | -56                         | 158                        | 2.9 @ 25°C; 2.10 @ 20°C                 | 22,000 @ 25°C; 16,090 @ 20°C      | 80                           | 150                            | Non-flammable  | Stable when pure                             | 10,000 by skin (vapor) or 1700 (liquid); 35 inhaled | 25 inhaled                                     | Very high   | Very rapid  | Cessation of breath – death may follow   | cumulative   | 1A(1)                        |       |
|   | Soman; <b>GD</b><br>CH <sub>3</sub> PO(F)OCH(CH <sub>3</sub> ) <sub>2</sub> C(CH <sub>3</sub> ) <sub>2</sub>  | 182.178                   | Colorless liquid                | Fruity; camphor when impure               | 6.33                             | 1.0222 @ 25°C                 | -42                         | 198                        | 0.4 @ 25°C                              | 3,900 @ 25°C                      | 72.4                         | 130                            | High enough not to interfere w/ military use                     | Less stable than GA or GB                    | 2,500 by skin (vapor) or 350 (liquid); 35 inhaled   | 25 inhaled                                     | Very high   | Very rapid  | Cessation of breath – death may follow   | Low, essentially cumulative  | 1A(1)                        |       |
|   | (Cyclic-sarin); <b>GF</b><br>CH <sub>3</sub> PO(F)OCH <sub>2</sub> H  | 180.2                     | Liquid                          | Sweet, musty; peaches; shellac            | 6.2                              | 1.1327 @ 20°C                 | -30                         | 239                        | 0.044 @ 20°C                            | 438 @ 20°C                        | 90.5                         | ---                            | 94°C   | Relatively stable in steel                   | 2,500 by skin (vapor) or 350 (liquid); 35 inhaled   | 25 inhaled                                     | Very high   | Very rapid  | Cessation of breath – death may follow   | Low  | 1A(1)                        |       |
|   | <b>VX</b><br>(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> CH(O)P(O)(S)(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> NC <sub>2</sub> H <sub>4</sub> (CH <sub>3</sub> ) <sub>2</sub> | 267.38                    | Colorless to amber liquid       | None                                      | 9.2                              | 1.0683 @ 20°C                 | below -51                   | 298                        | 0.0007 @ 25°C; 0.004 @ 20°C             | 10.5 @ 25°C                       | 78.2 @ 25°C                  | Half-life of 36 hr at 150      | 159°C  | Relatively stable at room temperature        | 150 by skin (vapor) or 5 (liquid); 15 inhaled       | 24 by skin (vapor) or 2.5 (liquid); 10 inhaled | Very high   | Very rapid  | Produces casualties when inhaled or absorbed   | low, essentially cumulative  | 1A(3)                        |       |
| <b>Vx</b> ("v sub x")   | 211.2   | Colorless liquid          | None                            | 7.29                                      | 1.062 @ 20°C                     | ---                           | 256                         | 0.007 @ 25°C; 0.004 @ 20°C | 75 @ 25°C; 48 @ 20°C                    | 67.2                              | ---                          | ---                            | Relatively stable  | ---  | ---   | Very high                                      | Rapid   | Produces casualties when inhaled or absorbed                                      | low, essentially cumulative  | ---  |                              |       |
| BLISTER   | Distilled Mustard; <b>HD</b><br>(ClCH <sub>2</sub> ) <sub>2</sub> S   | 159.08                    | Colorless to pale yellow liquid | Garlic or horseradish                     | 5.4                              | 1.268 @ 25°C; 1.27 @ 20°C     | 14.45                       | 217                        | 0.072 @ 20°C                            | 610 @ 20°C                        | 94                           | 149 – 177                      | 105°C, ignited by large explosive charges                        | Stable in steel or aluminum                  | 900 (inhaled); 5,000 (vapor) or 1,400 (liquid)      | 500 (skin); 100 (vapor); 25 (eyes or nose)     | Eyes very susceptible; skin less so                     | Delayed: hours to days  | Blisters; destroys tissue; injures blood cells   | Very low – cumulative  | 1A(4)                        |       |
|   | Nitrogen Mustard; <b>HN-1</b><br>(ClCH <sub>2</sub> ) <sub>2</sub> NC <sub>2</sub> H <sub>5</sub>   | 170.08                    | Dark liquid                     | Fishy or musty                            | 5.9                              | 1.09 @ 20°C                   | -34                         | 194                        | 0.24 @ 25°C                             | 1,520 @ 20°C                      | 77                           | ---                            | Decomposes before boiling is reached                             | High enough not to interfere w/ military use | Adequate  | 1,500 (inhaled); 20,000 (skin)                 | 200 by eye; 100 by eye                                  | Eyes susceptible to low concentration; skin less so                               | Delayed: 12 hours or longer  | Blisters; affects respiratory tract; destroys tissue; injures blood cells      | Not detoxified; cumulative   | 1A(6) |
