

*Handbook of*

**CHEMICAL and  
BIOLOGICAL  
WARFARE  
AGENTS**

*D. Hank Ellison*

*Handbook of*  
**CHEMICAL and  
BIOLOGICAL  
WARFARE  
AGENTS**

At the height of the Gulf War conflict, Iraqi President Saddam Hussein, who had already used deadly chemical and biological warfare agents against the Kurdish population, threatens similar action against U.S. troops. Years later, far

removed from the theater of war, a dangerous chemical agent is released in a Japanese subway train, injuring dozens of passengers. Indeed, highly lethal nerve gases, vesicants and other hazardous chemical and biological agents may be the new weapons of choice among terrorist groups around the world—a threat that is now of paramount concern to emergency response teams.

In his book, the **Handbook of Chemical and Biological Warfare Agents**, author *D. Hank Ellison* provides all the information emergency response teams need to deal with lethal materials—from the physical appearance and symptoms of such agents, to their detection and removal, as well as the treatment of victims.

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*D. Hank Ellison, C. H. M. M.*



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## *Author*

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**D. Hank Ellison, C.H.M.M.**, has served active duty in the United States Army as both an enlisted infantry soldier and a commissioned officer in the Chemical Corps. At the time of his service, Mr. Ellison was one of a very limited number of Airborne Ranger Chemical Officers in the Army. Serving as a Chemical Officer with both an infantry battalion and artillery battalion in the 101<sup>st</sup> Airborne Division, Mr. Ellison was responsible for managing training in all aspects of nuclear, biological, and chemical defense. Mr. Ellison was also an instructor on the construction and deployment of improvised flame munitions.

Mr. Ellison was employed by the U.S. Environmental Protection Agency as both a Remedial Project Manager and Federal On-Scene Coordinator. As a Remedial Project Manager in the Superfund Program, he managed the investigation and remediation of various hazardous waste sites. As an On-Scene Coordinator, he has responded to and managed numerous types of hazardous material emergencies throughout the Midwest. Mr. Ellison received numerous awards while employed at the EPA including a Bronze Medal for Commendable Service and he was named the 1994 Region 5 On-Scene Coordinator of the Year.

Mr. Ellison is president of Cerberus & Associates, Inc. and as a private consultant, has responded to both transportation and fixed facility hazardous material incidents throughout the state of Michigan. He has acted as incident commander, safety officer, and response specialist at scenes involving chemical fires, water reactive materials, and shock sensitive materials. He has provided chemical and biological counterterrorism training to members of hazardous materials (HazMat) teams, police Special Weapons and Tactics (SWAT) teams, and Explosive Ordinance Disposal (EOD) teams.

Mr. Ellison has a master of science degree in chemistry from the University of California, Irvine. His graduate research involved methods to synthesize poisons extracted from Colombian poison-dart frogs. He has a bachelor of science in chemistry from the Georgia Institute of Technology. Mr. Ellison has received specialized training from the U.S. Drug Enforcement Administration in operations involving clandestine drug laboratories. He is a graduate of the Radiation Safety course taught at Northwestern University. Mr. Ellison is a Certified Hazardous Materials Manager at the master's level. He is a member of the American Chemical Society and Federation of American Scientists. He is also a member of the Michigan Workgroup on Counterterrorism and a founding member of the Wayne County Emergency Management Division Technical Assistance Team for Weapons of Mass Destruction.

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I would also like to thank the following individuals for their reviews, suggestions, and encouragement. Bob Ceru is the Chemical Safety Officer of the Michigan State University Office of Radiological, Chemical, and Biological Safety. Mark Sparks is the Director of Wayne County Office of Emergency Management and head of the Wayne County Weapons of Mass Destruction Technical Support Team. Brendan Boyle is a Health Assessment Coordinator for the Michigan Department of Public Health.

And finally, I would like to thank my children, Sean and Sarah, for their patience and understanding as I worked on this project.

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## *Introduction*

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Chemical agents are solids, liquids, or gases, which, through their chemical properties, produce lethal or damaging effects in man, animals, plants, or materials. Historically, chemical agents have been divided into categories based on the major physiological impact caused by the agent or the target organ they attack. Nerve agents disrupt the function of the nervous system and produce effects on skeletal muscles, various sensitive organs, and the nervous system. Blister agents, also known as vesicants, affect the eyes, lungs and skin by destroying cell tissue. Blood agents are compounds which affect the ability of the blood system to either carry oxygen or transfer oxygen from the blood to cells. Choking agents are compounds that can cause the lungs to become filled with fluid. Incapacitating agents produce physiological effects that inhibit concerted effort. Tear agents cause intense eye pain and tears. Vomiting agents cause regurgitation.

While useful on the battlefield, this classification system may be misleading to civilian responders. Within a given agent class the reactivity, decomposition, and environmental fate of agents can vary greatly. Also, the health effect selected to describe the agent class may not be the only effect manifested in casualties. For example, chloropicrin is currently classified by the United States military as a tear agent because it causes severe lacrimation. However, inhalation of agent vapors also causes vomiting (vomiting agents) and pulmonary edema (choking agents). Contact with the liquid will blister the skin (blister agents). Further, military classifications of agents can also change with time. Hydrogen cyanide, for example, was at one time classified as a nerve agent.

Literally thousands of chemicals widely used in industry have been evaluated by various militaries for their possible use as chemical warfare agents and many have even been employed in combat. However, with the discovery of the more toxic nerve and blister agents, the use of most of these materials has been abandoned. Despite the lack of military use, these materials are still highly toxic and are significantly more easily obtained than military class agents. For someone interested in causing a deliberate release, this may prove to be the deciding factor in choosing what type of agent to release. Many of these “agents” are included in this book.

Biological agents may be any type of organism that can cause disease in man, animals, or plants. There are also some biological agents that could be used to promote the deterioration of key materials. Biological agents are divided into categories based on the type of pathogen involved. Usually these are bacteria, viruses, or fungi, but may also include plasmodia, prions, or even insects. In addition, biological agents may also be categorized by

their ability to produce lethal or non-lethal diseases. Incapacitating pathogens are those that can cause diseases that are expected to produce a low mortality rate of less than two percent for individuals who do not receive medical attention. Individuals exposed to incapacitating biological agents are therefore expected to fully recover without medical assistance.

Biological agents have some unique characteristics among weapons of mass destruction. Biological agents can multiply in the environment and the amount of agent can increase with time. Biological agents are also the only group in which secondary person-to-person transmission can occur. In addition, unlike many chemical agents and toxins, there is always an asymptomatic latent period due to incubation of the pathogen in the body. These latency periods range from hours up to several weeks.

Toxins are poisonous chemicals produced by any one of many different types of living organisms. Possible sources of toxins include bacteria, plants, molds, fungi, insects, and reptiles. There are even examples of birds and mammals that produce toxins. Bacteria produce the most lethal toxins. Most toxins of potential use by the military or terrorists are classified as either neurotoxins or cytotoxins. Neurotoxins inhibit the functioning of the nervous system but may do so in a fashion quite different than chemical nerve agents. Cytotoxins function by killing individual cells in the body or by inhibiting various cellular functions. Because they are produced by living creatures, toxins are often classified as biological agents. However, because of advances in chemistry, it is now possible to make synthetic toxins that are indistinguishable from their natural counterparts. This leads to some confusion as to whether the toxin is a biological agent or not. The United States classifies all toxins as biological agents, whether the toxin was produced by an organism or synthesized in a laboratory. Other countries do not utilize this definition and may classify synthetic toxins as chemical weapons. Toxins will be addressed as an independent category in this book.

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## *Organization of this Book*

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This book is formatted into a series of indices that were developed to facilitate rapid access to key information on chemical, biological, and toxin agents. Each index is cross-referenced to all others in order to allow easy crossover between individual entries.

In order to assist in identification of agents and agent precursors, an Alphabetical Index, Section I, containing a list of synonyms of agent names was compiled. While every effort has been made to make this list as comprehensive as possible, it is by no means exhaustive. In addition to military names and the U.S. military identification codes, this index contains scientific names, common names, and some foreign names. In some instances, names have been included that were popularized in the literature but have no real historical connection to the agent. This was done in order to provide the greatest possible catalog of aliases.

An Agent Index, Section II, was developed that contains information on the chemical, biological, and toxicological properties of agents. There is a section within the Agent Index for each major class of agent. These classes are nerve agents, vesicants (blister agents), blood agents, choking agents, incapacitating agents, tear agents, vomiting agents, industrial "agents," precursors and dual-threat chemicals, toxins, and pathogens. Individual agents within each index are listed alphabetically to facilitate rapid screening of the member of that particular class of agents.

The Class Indices, Section III, contain general information about agent classes and are similar to the response guides in the North American Emergency Response Guidebook. Although the general military classification system was maintained when developing these indices, variations within each class were noted with a different index. For example, there are six nerve agent indices as well as five vesicant indices. In addition, although they were not designed to deal with the unusual complications associated with a deliberate release situation, Section IV contains a compilation of applicable *North American Emergency Response Guidebook* guides.

All materials listed as agents in this book have been used on the battlefield, stockpiled by various countries, received significant interest by research programs evaluating potential agents, or used/threatened to be used by terrorists. While this book covers many of the major classes of chemical, biological, and toxin agents, there are some groups that were not covered. These include chemicals used as simulants for warfare agents, chemical anti-plant agents, chemical/biological anti-material agents, bioregulators/modulators, incendiary agents, and decontamination/disinfection agents.

The details contained in this book represent the best information currently available in sources accessible to the public. All physical, chemical, and biological data listed in the Agent Index has been cross-checked whenever possible. Where appropriate, data is reported in units that are most widely used by civilian responders. All information contained in each Class Index is a compilation of information gathered from numerous sources and arranged into the current format. In general, the most conservative recommendations have been incorporated into each index. As with all hazardous materials and safety information, readers are encouraged to evaluate as many sources as they can find in order to make the most informed decisions. Any use of the information contained in this book must be determined by the user to be in accordance with their standard operating procedures as well as applicable federal, state, and local laws and regulations.

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# *Contents*

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## **Section I    Alphabetical Index**

1.    Alphabetical Index

## **Section II    Agent Index**

2.    Agent Index
  - Nerve Agents
  - Vesicants
  - Blood Agents
  - Choking Agents
  - Incapacitating Agents
  - Tear Agents
  - Vomiting Agents
  - Industrial “Agents”
  - Precursors and Dual-Threat Chemicals
  - Toxins
  - Pathogens

## **Section III    Class Indices**

3.    Class Indices
  - C00 – Unknown Agent(s)
  - C01 – Nerve Agents – “G” Series
  - C02 – Nerve Agents – “V” Series
  - C03 – Nerve Agents – “GV” Series
  - C04 – Nerve Agents – Novichok
  - C05 – Nerve Agents – Binary and Components
  - C06 – Nerve Agents – Carbamate
  - C07 – Vesicants – Sulfur Based
  - C08 – Vesicants – Arsenic Based
  - C09 – Vesicants – Nitrogen Based
  - C10 – Vesicants – Mixture of Sulfur and Arsenic
  - C11 – Urticants
  - C12 – Blood Agents – General
  - C13 – Blood Agents – Arsenic Based
  - C14 – Choking Agents

C15 – Choking Agents – Metal Fume  
C16 – Incapacitating Agents  
C17 – Tear Agents – Halogenated  
C18 – Tear Agents – Non-Halogenated  
C19 – Tear Agents – In Solvents  
C20 – Vomiting Agents  
C21 – Corrosive Smoke  
C22 – Toxins  
C23 – Toxins – Dermal Hazardous  
C24 – Pathogens – Anti-Personnel  
C25 – Pathogens – Anti-Personnel/Vector  
C26 – Pathogens – Anti-Personnel/Ingestion  
C27 – Pathogens – Anti-Animal  
C28 – Pathogens – Anti-Plant  
C29 – Pathogens – Used as Simulants

## Section IV NAERG Guides

4. NAERG Guides
  - Guide 117 – Gases: Toxic/Flammable (Extreme Hazard)
  - Guide 118 – Gases: Flammable/Corrosive
  - Guide 119 – Gases: Toxic/Flammable
  - Guide 123 – Gases: Toxic and/or Corrosive
  - Guide 124 – Gases: Toxic and/or Corrosive/Oxidizing
  - Guide 125 – Gases: Corrosive
  - Guide 127 – Flammable Liquids (Polar/Water Miscible)
  - Guide 128 – Flammable Liquids  
(Non-Polar/Water Immiscible)
  - Guide 129 – Flammable Liquids  
(Polar/Water Miscible/Noxious)
  - Guide 131 – Flammable Liquids–Toxic
  - Guide 132 – Flammable Liquids–Corrosive
  - Guide 133 – Flammable Solids
  - Guide 135 – Substances: Spontaneously Combustible
  - Guide 136 – Substances: Spontaneously  
Combustible/Toxic (Air Reactive)
  - Guide 137 – Substances: Water-Reactive/Corrosive
  - Guide 139 – Substances: Water-Reactive  
(Emitting Flammable and Toxic Gases)
  - Guide 144 – Oxidizers (Water-Reactive)
  - Guide 151 – Substances: Toxic (Non-Combustible)
  - Guide 152 – Substances: Toxic (Combustible)
  - Guide 153 – Substances: Toxic and/or  
Corrosive (Combustible)

- Guide 154 – Substances: Toxic and/or Corrosive  
(Non-Combustible)
- Guide 155 – Substances: Toxic and/or Corrosive  
(Flammable/Water-Reactive)
- Guide 156 – Substances: Toxic and/or Corrosive  
(Combustible/Water-Sensitive)
- Guide 157 – Substances: Toxic and/or Corrosive  
(Non-Combustible/Water-Sensitive)
- Guide 158 – Infectious Substances
- Guide 159 – Substances (Irritating)
- Guide 160 – Halogenated Solvents
- Guide 171 – Substances (Low To Moderate Hazard)

## **Section V    General Section**

- 5.    Agent Detector Characteristics
- 6.    Personal Protective Equipment
- 7.    Sample Collection of Contaminated Materials
- 8.    Summary of U.S. Military Chemical Munition Markings
- 9.    International and Domestic U.S. Lists of Agents

Glossary

References

**Section I**

**Alphabetical Index**

# 1

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## *Alphabetical Index*

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Each synonym in this index is cross-referenced to detailed information in the Agent Index in Chapter 2 through use of the Agent Index Number (#). In the Agent Index, the Agent Index number is located in the upper left corner of each entry. These numbers proceed sequentially through the entire Agent Index. Synonyms for which detailed information is not available in the Agent Index have a “—” in the Agent Index number column.

Each synonym in this index is also cross-referenced to both the Class Indices, Chapter 3, and appropriate guides from the *North American Emergency Response Guidebook* (NAERG), Chapter 4. “Industrial” designations in the class index column mean that a Class Index for that material has not been developed because it is a common, commercially available chemical. “Precursor” designations in the class index column mean that a Class Index for that material has not been developed because it is primarily used to manufacture other agents. NAERG numbers are taken from the 1996 *North American Emergency Response Guidebook*. As in the *Guidebook*, the letter “P” following the numeric guide designation indicates that the material may pose a significant hazard from violent polymerization. A designation of “None” in the NAERG column means that the material is not regulated in North America as a hazardous material and an NAERG guide is not available. Synonyms for which a specific guide is not available have a “—” in the NAERG column.

Agent	Agent Index #	Class Index #	NAERG
ВНОВЬ ПРИБЫВШИЙ (Russian spelling of Novichok)	—	C04	153
ВЯЗКИЙ VX (Russian for thickened VX)	A011	C02	153
ВЯЗКИЙ ЗОМАН (Russian for thickened soman)	A006	C01	153
ВЯЗКИЙ ИППРИТА (Russian for thickened mustard)	A018	C07	153
ВЯЗКИЙ ЛЮИЗИТ (Russian for thickened lewisite)	A015	C08	153
ЗАРИН (Russian for sarin)	A004	C01	153
ЗОМАН (Russian for soman)	A005	C01	153
ИППРИТА (Russian for mustard)	A017	C07	153

Agent	Agent Index #	Class Index #	NAERG
ЛЮИЗИТ (Russian for lewisite)	A014	C08	153
СМЕСЬ ИПРИТА С ЛЮИЗИТОМ (Russian for a mustard/lewisite mixture)	—	C10	153
$\alpha$ -Bromo- $\alpha$ -tolunitrile	A059	C17	159
$\alpha$ -Bromobenzyl Cyanide	A059	C17	159
$\alpha$ -Bromobenzyl nitrile	A059	C17	159
$\alpha$ -Bromophenylacetonitrile	A059	C17	159
$\alpha$ -Bromotoluene	—	C17	156
$\alpha$ -Chloroacetophenone	A064	C17	153
$\alpha$ -Chloro-4-nitrotoluene	—	C17	—
$\alpha$ -Chlorotoluene	A058	C17	156
$\alpha$ -Chlortoluol	A058	C17	156
$\alpha$ -Conotoxin	A277	C22	153
$\alpha$ -Conotoxin SI	A277	C22	153
$\alpha$ -Lewisit	A014	C08	153
$\alpha$ -Nitrobenzyl Chloride	—	C17	—
$\alpha$ -Tolyl Chloride	A058	C17	156
$\beta$ -Bgt	A275	C22	153
$\beta$ -Bungarotoxin	A275	C22	153
$\beta$ -BuTx	A275	C22	153
$\beta$ -Bis(hydroxyethyl) Sulfide	A264	Precursor	None
$\beta$ -Chloroethanol	A211	Precursor	131
$\beta$ -Chloroethyl Alcohol	A211	Precursor	131
$\beta$ -Chlorovinyl dichloroarsine	A014	C08	153
$\beta$ -Cocain	—	C16	154
$\beta$ -Cocaine	—	C16	154
$\beta$ -Dichloroethane	A140	Industrial	129
$\beta$ -(Diethylamino)ethanol	A213	Precursor	132
$\beta$ -Diethylaminoethanol	A213	Precursor	132
$\beta$ -(Diethylamino)ethyl Alcohol	A213	Precursor	132
$\beta$ -Diethylaminoethyl Alcohol	A213	Precursor	132
$\beta$ -Diisopropylaminoethyl Chloride	A210	Precursor	154
$\beta$ -Hydroxyethyl Chloride	A211	Precursor	131
$\beta$ -Hydroxyethyl Sulfide	A264	Precursor	None
$\beta$ -Hydroxytriethylamine	A213	Precursor	132
$\beta$ -Lewisit	—	C08	153
$\beta$ Methylal Chloride	A134	Industrial	129P
( $\beta$ -Methoxyethyl)mercuric Chloride	A155	Industrial	151
$\beta$ -Methoxyethylmercury Chloride	A155	Industrial	151
$\beta$ -Methyl Acrolein	A091	Industrial	131P
$\beta$ -Methylacrolein	A091	Industrial	131P
$\beta$ -Methylalyl Chloride	A134	Industrial	129P
$\beta$ -Quinuclidinyl Benzilate	A055	C16	154
$\beta$ -Thiodiglycol	A264	Precursor	None
$\gamma$ -Aminopyridine	A157	Industrial	153
$\gamma$ -Chloroethanol	A211	Precursor	131
$\gamma$ -Chloroisobutylene	A134	Industrial	129P
$\gamma$ -Lewisit	—	C08	153
$\Delta$ -Chloroethanol	A211	Precursor	131
$\Delta$ -9 Tetrahydrocannabinol	—	C16	154
$\Delta$ -1 THC	—	C16	154

Agent	Agent Index #	Class Index #	NAERG
$\Delta$ -9 THC	—	C16	154
$\omega$ -Bromotoluene	—	C17	156
$\omega$ -Chloroacetophenone	A064	C17	153
$\omega$ -Chlorotoluene	A058	C17	156
$\omega$ -Salz	A064	C17	153
$\omega,\omega'$ -Dihydroxyethyl Sulfide	A264	Precursor	None
$\alpha,\alpha'$ -Dichlorodimethyl Ether	A034	C14	153
$\alpha,\beta$ -Dibromoethane	A139	Industrial	154
$\alpha,\beta$ -Dichloroethane	A140	Industrial	129
$\alpha,\beta$ -Oxidoethane	A141	Industrial	119
$\beta,\beta$ -Dichlor-ethyl-sulphide	A017	C07	153
$\beta,\beta$ -Dichlorodiethyl Ether	A084	Industrial	152
$\beta,\beta'$ -Dichlorodiethyl Sulfide	A017	C07	153
$\beta,\beta'$ -Dichlorodiethyl-N-methylamine	A020	C09	153
$\beta,\beta'$ -Dichloroethyl Ether	A084	Industrial	152
$\beta,\beta'$ -Dichloroethyl Sulfide	A017	C07	153
$\beta,\beta'$ -Dichloroethyl Sulphide	A017	C07	153
$\beta,\beta$ -Dicyano-o-chlorostyrene	A060	C17	159
$\beta,\beta'$ -Dihydroxydiethyl Sulfide	A264	Precursor	None
$\beta,\beta'$ -Dihydroxyethyl Sulfide	A264	Precursor	None
1080	A159	Industrial	151
62737	A137	Industrial	152
1066508	A232	Precursor	154
1619347	A254	Precursor	154
7704349	A259	Precursor	133
1-alpha-H,5-alpha-H-Tropane-2-beta-carboxylic Acid, 3-beta-Hydroxy-, Methyl Ester, Benzoate	—	C16	154
1-alpha-H,5-alpha-H-Tropane-2-beta-Carboxylic Acid, 3-beta-Hydroxy-, Methyl Ester, Benzoate (Ester)	—	C16	154
1-Azabicyclo[2.2.2]octan-3-ol	A254	Precursor	154
1-Azobicyclo[2.2.2]octan-3-ol, Benzilate (Ester)	A055	C16	154
1-Bromo-1-tolunitrile	A059	C17	159
1-Bromo-2-butanone	—	C17	—
1-Chloro-2-( $\beta$ -chloroethoxy)ethane	A084	Industrial	152
1-Chloro-2( $\beta$ -chloroethylthio)ethane	A017	C07	153
1-Chloro-2-(beta-chloroethoxy)ethane	A084	Industrial	152
1-Chloro-2(beta-Chloroethylthio)ethane	A017	C07	153
1-Chloro-2,3-dibromopropane	A132	Industrial	159
1-Chloro-2-methyl-2-propene	A134	Industrial	129P
1-Chloroacetophenone	A064	C17	153
1-Cocaine	—	C16	154
1 $\alpha$ H,5 $\alpha$ H-Tropane-2 $\beta$ -carboxylic Acid, 3 $\beta$ -Hydroxy-, Methyl Ester, Benzoate	—	C16	154
1 $\alpha$ H,5 $\alpha$ H-Tropane-2 $\beta$ -carboxylic Acid, 3 $\beta$ -Hydroxy-, Methyl Ester, Benzoate (Ester)	—	C16	154
1-Iodo-2-propanone	—	C17	—
1-Isopropyl-3-methyl-5-pyrazolyl Dimethylcarbamate	A127	Industrial	151
1-Methoxycarbonyl-1-propen-2-yl Dimethyl Phosphate	A190	Industrial	152
1-Methoxy-1,3,5-cycloheptatriene	A068	C18	159