|   | Nitrogen Mustard; <b>HN-2</b><br>(ClCH <sub>2</sub> ) <sub>2</sub> NCH <sub>3</sub>   | 156.07                    | Dark liquid                     | Soapy (low concentrations); Fruity (high) | 5.4                              | 1.15 @ 20°C                   | -68 to -60                  | 75 at 15mmHg               | 0.29 @ 20°C                             | 3,580 @ 25°C                      | 78.8                         | ---                            | Below boiling, polymerizes with heat generation                  | High enough not to interfere w/ military use | Unstable  | 3,000 (inhaled)                                | <HN-1 & >HN-3   | Toxic to eyes; blisters skin  | Skin – delayed 12 hrs or more; Eyes – faster than HD                                     | Similar to HD; bronchopneumonia possible after 24 hours                        | Not detoxified; cumulative   | 1A(6) |
|   | Nitrogen Mustard; <b>HN-3</b><br>N(CH <sub>2</sub> CH <sub>2</sub> Cl) <sub>2</sub>   | 204.54                    | Dark liquid                     | None, if pure                             | 7.1                              | 1.24 @ 20°C                   | -37                         | 256                        | 0.0109 @ 25°C                           | 121 @ 25°C                        | 74                           | ---                            | Below boiling point  | High enough not to interfere w/ military use | Stable  | 1,500 (inhaled); 10,000 (skin (est.))          | 200 by eye; 2,500 by skin (est.)                        | Eyes very susceptible; skin less so   | Serious effects same as HD; minor effects sooner   | Similar to HN-2  | Not detoxified – cumulative  | 1A(6) |
|   | Phosgene oxime/dichloroformoxime; <b>CX</b><br>ClC <sub>2</sub> NH  | 113.94                    | Colorless solid or liquid       | Sharp, penetrating liquid                 | 3.9                              | ---                           | 35 to 40                    | 53 – 54 at 28mmHg          | 11.2 @ 25°C (solid); 13 @ 40°C (liquid) | 1,800 @ 20°C                      | 101 at 40°C                  | ---                            | ---  | Decomposes slowly at normal temperature      | Decomposes  | 3,200 (inhaled)                                | very low  | Powerful irritant to eyes and nose; liquid corrosive to skin                      | Immediate effects on contact   | Violently irritates mucous membranes, eyes, and nose; forms wheals rapidly     | ---                          | ---   |
|   | Lewisite; <b>L</b><br>ClCH <sub>2</sub> CHAsCl <sub>2</sub>   | 207.35                    | Colorless to brownish           | Varies; may resemble geranium             | 7.1                              | 1.89 @ 20°C                   | -18                         | 190                        | 0.394 @ 20°C                            | 4,480 @ 20°C                      | 58 at 0°C to 190°C           | >100                           | None   | Stable in steel and glass                    | 1,200–1,500 (inhaled); 100,000 (skin)               | <300 by eye; >1,500 to 2,000 by skin           | Severe eye damage; skin less so                         | Rapid   | Similar to HD; plus may cause systemic poisoning   | Not detoxified   | 1A(5)                        |       |
|   | Mustard-Lewisite mixture; <b>HL</b>   | 186.4                     | Dark, oily liquid               | Garlic                                    | 6.5                              | 1.68 @ 20°C                   | -25.4 (pure)                | <190                       | 0.248 @ 20°C                            | 2,730 @ 20°C                      | 58 to 94                     | >100                           | High enough not to interfere w/ military use                     | Stable in lacquered steel                    | 15,000 (inhaled); >10,000 (skin)                    | 200 by eye; >1,500 to 2,000 by skin            | Very high   | Prompt stinging; blistering agent about 13 hours                                  | Similar to HD; plus may cause systemic poisoning   | Not detoxified   | 1A(4); 1A(5)                 |       |
|   | Phenyldichlorarsine; <b>PD</b><br>C <sub>6</sub> H <sub>5</sub> AsCl <sub>2</sub>   | 222.91                    | Colorless liquid                | None                                      | 7.7                              | 1.65 @ 20°C                   | -20                         | 252 to 265                 | 0.033 @ 25°C                            | 390 @ 25°C                        | 69                           | ---                            | Stable to boiling point  | High enough not to interfere w/ military use | Very stable   | 2,600 (inhaled)                                | 16 as vomiting agent; 1,600 as blister                  | 633 mg-min/m <sup>3</sup> produces eye casualty; skin effects in 30 to 60 minutes | Immediate eye effects; skin effects in 30 to 60 minutes                                  | Irritates; causes nausea, vomiting and blisters                                | Probably rapid               | ---   |