Agent	Agent Index #	Class Index #	NAERG
1-Methyl-3-hydroxypiperidine	A234	Precursor	129
1-Methyl-3-piperidinol	A234	Precursor	129
1-Methyl-4-piperidyl Cyclobutylphenylglycolate	—	C16	154
1-Methyl-4-piperidyl Cyclobutylphenylglycolate Hydrochloride	—	C16	154
1-Methyl-4-piperidyl Cyclopentyl-1-propynylglycolate	—	C16	154
1-Methyl-4-piperidyl Isopropylphenylglycolate	—	C16	154
1-Methyl-4-piperidyl Isopropylphenylglycolate Hydrochloride	—	C16	154
1-Methylethyl Alcohol	A235	Precursor	129
1-Methylethylamine	A237	Precursor	132
1-(Methylethyl)-ethyl-3-methyl-4-(methylthio)phenylphosphoramidate	A179	Industrial	152
1-Methylethyl 2-[[Ethoxy[(1-methylethyl)amino]phosphinothioyl]oxy]benzoate	A184	Industrial	152
(1-Methylethyl)phosphoramidic Acid Ethyl 3-Methyl-4-(methylthio)phenyl Ester	A179	Industrial	152
1-Propen-3-ol	A082	Industrial	131
1-Propene-3-ol	A082	Industrial	131
1-Propenol-3	A082	Industrial	131
([+]-2-Acetyl-9-azabicyclo[4.2.1]non-2-ene)	A271	C22	153
2-Amino-propaan	A237	Precursor	132
2-Aminopropan	A237	Precursor	132
2-Aminopropane	A237	Precursor	132
2-Amino-propano	A237	Precursor	132
2 beta-Carbomethoxy-3beta-benzoxytropane	—	C16	154
2 beta-Tropanecarboxylic Acid, 3 beta-Hydroxy-, Methyl Ester, Benzoate	—	C16	154
2-(Bis(1-methylethyl)amino)ethanethiol	A219	Precursor	132
2-Bromo-2-chloro-1,1,1-trifluoroethane	—	C16	154
2-Butenal	A091	Industrial	131P
2β-Carbomethoxy-3β-benzoxytropane	—	C16	154
2-Carbomethoxy-1-methylvinyl Dimethyl Phosphate	A190	Industrial	152
2-Chloorethanol	A211	Precursor	131
2-Chloraethanol	A211	Precursor	131
2-Chlorethanol	A211	Precursor	131
2-Chloroacetophenone	A064	C17	153
2-Chlorobenzalmononitrile	A060	C17	159
2-Chlorobenzylidene Malonitrile	A060	C17	159
2-Chloro BMN	A060	C17	159
2-Chloro-2-diethylcarbamoyl-1-methylvinyl Dimethyl Phosphate	A195	Industrial	152
2-Chloro-1-ethanol	A211	Precursor	131
2-Chloroethanol	A211	Precursor	131
2-Chloroethenylarsonous Dichloride	A014	C08	153
2-Chloroethyl Alcohol	A211	Precursor	131
2-Chloroethyl Ether	A084	Industrial	152
2-Chloroethylchloromethylsulfide	—	C07	153
(2-Chloroethynyl)arsonous Dichloride	A014	C08	153
2-Chloro-1-hydroxyethane	A211	Precursor	131

Agent	Agent Index #	Class Index #	NAERG
2-Chloro-N-(2-chloroethyl)-N-ethylethanamine	A019	C09	153
2-Chloro-N-(2-chloroethyl)-N-methylethanamine, Hydrochloride	A020	C09	153
2-Chloro-N,N-bis(2-chloroethyl)ethanamine	A021	C09	153
2-Chloro-N,N-diisopropylethylamine	A210	Precursor	154
2-Chloro-N,N-diisopropylethylamine Hydrochloride	A210	Precursor	154
2-Chloro-1-phenylethanone	A064	C17	153
((2-Chloro-phenyl)methylene)propanenitrile	A060	C17	159
2-Chlorovinyl-dichloroarsine	A014	C08	153
2-Chloroethanol	A211	Precursor	131
2-(Diethoxyphosphinylimino)-1,3-dithietane	A183	Industrial	152
2-(Diethoxyphosphinylimino)-1,3-dithiolane	A194	Industrial	152
2-(Diethylamino)ethanol	A213	Precursor	132
2-Diethylaminoethanol	A213	Precursor	132
2-(Diethylamino)ethyl Alcohol	A213	Precursor	132
2-Diethylaminoethyl Alcohol	A213	Precursor	132
(2-Diethylamino)ethylphosphorothioic Acid O,O-Diethyl Ester	—	C02	153
2-(Diisopropylamino)ethanethiol	A219	Precursor	132
2-(Diisopropylamino)ethanol	A220	Precursor	132
2-Diisopropylaminoethanol	A220	Precursor	132
2-Diisopropylaminoethyl Chloride	A210	Precursor	154
2-Diisopropylaminoethyl Chloride Hydrochloride	A210	Precursor	154
2-Dimethylaminoethyl N,N-Dimethylphosphoramidofluoridate Methiodide	—	C03	153
2-Dimethylaminoethyl N,N-Dimethylphosphoramidofluoridate	A002	C03	153
2-Dimethylamino-1-(methylthio)glyoxal O-Methylcarbamoylmonoxime	A130	Industrial	151
2-(Dimethylamino)-N-[[[(methylamino)carbonyl]oxy]-2-oxoethanimidothioic Acid Methyl Ester	A130	Industrial	151
2-Dimethylcarbamoyl-3-methyl-5-pyrazolyl Dimethylcarbamate	A125	Industrial	151
2-[[Ethoxy[(1-methylethyl)amino]phosphinothioyl]oxy]bezoic Acid 1-Methylethyl Ester	A184	Industrial	152
2-Hydroxy-2,2-diphenylethanoic Acid	A209	Precursor	154
2-Hydroxyethyl Chloride	A211	Precursor	131
(2-Hydroxyethyl)diethylamine	A213	Precursor	132
2-Hydroxyethyl Sulfide	A264	Precursor	None
2-Hydroxypropane	A235	Precursor	129
2-Hydroxytriethylamine	A213	Precursor	132
2-Methoxy-6-N-pentyl-4-benzoquinone	A127	Industrial	151
2-Methoxy-6-pentylbenzoquinone	A127	Industrial	151
2-Methoxyethylmercuric Chloride	A155	Industrial	151
2-Methoxyethylmercury Chloride	A155	Industrial	151
2-Methylallyl Chloride	A134	Industrial	129P

Agent	Agent Index #	Class Index #	NAERG
2-Methyl-allylchlorid	A134	Industrial	129P
2-(Methylamino)-2-(2-chlorophenyl)-cyclohexanone	—	C16	154
2-Methylcyclohexyl Methylphosphonofluoridate	—	C01	153
2-Methyl-2-(methylthio)propanal O-[(Methylamino)carbonyl]oxime	A120	Industrial	151
2-Methyl-2-(methylthio)propionaldehyde O-(Methylcarbamoyl)oxime	A120	Industrial	151
2-Methyl-2-(methylthio) propionaldehyde O-(Methylcarbamoyl) Oxime	A120	Industrial	151
2-Methyl-2-propenyl Chloride	A134	Industrial	129P
2-Monochloroethanol	A211	Precursor	131
2-N-(Diethylamino)ethanol	A213	Precursor	132
2-N-Diethylaminoethanol	A213	Precursor	132
2-(N-Ethyl-N-2-hydroxyethylamino)ethanol	A229	Precursor	None
2-(N-2-Hydroxyethyl-N-methylamino)ethanol	A239	Precursor	None
2-Nitrobenzyl Chloride	—	C17	—
2-(N,N-Diethylamino)ethanol	A213	Precursor	132
2-Propanamine	A237	Precursor	132
2-Propanamine, N-(1-Methylethyl)-	A218	Precursor	132
2-Propanamine, N-(2-chloroethyl)-N-(1-methylethyl)-, Hydrochloride	A210	Precursor	154
2-Propanol	A235	Precursor	129
2-Propanone, 1-Iodo	—	C17	—
2-Propen-1-ol	A082	Industrial	131
2-Propen-1-one	A056	C18	131P
2-Propenal	A056	C18	131P
2-Propene-1-ol	A082	Industrial	131
2-Propenenitrile	A081	Industrial	131P
2-Propenol	A082	Industrial	131
2-Propenyl Alcohol	A082	Industrial	131
2-Propyl Alcohol	A235	Precursor	129
2-Propylamine	A237	Precursor	132
2 Red Star	—	C12	—
2-Thio-3,5-dimethyl-tetrahydro-1,3,5-thiadiazine	A135	Industrial	171
2-(Trifluoromethyl)-10-[3-[1-(β-hydroxyethyl)-4-piperazinyl]propyl]phenothiazine	—	C16	154
2-(Trifluoromethyl)-10-[3-[1-(beta-hydroxyethyl)-4-piperazinyl]propyl]phenothiazine	—	C16	154
2β-Tropanecarboxylic Acid, 3β-Hydroxy-, Methyl Ester, Benzoate	—	C16	154
2β-Tropanecarboxylic Acid, 3β-Hydroxy-, Methyl Ester, Benzoate (Ester)	—	C16	154
3-beta-Hydroxy-2-beta-tropanecarboxylic Acid Methyl Ester, Benzoate	—	C16	154
3-Chlor-2-methyl-prop-1-en	A134	Industrial	129P
3-Chloro-1,2-dibromopropane	A132	Industrial	159
3-Chloro-2-methyl-1-propene	A134	Industrial	129P
3-Chloro-2-methylprop-1-ene	A134	Industrial	129P
3-Chloro-2-methylpropene	A134	Industrial	129P
3-Chloro-2-methylpropene-1	A134	Industrial	129P

Agent	Agent Index #	Class Index #	NAERG
3-Chloro-4-methyl-7-coumarinyl Diethyl Phosphorothioate	A167	Industrial	152
3-Chloro-4-methyl-7-hydroxycoumarin Diethyl Thiophosphoric Acid Ester	A167	Industrial	152
3-Chloro-7-hydroxy-4-methyl-coumarin O,O-Diethyl Phosphorothioate	A167	Industrial	152
3-Chloroisobutene	A134	Industrial	129P
3-Chloroisobutylene	A134	Industrial	129P
3-Chloro-2-metil-prop-1-ene	A134	Industrial	129P
3-Dimethylamionpropyl N,N-Dimethyl-phosphoramidofluoridate	A003	C03	153
3-[(Dimethoxyphosphinyloxy)-2-butenic Acid Methyl Ester	A190	Industrial	152
3-(Dimethoxyphosphinyloxy)-N,N-dimethyl-cis-crotonamide	A171	Industrial	152
3-(Dimethoxyphosphinyloxy)-N-methyl-cis-crotonamide	A192	Industrial	152
3-Hydroxy-1-azabicyclo[2.2.2]octane	A254	Precursor	154
3-Hydroxycrotonic Acid Methyl Ester Dimethyl Phosphate	A190	Industrial	152
3-Hydroxyglutaconic Acid Dimethyl Ester Dimethyl Phosphate	A161	Industrial	152
3-Hydroxy-1-methylpiperidine	A234	Precursor	129
3-Hydroxy-N-methylpiperidine	A234	Precursor	129
3-Hydroxy-2-pentenedioic Acid Dimethyl Ester Dimethyl Phosphate	A161	Industrial	152
3 $\beta$ -Hydroxy-2 $\beta$ -tropanecarboxylic Acid Methyl Ester, Benzoate	—	C16	154
3-Hydroxypropene	A082	Industrial	131
3-Hydroxyquinuclidine	A254	Precursor	154
3-Hydroxyquinuclidine Benzilate	A055	C16	154
3-(Mercaptomethyl)-1,2,3-benzotriazin-4(3H)-one O,O-Dimethyl Phosphorodithioate	A160	Industrial	152
3-(Mercaptomethyl)-1,2,3-benzotriazin-4(3H)-one O,O-Dimethyl Phosphorodithioate S-Ester	A160	Industrial	152
3-Methyl-4-(dimethylamino)phenyl Methylcarbamate	A121	Industrial	151
3-Methyl-4-[(1-oxopropyl)phenylamino]-1-(2-phenylethyl)-4-piperidinecarboxylic Acid Methyl Ester	—	C16	154
3-Oxyquinuclidine Benzilate	A055	C16	154
3-Quinuclidinol	A254	Precursor	154
3-Quinuclidinyl Benzilate	A055	C16	154
3-Quinuclidinyl Cyclopentylphenylglycolate	—	C16	154
3-Quinuclidyl N,N-Dimethylphosphoramidofluoridate	—	C03	153
3-Tropanylbenzoate-2-carboxylic Acid Methyl Ester	—	C16	154
4 AP	A157	Industrial	153
4-Aminopyridine	A157	Industrial	153
(4 $\beta$ , 15-Diacetoxy-3 $\alpha$ -hydroxy-8 $\alpha$ -[3-methylbutyryloxy]-12,13-epoxytrichothec-9-ene	A287	C23	153

Agent	Agent Index #	Class Index #	NAERG
4-Bromophenylacetonitrile	A059	C17	159
(4β, 15-Diacetoxy-3α-hydroxy-8α-[3-methylbutyryloxy]-12,13-epoxytrichothec-9-ene	A287	C23	153
4-Dimethylamine m-Cresyl Methylcarbamate	A121	Industrial	151
4-Dimethylamine meta-Cresyl Methylcarbamate	A121	Industrial	151
4-(Dimethylamino)-3-cresyl Methylcarbamate	A121	Industrial	151
4-Dimethylamino-3-cresyl Methylcarbamate	A121	Industrial	151
4-(Dimethylamino)-meta-tolyl Methylcarbamate	A121	Industrial	151
4-Dimethylamino-meta-tolyl Methylcarbamate	A121	Industrial	151
4-(Dimethylamino)-meta-tolylmethylcarbamate	A121	Industrial	151
4-(Dimethylamino)-3-methylphenol Methyl Carbamate	A121	Industrial	151
4-(Dimethylamino)-3-methylphenol Methylcarbamate (Ester)	A121	Industrial	151
4-(Dimethylamino)-3-methylphenyl Methylcarbamate	A121	Industrial	151
4-Dimethylamino-3-methylphenyl Methylcarbamate	A121	Industrial	151
(4-Dimethylamino-3-methyl-phenyl)N-methyl-carbamaat	A121	Industrial	151
(4-Dimethylamino-3-methyl-phenyl)N-methyl-carbamate	A121	Industrial	151
(4-Dimethylamino-3-methyl-phenyl)N-methyl-carbamate	A121	Industrial	151
4-(Dimethylamino)-3-tolyl Methylcarbamate	A121	Industrial	151
4-Dimethylamino-m-tolyl Methylcarbamate	A121	Industrial	151
4-(Dimethylamino)-m-tolyl Methylcarbamate	A121	Industrial	151
4-(Dimethylamino)-m-tolylmethylcarbamate	A121	Industrial	151
(4-Dimethylamino-3-metil-fenil)-N-metil-carbammato	A121	Industrial	151
(4-Methyl-1,3-dithiolan-2-ylidene)phosphoramidic Acid Diethyl Ester	A186	Industrial	152
4-Methyl-meta-phenylene Diisocyanate	A206	Industrial	156
4-Methyl-meta-phenylene Isocyanate	A206	Industrial	156
4-Methyl-m-phenylene Diisocyanate	A206	Industrial	156
4-Methyl-m-phenylene Isocyanate	A206	Industrial	156
4-Methyl-phenylene Diisocyanate	A206	Industrial	156
4-Methyl-phenylene Isocyanate	A206	Industrial	156
4-Methylthio-3,5-dimethylphenyl N-Methylcarbamate	A128	Industrial	151
4-(Methylthio)-3,5-xylyl Methylcarbamate	A128	Industrial	151
4-Phosphoryl-oxy-N-N-dimethyl-tryptamine	—	C16	154
4-Pyridylamine	A157	Industrial	153
(4R-(4α,4α α, 5α,7α,9α,10α,10a β, 11S*, 12S*))-Octahydro-12-(hydroxymethyl)-2-imino-5,9:7,10a-dimethano-10ah-(1,3)dioxocino(6,5-d)Pyrimidine-4,7,10,11,12-pentol	A289	C22	153
(4R-(4α,4α alpha, 5alpha,7alpha,9alpha,10alpha,10a beta, 11S*, 12S*))Octahydro-12-(hydroxymethyl)-2-imino-5,9:7,10a-dimethano-10ah-(1,3)dioxocino(6,5-d)Pyrimidine-4,7,10,11,12-pentol	A289	C22	153

Agent	Agent Index #	Class Index #	NAERG
5-Chloro-5,10-dihydroarsacridine	—	C20	—
(5R,8R)-(+)-Lysergic Acid-N,N-diethylamide	—	C16	154
6-Nonenamide, N-[(4-Hydroxy-3-methoxyphenyl)methyl]-8-methyl-, (E)-	A070	C18	159
8-Azabicyclo[3.2.1]octane-2-carboxylic acid, 3-(Benzoyloxy)-8-methyl-, Methyl Ester, [1R-(exo,exo)]-	—	C16	154
8UK	—	C29	158
9-Mile Fever	A327	C24	158
9-Ethylcarbazole	—	C18	—
10-Chloro-5,10-dihydrophenarsazine	A073	C20	152
1,1'-Dichlorodimethyl Ether	A034	C14	153
1,1-Dichloro-1-nitroethaan	A131	Industrial	153
1,1-Dichloro-1-nitroethan	A131	Industrial	153
1,1-Dichloro-1-nitroethane	A131	Industrial	153
1,1-Dicloro-1-nitroetano	A131	Industrial	153
1,1-Difluoro-2,2-dichloroethyl Methyl Ether	—	C16	154
1,1'-Oxybis(2-chloro)ethane	A084	Industrial	152
1-(1-Phenylcyclohexyl)piperidine	—	C16	154
1,1'-Thiobis(2-chloroethane)	A017	C07	153
1,2-Bichloroethane	A140	Industrial	129
1,2-Bis(2-chloroethylmercapto) Ethane	A025	C07	153
1,2-Bis(2-chloroethylthio)ethane	A025	C07	153
1,2-Di(chloroethylthio) Ethane	A025	C07	153
1,2-Dibrom-3-chloro-propan	A132	Industrial	159
1,2-Dibromo-3-chloropropane	A132	Industrial	159
(DBCP)-EM	A132	Industrial	159
1,2-Dibromo-3-cloro-propano	A132	Industrial	159
1,2-Dibromoetano	A139	Industrial	154
1,2-Dibromoethane	A139	Industrial	154
1,2-Dibroom-3-chloorpropaan	A132	Industrial	159
1,2-Dibroomethaan	A139	Industrial	154
1,2-Dichloorethaan	A140	Industrial	129
1,2-Dichloro-aethan	A140	Industrial	129
1,2-Dichlorethane	A140	Industrial	129
1,2-Dichloroethane	A140	Industrial	129
1,2-Dicloroetano	A140	Industrial	129
1,2-Epoxyethane	A141	Industrial	119
1,2-Epoxypropane	A144	Industrial	127P
1,2-Ethylene Dibromide	A139	Industrial	154
1,2-Ethylene Dichloride	A140	Industrial	129
1-(2-Hydroxyethyl)-4-[3'-[4''-(β-hydroxyethyl)-1''-piperazinyl]propyl]-3-trifluoromethylphenothiazine	—	C16	154
1-(2-Hydroxyethyl)-4-[3'-[4''-(beta-hydroxyethyl)-1''-piperazinyl]propyl]-3-trifluoromethylphenothiazine	—	C16	154
1,2-Propylene Oxide	A144	Industrial	127P
1,3-Benzodioxole, 2,2-Dimethyl-4-(N-methylaminocarboxylato)-	A122	Industrial	131
1,3-Benzodioxole, 2,2-Dimethyl-4-(N-methylcarbamato)-	A122	Industrial	131