|   | Ethyldichlorarsine; <b>ED</b><br>C <sub>2</sub> H <sub>5</sub> AsCl <sub>2</sub>  | 174.88                    | Colorless liquid                | Fruity, but biting; irritating            | 6.0                              | 1.66 @ 20°C                   | -65                         | 156                        | 2.09 @ 20°C                             | 20,000 @ 20°C                     | 52.5                         | ---                            | Stable to boiling point  | High enough not to interfere w/ military use | Stable in steel                                     | 3,000–5,000 (inhaled); 100,000 (skin)          | 5 to 10 by inhalation                                   | Vapor harmful on long exposure; liquid blisters -L                                | Immediate irritation; delayed blistering   | Damages respiratory tract; irritates blisters                                  | Rapid                        | ---   |
|   | Methyldichlorarsine; <b>MD</b><br>CH <sub>3</sub> AsCl <sub>2</sub>   | 160.86                    | Colorless liquid                | None                                      | 5.5                              | 1.636 @ 20°C                  | -55                         | 133                        | 7.76 @ 20°C                             | 74,900 @ 20°C                     | 49                           | ---                            | Stable to boiling point  | High enough not to interfere w/ military use | Stable in steel                                     | 3,000 – 5,000 (est.)                           | 25 by inhalation  | Eye damage possible; blisters less than HD  | Immediate irritation; delayed blistering   | Irritates respiratory tract; injures lungs and eyes; Causes systemic poisoning | Rapid                        | ---   |
| BLOOD   | Hydrogen cyanide; <b>AC</b><br>HCN  | 27.02                     | Colorless gas or liquid         | Bitter almonds                            | 0.990 @ 20°C                     | 0.887 @ 20°C                  | -13.3                       | 25.7                       | 742 @ 25°C; 612 @ 20°C                  | 1,080,000 @ 25°C                  | 233                          | >65.5                          | 0°C, ignited 50% of time when disseminated by artillery shells   | Stable if pure; can burn on explosion        | Varies widely with concentration                    | Varies with concentration                      | Moderate  | Very rapid  | Interferes with body tissues' oxygen use; accelerates rate of breathing                  | Rapid; 0.017 mg/kg/min   | 3A(3)                        |       |
|   | Cyanogen chloride; <b>CK</b><br>CNCl  | 61.48                     | Colorless gas or liquid         | Pungent, biting. Can go unnoticed         | 2.1                              | 1.18 @ 20°C                   | -6.9                        | 12.8                       | 1,000 @ 25°C                            | 2,600,000 @ 20°C                  | 103                          | 100                            | None   | Tends to polymerize; may explode             | 11,000  | 7,000  | Low, lacrimatory and irritating                         | Very rapid  | Chokes, irritates, causes slow breathing rate  | 0.1 mg/kg/min  | 3A(2)                        |       |
|   | Arsine; <b>SA</b><br>AsH <sub>3</sub>   | 77.93                     | Colorless gas                   | Mild garlic                               | 2.69                             | 1.34 @ 20°C                   | -116                        | -62.5                      | 11,100 @ 20°C                           | 30,900,000 @ 20°C                 | 53.7 @ -62.5°C               | 280                            | Below detonation temp; mixtures of air may explode spontaneously | Not stable in uncoated metal containers      | 5,000   | 2,500  | None  | Delayed 2 hours to 11 days  | Damages blood liver, and kidneys   | Low  | ---                          |       |
| CHOKING   | Phosgene; <b>CG</b><br>COCl <sub>2</sub>  | 98.92                     | Colorless gas                   | New-mown hay; green corn                  | 3.4                              | 1.37 @ 20°C                   | -128                        | 7.6                        | 1.173 @ 20°C                            | 4,300,000 @ 7.6°C                 | 59                           | 800                            | None   | Stable in steel if dry                       | 3,200   | 1,600  | None  | Immediate to 3 hr depending on conc.  | Damages and floods lungs   | Not detoxified – cumulative  | 3A(1)                        |       |