Agent	Agent Index #	Class Index #	NAERG
1,3-Benzodioxol-4-ol, 2,2-Dimethyl-, Methylcarbamate	A122	Industrial	131
1,3-Bis(2-chloroethylthio)-normal-propane	—	C07	153
1,3-Bis(2-chloroethylthio)-n-propane	—	C07	153
1,3-Dithietan-2-ylidenephosphoramidic Acid Diethyl Ester	A183	Industrial	152
1,3-Dithiolan-2-ylidenephosphoramidic Acid Diethyl Ester	A194	Industrial	152
1,4-Bis(2-chloroethylthio)-n-butane	—	C07	153
1,4-Bis(2-chloroethylthio)-normal-butane	—	C07	153
1,4-Dioxan-2,3-diyl-bis(O,O-diaethyl-dithiophosphat)	A173	Industrial	152
1,4-Dioxan-2,3-diyl-bis(O,O-diethyl-ditiofosfato)	A173	Industrial	152
1,4-Dioxan-2,3-diyl-bis(O,O-diethyl-dithiofosfaat)	A173	Industrial	152
1,4-Dioxan-2,3-diyl Bis(O,O-diethyl Phosphorothiolothionate)	A173	Industrial	152
1,4-Dioxan-2,3-diyl Bis(O,O-diethyl Phosphorodithioate)	A173	Industrial	152
1,4-Dioxan-2,3-diyl-bis(O,O-diethyl Phosphorothiolothionate)	A173	Industrial	152
1,4-Dioxan-2,3-diyl O,O,O',O'-Tetraethyl Di(phosphoromithioate)	A173	Industrial	152
1,5-Bis(2-chloroethylthio)-normal-pentane	—	C07	153
1,5-Bis(2-chloroethylthio)-n-pentane	—	C07	153
1,5-Dichloro-3-oxapentane	A084	Industrial	152
1,8-Bis[methyl-2(3-dimethylcarbamoxypyridyl)methylamino] Octane Dimethobromide	—	C06	153
1,10-Bis[methyl-2-(3-dimethylcarbamoxypyridyl)methylamino] Decane Dimethobromide	—	C06	153
2-(2-Chloro-1-methylethoxy)phenyl Methylcarbamate	A124	Industrial	151
2-(2-Chlorophenyl)-2-(methylamino)-cyclohexanone	—	C16	154
(2,2-Dichloor-vinyl)-dimethyl-fosfaat	A137	Industrial	152
(2,2-Dichloor-vinyl)-dimethyl-phosphat	A137	Industrial	152
2,2'-Dichlor-diaethylaether	A084	Industrial	152
2,2'-Dichlorethyl Ether	A084	Industrial	152
2,2-Dichloro-1,1-difluoro-1-methoxyethane	—	C16	154
2,2-Dichloro-1,1-difluoroethyl Methyl Ether	—	C16	154
2,2-Dichlorobinyldimethyl Phosphate	A137	Industrial	152
2,2'-Dichlorodiethyl Ether	A084	Industrial	152
2,2'-Dichlorodiethyl Sulfide	A017	C07	153
2,2'-Dichlorodiethyl Sulphide	A017	C07	153
2,2-Dichloro-diethylether	A084	Industrial	152
2,2-Dichloroethenol Dimethyl Phosphate	A137	Industrial	152
2,2-Dichloroethenyl Dimethyl Phosphate	A137	Industrial	152
2,2-Dichloroethenyl Phosphoric Acid Dimethyl Ester	A137	Industrial	152
2,2'-Dichloroethylether	A084	Industrial	152

Agent	Agent Index #	Class Index #	NAERG
2,(2'-Dichloroethyl)methylamine	A020	C09	153
2,2'-Dichloroethyl Sulfide	A017	C07	153
2,2'-Dichloroethyl Sulphide	A017	C07	153
2,2'-Dichloro-N-methyldiethylamine	A020	C09	153
2,2'-Dichlorotriethylamine	A019	C09	153
(2,2-Dichloro-vinyl)dimetil-fosfate	A137	Industrial	152
(2,2-Dichloro-vinyl)dimetil-fosfato	A137	Industrial	152
2,2-Dichlorovinyl Alcohol Dimethyl Phosphate	A137	Industrial	152
(2,2-Dichlorovinyl)-dimethyl-fosfate	A137	Industrial	152
(2,2-Dichlor-vinyl)-dimethyl-phosphat	A137	Industrial	152
2,2-Dichlorovinyl Dimethyl Phosphate	A137	Industrial	152
2,2-Dichlorovinyl Dimethylphosphate	A137	Industrial	152
2,2-Dichlorovinyl Dimethyl Phosphoric Acid Ester	A137	Industrial	152
2,2-Dichlorovinyl-O,O-dimethyl Phosphate	A137	Industrial	152
2,2'-Dichloroetiletere	A084	Industrial	152
2,2'-Difluorodiethylsulfide	—	C07	153
2,2-Dimethyl-1,3-benzodioxol-4-yl N-Methylcarbamate	A122	Industrial	131
2,2-Dimethyl-1,3-benzodioxol-4-ol Methylcarbamate	A122	Industrial	131
2,2-Dimethyl-1,3-benzodioxol-4-yl Methylcarbamate	A122	Industrial	131
2,2-Dimethyl-2,3-dihydro-7-bezofuranyl-N-methylcarbamate	A123	Industrial	151
2,2-Dimethyl-7-coumaranyl N-Methylcarbamate	A123	Industrial	151
2,2-Dimethylbenzo-1,3-dioxol-4-yl Methylcarbamate	A122	Industrial	131
2,2-Dimethyldichlorovinyl Phosphate	A137	Industrial	152
2,2-Diphenyl-2-hydroxyacetic Acid	A209	Precursor	154
2,2'-(Ethylimino)diethanol	A229	Precursor	None
2,2'-Ethyliminodiethanol	A229	Precursor	None
2,2'-(Methylimino)diethanol	A239	Precursor	None
2,2-(Methylimino)diethanol	A239	Precursor	None
2,2' Methyliminodiethanol	A239	Precursor	None
2,2'-Methyliminodiethanolamine	A239	Precursor	None
2,2'-Thiobis[ethanol]	A264	Precursor	None
2,2'-Thiobisethanol	A264	Precursor	None
2,2'-Thiodiethanol	A264	Precursor	None
2,2-Thiodiethanol	A264	Precursor	None
2,2'-Thiodiglycol	A264	Precursor	None
2,3-Bis(diethoxyphosphinothioylthio)-1,4-dioxane	A173	Industrial	152
2,3-Dihydro-2,2-dimethyl-7-benzofuranol Methylcarbamate	A123	Industrial	151
2,3-Isopropylidene-dioxyphenyl Methylcarbamate	A122	Industrial	131
2,3-para-Dioxandithiol S,S-Bis(O,O-diethyl Phosphorodithioate)	A173	Industrial	152
2,3-para-Dioxane S,S'-Bis(O,O-diethyl Phosphorodithioate)	A173	Industrial	152

Agent	Agent Index #	Class Index #	NAERG
2,3-para-Dioxane S,S-Bis(O,O-diethylphosphorodithioate)	A173	Industrial	152
2,3-para-Dioxane S,S-Bis(O,O-diethylphosphoroithioate)	A173	Industrial	152
2,3-para-Dioxanedithiol S,S-Bis(O,O-diethyl Phosphorodithioate)	A173	Industrial	152
2,3-para-Dioxan-S,S'-bis(O,O-diaethyldithiophosphat)	A173	Industrial	152
2,3-p-Dioxandithiol S,S-Bis(O,O-diethyl Phosphorodithioate)	A173	Industrial	152
2,3-p-Dioxane S,S'-Bis(O,O-diethyl Phosphorodithioate)	A173	Industrial	152
2,3-p-Dioxane S,S-Bis(O,O-diethylphosphorodithioate)	A173	Industrial	152
2,3-p-Dioxane S,S-Bis(O,O-diethylphosphoroithioate)	A173	Industrial	152
2,3-p-Dioxanedithiol S,S-Bis(O,O-diethyl Phosphorodithioate)	A173	Industrial	152
2,3-p-Dioxan-S,S'-bis(O,O-diaethyldithiophosphat)	A173	Industrial	152
2,4-Dichloro- $\alpha$ -(chloromethylene)benzyl Alcohol Diethyl Phosphate	A164	Industrial	152
2,4-Dichloro-alpha-(chloromethylene)benzyl Alcohol Diethyl Phosphate	A164	Industrial	152
2,4-Diisocyanato-1-methylbenzene	A206	Industrial	156
2,4-Diisocyanatotoluene	A206	Industrial	156
2,4-TDI	A206	Industrial	156
2,4 Toluene Diisocyanate	A206	Industrial	156
2,4-Toluenediisocyanate	A206	Industrial	156
2,4-Toluylene Diisocyanate	A206	Industrial	156
2,4-Tolylene Diisocyanate	A206	Industrial	156
2,4-Tolylenediisocyanate	A206	Industrial	156
3-[2-(Dimethylamino)ethyl]-4-phosphoryloxyindole	—	C16	154
3,3-Dimethyl-2-butanol	A250	Precursor	127
3,3-Dimethylbutan-2-ol	A250	Precursor	127
3,3-Dimethylbutane-2-ol	A250	Precursor	127
3,3 Dimethyl-N-but-2-yl Methylphosphonofluridate	A005	C01	153
33SN	A008	C02	153
3,5-Dimethyl-1,3,5-2H-tetrahydrothiadiazine-2-thione	A135	Industrial	171
3,5-Dimethyl-4-(methylthio)phenol Methylcarbamate	A128	Industrial	151
3,5-Dimethyl-4-(methylthio)phenyl Methylcarbamate	A128	Industrial	151
3,5-Dimethylperhydro-1,3,5-thiadiazine-2-thione	A135	Industrial	171
3,5-Dimethyltetrahydro-2H-1,3,5-thiadiazine-2-thione	A135	Industrial	171
3,5-Dimethyltetrahydro-1,3,5-2H-thiadiazine-2-thione	A135	Industrial	171