|   | Diphosgene; <b>DP</b><br>ClCOCOC <sub>2</sub>   | 197.85                    | Colorless gas                   | New-mown hay; green corn                  | 6.8                              | 1.65 @ 20°C                   | -57                         | 127–128                    | 4.2 @ 20°C                              | 45,000 @ 20°C                     | 57.4                         | 300 to 350                     | None   | Unstable; tends to convert to CG             | 3,200   | 1,600  | Slightly lacrimatory                                    | Immediate to 3 hr depending on conc.  | Damages and floods lungs   | Not detoxified – cumulative  | 3A(1)                        |       |
| TOXIC   | Diphenylchlorarsine; <b>DA</b><br>(C <sub>6</sub> H <sub>5</sub> ) <sub>2</sub> AsCl  | 264.5                     | White to brown solid            | None                                      | Forms little vapor               | 1.387 @ 45°C                  | 41 to 44.5                  | 333                        | 0.0036 @ 45°C                           | 48 @ 45°C                         | 56.6                         | 300                            | 350  | Stable if pure                               | 15,000 (est.)                                       | 12 (>10 minutes)                               | Irritating; not toxic                                   | Very rapid  | Like cold symptoms, plus headache, vomiting, nausea                                      | Moderate   | ---                          |       |
|   | Adamite; <b>DM</b><br>C <sub>2</sub> H <sub>4</sub> (AsCl) <sub>2</sub> NH(C <sub>2</sub> H <sub>5</sub> )  | 277.57                    | Yellow to green solid           | None                                      | Forms little vapor               | 1.65 (solid) @ 20°C           | 195                         | 410                        | Negligible                              | Negligible                        | 80                           | >boiling point                 | None   | Stable in glass or steel                     | Variable; avg.: 11,000                              | 22 (1 min.); 8 (60 min. exposure)              | Irritating; relatively not toxic                        | Very rapid  | Like cold symptoms, plus headache, vomiting, nausea                                      | Rapid in small amounts   | ---                          |       |
|   | Dibiphenylcyanosarsine; <b>DC</b><br>(C <sub>6</sub> H <sub>5</sub> ) <sub>2</sub> AsCN   | 255.0                     | White to pink solid             | Bitter almond-garlic mixture              | Forms little vapor               | 1.3338 @ 35°C                 | 31.5 to 35                  | 350                        | 0.0002 @ 20°C                           | 2.8 @ 20°C                        | 71.1                         | 300 (25% decomposed)           | Low  | Stable at normal temperatures                | 10,000 (est.)                                       | 30 (30 sec); 20 (5 min. exposure)              | Irritating; not toxic                                   | More rapid than DM or DA  | Like cold symptoms, plus headache, vomiting, nausea                                      | Rapid  | ---                          |       |
|   | <b>BZ</b>   | 337.4                     | White crystal                   | None                                      | 11.6                             | Bulk 0.51 solid; Crystal 1.33 | 167.5                       | 320                        | 0.03 @ 70°C                             | 0.5 @ 70°C                        | 62.9                         | begins at 170°C                | 246°C  | Adequate                                     | 200,000 (est.)                                      | 112  | ---   | Delayed; 1 to 4 hours depending on exposure                                       | Fast heart beat, vomiting, dry mouth, blurred vision, stupor, increasing random activity | ---  | 2A(3)                        |       |
|   | Chloroacetophenone; <b>CN</b><br>ClCH <sub>2</sub> COCH <sub>3</sub>  | 154.59                    | Solid                           | Apple blossoms                            | 5.3                              | 1.318 (solid) @ 20°C          | 54                          | 248                        | 0.0041 @ 20°C                           | 34.3 @ 20°C                       | 98                           | ---                            | Stable to boiling point  | High enough not to interfere w/ military use | Stable  | 7,000 to 14,000                                | 80  | Temporarily severe eye irritation; mild skin irritation                           | Instantaneous  | Causes tearing; irritates eyes and respiratory tract                           | Rapid                        | ---   |