Agent	Agent Index #	Class Index #	NAERG
A			
A	A064	C17	153
A	A026	C13	119
A-230	—	C04	—
A-232	—	C04	153
A-234	—	C04	153
A 363	A121	Industrial	151
AA	A082	Industrial	131
Aadibroom	A139	Industrial	154
AASTAR	A193	Industrial	152
Abar	A185	Industrial	152
Abattoir Fever	A327	C24	158
Abor	A185	Industrial	152
Abortus Fever	A291	C24	158
Abrin	A269	C22	153
Abrin A	A269	C22	153
Abrin b+c	A269	C22	153
Abrin C	A269	C22	153
AC	A030	C12	117
AC 528	A173	Industrial	152
AC 3422	A177	Industrial	152
AC 47031	A194	Industrial	152
AC 64475	A183	Industrial	152
AC 92100	A199	Industrial	131
(Acetato)phenyl Mercury	A156	Industrial	151
(Acetato-O)(2-methoxyethyl)mercury	A154	Industrial	151
(Acetato-O)methylmercury	A151	Industrial	151
(Acetato-O)phenylmercury	A156	Industrial	151
Acetic acid, Bromo-(phenyl)-, Nitrile	A059	C17	159
Acetic Acid, Bromophenyl-, Nitrile	A059	C17	159
Acetic Acid, Phenylmercury Derivative	A156	Industrial	151
Acetonitrile, Bromophenyl-	A059	C17	159
Acetophenone, 2-Chloro-	A064	C17	153
(Aceto)phenylmercury	A156	Industrial	151
(Acetoxymercuri)benzene	A156	Industrial	151
Acetoxy(2-methoxyethyl)mercury	A154	Industrial	151
Acetoxyphenylmercury	A156	Industrial	151
Acetyl andromedol	A279	C22	153
Acid	—	C16	154
Acid Ammonium Fluoride	A208	Precursor	154
Acid Copper Arsenite	A111	Industrial	151
Acide Bromhydrique	A095	Industrial	125
Acide Chlorhydrique	A096	Industrial	125
Acide Cyanhydrique	A030	C12	117
Acide Fluorhydrique	A097	Industrial	125
Acide Nitrique	A100	Industrial	157
Acide Sulhydrique	A032	C12	117
Acide Sulfurique	A203	Industrial	137
Acide Sulphhydrique	A032	C12	117
Acido Bromhidrico	A095	Industrial	125

Agent	Agent Index #	Class Index #	NAERG
Acido Bromidrico	A095	Industrial	125
Acido Cianidrico	A030	C12	117
Acido Clorhidrico	A096	Industrial	125
Acido Cloridrico	A096	Industrial	125
Acido Fluorhidrico	A097	Industrial	125
Acido Fluoridrico	A097	Industrial	125
Acido Nitrico	A100	Industrial	157
Acido Solforico	A203	Industrial	137
Acido Sulfurico	A203	Industrial	137
Acquinite	A056	C18	131P
Acraldehyde	A056	C18	131P
Acreline	A056	C18	131P
Acrolein	A056	C18	131P
Acroleina	A056	C18	131P
Acroleine	A056	C18	131P
Acrylaldehyd	A056	C18	131P
Acrylaldehyde	A056	C18	131P
Acrylates	A263	Precursor	—
Acrylic Aldehyde	A056	C18	131P
Acrylnitril	A081	Industrial	131P
Acrylonitrile	A081	Industrial	131P
Acrylonitrile Monomer	A081	Industrial	131P
<i>Actinobacillus mallei</i>	A301	C27	158
AD 6 (Suspending Agent)	A144	Industrial	127P
Adam	—	C16	154
Adamsit	A073	C20	152
Adamsite	A073	C20	152
Adrizine	—	C16	154
Advacide PMA 18	A156	Industrial	151
Aero Liquid HCN	A030	C12	117
Aethylenbromid	A139	Industrial	154
Aethylenchlorid	A140	Industrial	129
Aethylenchlorhydrin	A211	Precursor	131
Aethylenoxid	A141	Industrial	119
Aethylformiat	A138	Industrial	129
AF	—	C29	158
Aflatoxin (B1)	A270	C22	153
Aflatoxins	A270	C22	153
African Hemorrhagic Fever	A299	C24	158
African Histoplasmosis	A305	C24	158
African Swine Fever	—	C27	158
African Tick Typhus	A316	C25	158
Aftosa	—	C27	158
<i>A. fumigatus</i>	—	C29	158
Agallol	A155	Industrial	151
Agallolat	A155	Industrial	151
Agalol	A155	Industrial	151
Agent 15	—	C16	154
Agent Blue	A106	Industrial	151
Agglutinin	A269	C22	153
Aggridip	A167	Industrial	152
Agritox	A180	Industrial	152

Agent	Agent Index #	Class Index #	NAERG
Agrosan	A156	Industrial	151
Agrosan GN 5	A156	Industrial	151
AH9100000	A159	Industrial	151
AHF	A307	C24	158
AI3-01636	A235	Precursor	129
AI3-01916	A142	Industrial	123
AI3-07541	A144	Industrial	127P
AI3-15101	A206	Industrial	156
AI3-15300	—	C17	156
AI3-15349	A139	Industrial	154
AI3-15518	A058	C17	156
AI3-15638-X	A221	Precursor	118
AI3-16198	A021	C09	153
AI3-16200	A019	C09	153
AI3-18303	A091	Industrial	131P
AI3-18445	A132	Industrial	159
AI3-24160	A056	C18	131P
AI3-28749	A252	Precursor	157
AI3-31100-X	A030	C12	117
AI3-52118	A012	C07	156
Akrolein	A056	C18	131P
Akroleina	A056	C18	131P
Akrylonitryl	A081	Industrial	131P
Alagoas	A345	C25	158
Alcoa Sodium Fluoride	A257	Industrial	154
Alcohol	A235	Precursor	129
Alcohol of Sulfur	A089	Industrial	131
Alcohol, Rubbing	A235	Precursor	129
Alcojel	A235	Precursor	129
Alcolo	A235	Precursor	129
Alcool Allilco	A082	Industrial	131
Alcool Allylique	A082	Industrial	131
Alcool Isopropilico	A235	Precursor	129
Alcool Isopropylique	A235	Precursor	129
Alcosolve	A235	Precursor	129
Alcosolve 2	A235	Precursor	129
Aldehyde Acrylique	A056	C18	131P
Aldeide Acrilica	A056	C18	131P
Aldicarb	A120	Industrial	151
Aldicarb+	A120	Industrial	151
Alfenta	—	C16	154
Alfentanil	—	C16	154
Algard	A137	Industrial	152
Algimycin	A156	Industrial	151
Alkano	A266	Precursor	None
Alkanolamine 244	A266	Precursor	None
Alkolave	A235	Precursor	129
Alkron	A177	Industrial	152
Alleron	A177	Industrial	152
Allilowy Alkohol	A082	Industrial	131
Alloprene	A263	Precursor	—
Allyl Al	A082	Industrial	131

Agent	Agent Index #	Class Index #	NAERG
Allyl Alcohol	A082	Industrial	131
Allyl Aldehyde	A056	C18	131P
Allylalkohol	A082	Industrial	131
Allylic Alcohol	A082	Industrial	131
AIP	A133	Industrial	139
alpha,alpha'-Dichlorodimethyl Ether	A034	C14	153
alpha,beta-Dibromoethane	A139	Industrial	154
alpha,beta-Dichloroethane	A140	Industrial	129
alpha,beta-Oxidoethane	A141	Industrial	119
alpha-Bromo-alpha-tolunitrile	A059	C17	159
alpha-Bromobenzyl Cyanide	A059	C17	159
alpha-Bromobenzyl nitrile	A059	C17	159
alpha-Bromophenylacetone nitrile	A059	C17	159
alpha-Bromotoluene	—	C17	156
alpha-Chloro-4-nitrotoluene	—	C17	—
alpha-Chloroacetophenone	A064	C17	153
alpha-Chlorotoluene	A058	C17	156
alpha-Chlortoluol	A058	C17	156
alpha-Conotoxin	A277	C22	153
alpha-Conotoxin SI	A277	C22	153
alpha-Lewisit	A014	C08	153
alpha-Nitrobenzyl Chloride	—	C17	—
alpha-Tolyl Chloride	A058	C17	156
AL-PHOS	A133	Industrial	139
Aluminum Monophosphide	A133	Industrial	139
Aluminum Phosphide	A133	Industrial	139
Amaze	A184	Industrial	152
Ambush	A120	Industrial	151
Am-Dex	—	C16	154
American Cyanamid 38023	A178	Industrial	152
American Cyanamid 3911	A193	Industrial	152
American Histoplasmosis	A305	C24	158
Am-Fol	A083	Industrial	125
Amine, Triethyl, 2,2',2''-trihydroxy-	A266	Precursor	None
Amino-4-pyridine	A157	Industrial	153
Aminocarb	A121	Industrial	151
Aminocarbe	A121	Industrial	151
Amiton	—	C02	153
Ammonia	A083	Industrial	125
Ammonia (Anhydrous)	A083	Industrial	125
Ammonia Gas	A083	Industrial	125
Ammoniac	A083	Industrial	125
Ammoniaca	A083	Industrial	125
Ammoniak	A083	Industrial	125
Ammonium Acid Fluoride	A208	Precursor	154
Ammonium Bifluoride	A208	Precursor	154
Ammonium Fluoride	A208	Precursor	154
Ammonium Fluoride, Acidic	A208	Precursor	154
Ammonium Hydrogen Fluoride	A208	Precursor	154
Ammonium Hydrogendifluoride	A208	Precursor	154
Amoniak	A083	Industrial	125
Amphedrine	—	C16	154

Agent	Agent Index #	Class Index #	NAERG
Ampherex	—	C16	154
Amphes	—	C16	154
Amsustain Amitrene	—	C16	154
AN	A081	Industrial	131P
Anaerobic Cellulitis	A300	C24	158
Anaerobic Myositis	A300	C24	158
Anatensol	—	C16	154
Anatoxin-A	A271	C22	153
Andromedotoxin	A279	C22	153
Angel Dust	—	C16	154
Anhydrous Ammonia	A083	Industrial	125
Anhydrous Hydrobromic Acid	A095	Industrial	125
Anhydrous Hydrochloric Acid	A096	Industrial	125
Anhydrous Hydrofluoric Acid	A097	Industrial	125
Ansar	A116	Industrial	151
Ansar 6.6	A116	Industrial	151
Ansar 157	A115	Industrial	151
Ansar 170	A116	Industrial	151
Ansar 170HC	A116	Industrial	151
Ansar 184	A112	Industrial	151
Ansar 529	A116	Industrial	151
Ansar 529HC	A116	Industrial	151
Ansar 8100	A112	Industrial	151
Ansar DSMA Liquid	A112	Industrial	151
Anthrax	A290	C24	158
Antibulit	A257	Industrial	154
Anticon	A156	Industrial	151
Antimucin WDR	A156	Industrial	151
Antisal 2B	A097	Industrial	125
APA	A269	C22	153
Apachlor	A164	Industrial	152
Apavap	A137	Industrial	152
Aphamite	A177	Industrial	152
Aphthous Fever	—	C27	158
Apomorphine	—	C20	—
Aqua Fortis	A100	Industrial	157
Aquinite	A041	C14	154
Aquinite	A043	C14	—
Aratan	A155	Industrial	151
Aretan	A155	Industrial	151
Aretan 6	A155	Industrial	151
Argentinian Hemorrhagic Fever	A307	C24	158
Aromatic Ammonia	A083	Industrial	125
Arquad DMCB	A235	Precursor	129
Arrhenal	A112	Industrial	151
Arsanote	A116	Industrial	151
Arsenous Acid, Sodium Salt	A119	Industrial	151
Arsenic Acid	A104	Industrial	154
Arsenic Acid, Sodium Salt	A118	Industrial	151
Arsenic Butter	A033	C14	157
Arsenic Dichloroethane	A013	C08	151
Arsenic Hydrid	A026	C13	119

Agent	Agent Index #	Class Index #	NAERG
Arsenic Hydride	A026	C13	119
Arsenic (III) Chloride	A033	C14	157
Arsenic (III) Oxide	A105	Industrial	151
Arsenic (III) Trioxide	A105	Industrial	151
Arsenic Oxide	A105	Industrial	151
Arsenic Oxide (3)	A105	Industrial	151
Arsenic Sesquioxide	A105	Industrial	151
Arsenic Trichloride	A033	C14	157
Arsenic Trihydride	A026	C13	119
Arsenic Trioxide	A105	Industrial	151
Arsenicum Album	A105	Industrial	151
Arsenic (White)	A105	Industrial	151
Arsenious Acid	A105	Industrial	151
Arsenious Acid, Monosodium Salt	A119	Industrial	151
Arsenious Acid, Potassium Salt	A117	Industrial	151
Arsenious Acid, Sodium Salt	A119	Industrial	151
Arsenious Chloride	A033	C14	157
Arsenious Oxide	A105	Industrial	151
Arsenious Trioxide	A105	Industrial	151
Arsenite	A105	Industrial	151
Arsenite de Sodium	A119	Industrial	151
Arseniuretted Hydrogen	A026	C13	119
Arsenolite	A105	Industrial	151
Arsenous Acid	A105	Industrial	151
Arsenous Acid Anhydride	A105	Industrial	151
Arsenous Acid, Potassium Salt	A117	Industrial	151
Arsenous Anhydride	A105	Industrial	151
Arsenous Chloride	A033	C14	157
Arsenous Hydride	A026	C13	119
Arsenous Oxide	A105	Industrial	151
Arsenous Oxide Anhydride	A105	Industrial	151
Arsenous Trioxide	A105	Industrial	151
Arsenowodor	A026	C13	119
Arsenwasserstoff	A026	C13	119
Arsine	A026	C13	119
Arsine Oil	—	C08	156
Arsine, (2-chlorovinyl) Dichloro-	A014	C08	153
Arsine, Dichloro(2-chlorovinyl)-	A014	C08	153
Arsine, Dichloro(phenyl)-	A023	C08	152
Arsine, Dichloroethyl-	A013	C08	151
Arsine, Dichloromethyl	A016	C08	152
Arsine, Dichlorophenyl-	A023	C08	152
Arsinol	A078	C20	152
Arsin-Ol	A078	C20	152
Arsinyl	A112	Industrial	151
Arsodent	A105	Industrial	151
Arsonate	A116	Industrial	151
Arsonate Liquid	A116	Industrial	151
Arsonic Acid, Methyl-, Monoammonium Salt	A115	Industrial	151
Arsonic Acid, Potassium Salt	A117	Industrial	151
Arsonous Dichloride, (2-Chloroethenyl)	A014	C08	153
Arsonous Dichloride, Ethyl-	A013	C08	151

Agent	Agent Index #	Class Index #	NAERG
Arsonous Dichloride, Phenyl-	A023	C08	152
Arthur	A026	C13	119
Asantol	A167	Industrial	152
Asebotoxin	A279	C22	153
ASP 47	A198	Industrial	153
<i>Aspergillus fumigatus</i>	—	C29	158
A-Stoff	—	C17	131
Astrobot	A137	Industrial	152
Asulfa-Supra	A259	Precursor	133
Asunthol	A167	Industrial	152
Asuntol	A167	Industrial	152
Atgard	A137	Industrial	152
Atgard C	A137	Industrial	152
Atgard V	A137	Industrial	152
Atiran	A155	Industrial	151
Atlas "A"	A119	Industrial	151
Atomic Sulfur	A259	Precursor	133
Aujeszký's Disease	—	C27	158
Australian Encephalitis	A319	C25	158
Australian Q Fever	A327	C24	158
Australian Query Fever	A327	C24	158
Avantin	A235	Precursor	129
Avantine	A235	Precursor	129
A7 Vapam	A145	Industrial	—
Avian Chlamydiosis	A326	C27	158
Avian Influenza	—	C27	158
Avitrol	A157	Industrial	153
Avitrol 200	A157	Industrial	153
Azimil	A160	Industrial	152
Azin	A073	C20	152
Azinfos-Methyl	A160	Industrial	152
Azinphos	A160	Industrial	152
Azinphos-Me	A160	Industrial	152
Azinphos-Methyl	A160	Industrial	152
Azinphos-Metile	A160	Industrial	152
Azodrin	A192	Industrial	152
Azotic Acid	A100	Industrial	157
Azotowy Kwas	A100	Industrial	157
Azunthol	A167	Industrial	152

B

B	—	C10	156
B1	A017	C07	153
BA	—	C17	131
<i>B. abortus</i>	A291	C24	158
Babylonia Japonica Toxin 1	A289	C22	153
Bacillary Dysentery	A334	C26	158
<i>Bacillus anthracis</i>	A290	C24	158
<i>Bacillus globigii</i>	—	C29	158
<i>Bacillus subtilis</i>	—	C29	158
<i>Bacillus subtilis var. niger</i>	—	C29	158

Agent	Agent Index #	Class Index #	NAERG
<i>Bacillus subtilis variant niger</i>	—	C29	158
<i>Bacillus thuringiensis</i>	—	C29	158
Balkan Influenza	A327	C24	158
Banana Bunchy Top Virus	—	C28	158
Bang's Disease	A291	C24	158
<i>B. anthracis</i>	A290	C24	158
<i>Bartonella quintana</i>	A338	C25	158
BAS 263 I	A124	Industrial	151
Basamid	A135	Industrial	171
Basamid P	A135	Industrial	171
Basamid-Fluid	A145	Industrial	—
Basamid-Puder	A135	Industrial	171
Bash	A178	Industrial	152
Bashunto	A336	C24	158
Basimid G	A135	Industrial	171
Batrachotoxin	A272	C22	153
Bay 21/199	A167	Industrial	152
Bay 25/141	A181	Industrial	152
Bay 9026	A128	Industrial	151
Bay 9027	A160	Industrial	152
Bay 17147	A160	Industrial	152
Bay 19149	A137	Industrial	152
Bay 19639	A174	Industrial	152
Bay 37289	A180	Industrial	152
Bay 37344	A128	Industrial	151
Bay 44646	A121	Industrial	151
Bay 68138	A179	Industrial	152
Bay 70134	A123	Industrial	151
Bay 92114	A184	Industrial	152
Bay G-393	A198	Industrial	153
Bay SRA 3886	A179	Industrial	152
Bayer 21/199	A167	Industrial	152
Bayer 5080	A121	Industrial	151
Bayer 8169	A169	Industrial	152
Bayer 9027	A160	Industrial	152
Bayer 17147	A160	Industrial	152
Bayer 19149	A137	Industrial	152
Bayer 21199	A167	Industrial	152
Bayer 37344	A128	Industrial	151
Bayer 44646	A121	Industrial	151
Bayer 71628	A187	Industrial	152
Bayer E 393	A198	Industrial	153
Baymix	A167	Industrial	152
Baymix 50	A167	Industrial	152
Bazmix	A167	Industrial	152
BB	A017	C07	153
BBC	A059	C17	159
BBC 12	A132	Industrial	159
BBCP	A132	Industrial	159
BBN	A059	C17	159
BCEE	A084	Industrial	152
BCME	A034	C14	153

Agent	Agent Index #	Class Index #	NAERG
Beetle Buster	A160	Industrial	152
Bencarbate	A122	Industrial	131
Bendiocarb	A122	Industrial	131
Bendiocarbe	A122	Industrial	131
Benfos	A137	Industrial	152
Bensulfoïd	A259	Precursor	133
Benzene, (Acetoxymercurio)-	A156	Industrial	151
Benzene, (Bromomethyl)-	—	C17	156
Benzene, (Chloromethyl)-	A058	C17	156
Benzene, 1,1'-Methylenebis(4-isocyanato-	A092	Industrial	156
Benzene, 2,4-Diisocyanato-1-methyl-	A206	Industrial	156
Benzeneacetic Acid, $\alpha$ -Hydroxy- $\alpha$ -Phenyl-	A209	Precursor	154
Benzeneacetic Acid, $\alpha$ -Hydroxy- $\alpha$ -Phenyl-, Methyl Ester	A238	Precursor	154
Benzeneacetic Acid, alpha-Hydroxy-alpha- phenyl-	A209	Precursor	154
Benzeneacetic Acid, alpha-Hydroxy-alpha- phenyl-, Methyl Ester	A238	Precursor	154
Benzeneaceticacid, $\alpha$ -Hydroxy- $\alpha$ -phenyl-	A209	Precursor	154
Benzeneaceticacid, alpha-Hydroxy- alpha-phenyl-	A209	Precursor	154
Benzeneacetonitrile, $\alpha$ -Bromo-	A059	C17	159
Benzeneacetonitrile, alpha-Bromo-	A059	C17	159
Benzile (Cloruro di)	A058	C17	156
Benzilic Acid	A209	Precursor	154
Benzilic Acid, Methyl Ester	A238	Precursor	154
Benzodioxol-4-ol, 2,2-Dimethyl-, Methylcarbamate	A122	Industrial	131
Benzodioxole, 2,2-Dimethyl- 4-(N-methylaminocarboxylato)-	A122	Industrial	131
(Benzopyran-7-yl)phosphorothioate	A167	Industrial	152
Benzotriazinedithiophosphoric Acid Dimethoxy Ester	A160	Industrial	152
Benzoylmethylecgonine	—	C16	154
Benzyl Bromide	—	C17	156
Benzyl Chloride	A058	C17	156
Benzyl Iodide	—	C17	156
Benzylchlorid	A058	C17	156
Benzyle (Chlorure de)	A058	C17	156
Berce\Ma	A142	Industrial	123
Bernice	—	C16	154
Bernies	—	C16	154
Bertholite	A038	C14	124
Be-Stoff	—	C17	131
beta, beta-Dichlor-ethyl-sulphide	A017	C07	153
beta, beta'-Dichlorodiethyl Sulfide	A017	C07	153
beta, beta'-Dichlorodiethyl-N-methylamine	A020	C09	153
beta, beta'-Dichloroethyl Sulfide	A017	C07	153
beta, beta'-Dichloroethyl Sulphide	A017	C07	153
beta, beta'-Dihydroxydiethyl Sulfide	A264	Precursor	None
beta, beta'-Dihydroxyethyl Sulfide	A264	Precursor	None
beta,beta-Dichlorodiethyl Ether	A084	Industrial	152