| TEAR  | Chloroacetophenone in Chloroform; <b>CNC</b>  | 128.17                    | Liquid                          | Chloroform                                | 4.4                              | 1.40 @ 20°C                   | 0.23                        | variable; 60 to 247        | 1.173 @ 20°C                            | Indeterminate                     | n/a                          | ---                            | Stable to boiling point  | None   | Adequate  | 11,000 (est.)                                  | 80  | Temporarily severe eye irritation; mild skin irritation                           | Instantaneous  | Cause tearing; irritates eyes and respiratory tract                            | Rapid                        | ---   |
|   | Chloroacetophenone and Chloroform in Chloroform; <b>CNS</b>   | 141.78                    | Liquid                          | Flypaper                                  | ~5                               | 1.47 @ 20°C                   | 2                           | variable; 60 to 247        | 78 @ 20°C                               | 610,000 @ 20°C (includes solvent) | n/a                          | ---                            | Stable to boiling point  | None   | Adequate  | 11,400   | 60  | Irritating; not toxic   | Instantaneous  | Vomiting and choking agent as well as a tear agent                             | Slow because of effect of PS | ---   |
|   | Chloroacetophenone in Benzene and Carbon Tetrachloride; <b>CNB</b>  | 119.7                     | Liquid                          | Benzene                                   | ~4                               | 1.14 @ 20°C                   | -7 to -30                   | variable; 75 to 247        | variable; mostly solvent vapor          | Indeterminate                     | n/a                          | >247                           | -4.44°C  | Adequate                                     | 11,000 (est.)                                       | 80   | Temporarily severe eye irritation; mild skin irritation | Instantaneous   | Powerfully lacrimatory   | Rapid  | ---                          |       |
|   | Bromobenzylcyanide; <b>CA</b><br>BrC <sub>6</sub> H <sub>4</sub> CH <sub>2</sub> CN   | 196                       | Yellow or solid liquid          | Soured fruit                              | 6.7                              | 1.47 @ 25°C                   | 25.5                        | Decomp onset at 242        | 0.011 @ 20°C                            | 115 @ 20°C                        | 79.5 @ 20°C                  | 60 to 242                      | None   | Fairly stable in glass, lead, or enamel      | Stable  | 8,000 to 11,000 (est.)                         | 30  | Irritating; not toxic   | Instantaneous  | Irritates eyes and respiratory tract   | Rapid in low dosage          | ---   |
|   | O-chlorobenzylmalonitrile; <b>CS</b><br>ClC <sub>6</sub> H <sub>4</sub> CH <sub>2</sub> CN  | 188.5                     | Colorless solid                 | Pepper                                    | ---                              | 1.04 @ 20°C                   | 93 to 95                    | 310 to 315                 | 0.00034 @ 20°C                          | 0.71 @ 25°C                       | 53.6                         | ---                            | 197°C  | Stable                                       | 61,000  | 10 to 20                                       | Highly irritating; not toxic                            | Instantaneous   | Highly irritating; not toxic   | Rapid  | ---                          |       |
| <b>CR</b><br>(C <sub>2</sub> H <sub>5</sub> ) <sub>2</sub> O(N)CH | 195.25  | Yellow powder in solution | Burning sensation               | 6.7                                       | ---                              | 72                            | 335                         | 0.00059 @ 20°C             | 0.63 @ 25°C                             | ---                               | ---                          | ---                            | Stable   | ---  | 0.15  | Highly irritating; not toxic                   | Instantaneous   | Irritates skin, eyes, nose, and throat  | Moderate   | ---  |                              |       |
| Chloropicrin; <b>PS</b><br>ClC(=O)Cl                              | 164.38  | Liquid                    | Stinging; pungent               | 5.6                                       | 1.66                             | -69                           | 112                         | 18.3 @ 20°C                | 165,000 @ 20°C                          | ---                               | >400                         | Not flammable                  | Unstable in light  | 2,000  | 9   | Highly irritating                              | Instantaneous   | Acts as tear, vomiting, and choking agent   | Slow   | 3A(4)  |                              |       |

Sources: U.S. Department of the Army, *Potential Military Chemical/Biological Agents and Compounds*, U.S. Army Field Manual 3-9, (NANFAC P-467, AFR 355-7), 12 December 1990, Washington, D.C.: U.S. Government Printing Office.   
 Committee on Toxicology, National Research Council, 1997, *Review of Acute Human Toxicity Estimates for Selected Chemical Warfare Agents*, Washington, D.C.: National Academy Press.