Agent	Agent Index #	Class Index #	NAERG
beta,beta'-Dichloroethyl Ether	A084	Industrial	152
beta,beta-Dicyano-o-chlorostyrene	A060	C17	159
beta-Bgt	A275	C22	153
beta-Bis(hydroxyethyl) Sulfide	A264	Precursor	None
beta-Bungarotoxin	A275	C22	153
beta-BuTx	A275	C22	153
beta-Chloroethanol	A211	Precursor	131
beta-Chloroethyl Alcohol	A211	Precursor	131
beta-Chlorovinyl-dichloroarsine	A014	C08	153
beta-Cocain	—	C16	154
beta-Cocaine	—	C16	154
beta-Dichloroethane	A140	Industrial	129
beta-(Diethylamino)ethanol	A213	Precursor	132
beta-Diethylaminoethanol	A213	Precursor	132
beta-(Diethylamino)ethyl Alcohol	A213	Precursor	132
beta-Diethylaminoethyl Alcohol	A213	Precursor	132
beta-Diisopropylaminoethyl Chloride	A210	Precursor	154
Betafedrina	—	C16	154
beta-Hydroxyethyl Chloride	A211	Precursor	131
beta-Hydroxyethyl Sulfide	A264	Precursor	None
beta-Hydroxytriethylamine	A213	Precursor	132
beta-Lewisite	—	C08	153
beta Methallyl Chloride	A134	Industrial	129P
(beta-Methoxyethyl)mercuric Chloride	A155	Industrial	151
beta-Methoxyethylmercury Chloride	A155	Industrial	151
beta-Methyl Acrolein	A091	Industrial	131P
beta-Methylacrolein	A091	Industrial	131P
beta-Methylallyl Chloride	A134	Industrial	129P
beta-Quinuclidinyl Benzilate	A055	C16	154
beta-Thiodiglycol	A264	Precursor	None
BFV	A094	Industrial	132
BG	—	C29	158
BHF	A314	C24	158
Bibesol	A137	Industrial	152
Bibi	—	C14	—
Bichlorure d'Ethylene	A140	Industrial	129
Bidrin	A171	Industrial	152
Bifluoriden	A093	Industrial	124
Bifluorure de Potassium	A251	Precursor	154
BI IV 99	—	C13	139
Binary GB	—	C05	153
Binary VX	—	C05	153
Bioxyde d'Azote	A101	Industrial	124
Biphasic meningoencephalitis	A332	C25	158
Birlane	A164	Industrial	152
Bis(2-aminophenyl)hydroxystibine	—	C20	—
Bis(beta-chloroethyl) Ether	A084	Industrial	152
Bis(beta-chloroethyl)methylamine	A020	C09	153
Bis(beta-chloroethyl)sulfide	A017	C07	153
Bis(beta-chloroethyl)sulphide	A017	C07	153
Bis(beta-chloroethylthio)ethane	A025	C07	153
Bis(beta-hydroxyethyl) Sulfide	A264	Precursor	None

Agent	Agent Index #	Class Index #	NAERG
Bis(bromomethyl) Ether	—	C14	—
Bis( $\beta$ -chloroethyl) Ether	A084	Industrial	152
Bis(2-chloroethyl) Ether	A084	Industrial	152
Bis(chloroethyl)ether	A084	Industrial	152
Bis( $\beta$ -chloroethyl)ethylamine	A019	C09	153
Bis(2-chloroethyl)ethylamine	A019	C09	153
Bis( $\beta$ -chloroethyl)methylamine	A020	C09	153
Bis(2-chloroethyl)methylamine	A020	C09	153
Bis(chloro-2-ethyl) Oxide	A084	Industrial	152
Bis( $\beta$ -chloroethyl)sulfide	A017	C07	153
Bis(2-chloroethyl) Sulfide	A017	C07	153
Bis-(2-chloroethyl)sulfide	A017	C07	153
Bis( $\beta$ -chloroethyl)sulphide	A017	C07	153
Bis( $\beta$ -chloroethylthio)ethane	A025	C07	153
Bis[2(2-chloroethylthio)ethyl] Ether	A022	C07	153
Bis(2-chloroethylthioethyl)ether	A022	C07	153
Bis(2-chloroethylthio)methane	—	C07	153
Bis(2-chloroethylthiomethyl)ether	—	C07	153
Bis(chloromethyl) Ether	A034	C14	153
Bis(2-chlorovinyl)chloroarsine	—	C08	153
Bis(dimethylamido)fluorophosphate	A172	Industrial	152
Bis(dimethylamido)phosphoryl Fluoride	A172	Industrial	152
Bis(dimethylamino)fluorophosphine Oxide	A172	Industrial	152
Bis(dimethylamino)phosphonous Anhydride	A197	Industrial	152
Bis(dithiophosphate de O,O-Diethyle) de S,S'- (1,4-Dioxanne-2,3-diyle)	A173	Industrial	152
Bis(2-hydroxyethyl)methylamine	A239	Precursor	None
Bis( $\beta$ -hydroxyethyl) Sulfide	A264	Precursor	None
Bis(2-hydroxyethyl)sulfide	A264	Precursor	None
Bis(2-hydroxyethyl) Sulphide	A264	Precursor	None
Bis(2-hydroxyethyl) Thioether	A264	Precursor	None
Bis(4-isocyanatophenyl)methane	A092	Industrial	156
Bis(isopropyl)amine	A218	Precursor	132
Bis(isopropylamino)fluorophosphine Oxide	A191	Industrial	152
Bis(monoisopropylamino)fluorophosphine Oxide	A191	Industrial	152
Bis(O,O-diethylphosphorothionic) Anhydride	A198	Industrial	153
Bis(para-isocyanatophenyl)methane	A092	Industrial	156
Bis(p-isocyanatophenyl)methane	A092	Industrial	156
Bis-CME	A034	C14	153
Bisdimethylaminofluorophosphine Oxide	A172	Industrial	152
Bis-O,O-diethylphosphoric Anhydride	A200	Industrial	152
Bis-O,O-diethylphosphorothionic Anhydride	A198	Industrial	153
BJT-1	A289	C22	153
Black Death	A324	C25	158
Black Leaf 40	A158	Industrial	151
Black Typhus	A314	C24	158
Black Vomit	A347	C25	158
Bladafum	A198	Industrial	153
Bladafume	A198	Industrial	153
Bladafun	A198	Industrial	153
Bladan	A200	Industrial	152
Blaukreuz	A076	C20	151

Agent	Agent Index #	Class Index #	NAERG
Blaukreuz	A077	C20	—
Blaukreuz 1	A079	C20	152
Blaukreuz 1	A080	C20	—
Blauring 1	A073	C20	152
Blauring 2	A078	C20	152
Blauring 3	A079	C20	152
Blausaeure	A030	C12	117
Blauwzuur	A030	C12	117
Bleached Lignite Wax	A263	Precursor	—
Bleached Montan Wax	A263	Precursor	—
Blister Gas No. 1	A017	C07	153
Blister Gas No. 2	A017	C07	153
Blister Gas No. 3	A014	C08	153
Blister Gas No. 4	—	C07	153
Blister Gas No. 5	A019	C09	153
Blue	A106	Industrial	151
Blue Cross Agent	A076	C20	151
Blue No. 1	A048	C14	125
Blue Star	—	C14	—
<i>B. melitensis</i>	A291	C24	158
Bn-Stoff	—	C17	—
BO0875000	A083	Industrial	125
Bo-Ana	A178	Industrial	152
Bolivian Hemorrhagic Fever	A314	C24	158
Bomyl	A161	Industrial	152
Bonebreak Fever	A296	C25	158
Bonide Blue Death Rat Killer	—	C21	136
Bonide Sulfur Plant Fungicide	A259	Precursor	133
Borane, Trifluoro-	A087	Industrial	125
Borer Sol	A140	Industrial	129
Boron Bromide	A085	Industrial	157
Boron Chloride	A086	Industrial	125
Boron Fluoride	A087	Industrial	125
Boron Tribromide	A085	Industrial	157
Boron Trichloride	A086	Industrial	125
Boron Trifluoride	A087	Industrial	125
<i>Borrelia recurrentis</i>	A328	C25	158
Botulinum Toxins	A273	C22	153
Botulism	A273	C22	153
Boutonneuse Fever	A316	C25	158
BOV	A203	Industrial	137
Bovine Plague	—	C27	158
Bovine Spongiform Encephalitis	—	C27	158
Bovine Spongiform Encephalopathy	—	C27	158
BQ9200000	A208	Precursor	154
<i>B. quintana</i>	A338	C25	158
Brazilian Hemorrhagic Fever	A333	C24	158
<i>B. recurrentis</i>	A328	C25	158
Bretonite	—	C17	—
Brevetoxins	A274	C22	153
Brevinyl	A137	Industrial	152
Brevinyl E-50	A137	Industrial	152

Agent	Agent Index #	Class Index #	NAERG
Brimstone	A259	Precursor	133
Brocide	A140	Industrial	129
Brom	A036	C14	154
Brome	A036	C14	154
Bromine	A036	C14	154
Bromine Fluoride	A088	Industrial	144
Bromine Trifluoride	A088	Industrial	144
Brominetrifluoride	A088	Industrial	144
Brom-methan	A142	Industrial	123
Bromo	A036	C14	154
Bromo-2,5-dichlorophenyl) O,O-Diethyl Phosphorothioate	A162	Industrial	152
Bromoacetone	—	C17	131
Bromobenzyl Cyanide	A059	C17	159
Bromobenzylcyanide	A059	C17	159
BromobenzylNitrile	A059	C17	159
Bromochlorotrifluoroethane	—	C16	154
Bromofume	A139	Industrial	154
Brom-O-Gas	A142	Industrial	123
Brom-O-Gas Methyl Bromide Soil Fumigant	A142	Industrial	123
Bromometano	A142	Industrial	123
Bromomethane	A142	Industrial	123
(Bromomethyl)benzene	—	C17	156
Bromomethylethyl Ketone	—	C17	—
Bromophenylmethane	—	C17	156
Bromophos-ethyl	A162	Industrial	152
Brom-O-Sol	A142	Industrial	123
Bromotoluene, $\alpha$ -	—	C17	156
Bromotoluene, alpha-	—	C17	156
Bromowodor	A095	Industrial	125
Bromur di Metile	A142	Industrial	123
Bromure de Methyle	A142	Industrial	123
Bromure d'Hydrogene Anhydre	A095	Industrial	125
Bromuro de Hidrogeno Anhidro	A095	Industrial	125
Bromuro di Etile	A139	Industrial	154
Bromwasserstoff	A095	Industrial	125
Broom	A036	C14	154
Broommethaan	A142	Industrial	123
Broomwaterstof	A095	Industrial	125
Brown No. 1	A030	C12	117
<i>Brucella abortus</i>	A291	C24	158
<i>Brucella melitensis</i>	A291	C24	158
<i>Brucella suis</i>	A291	C24	158
Brucellosis	A291	C24	158
BSE	—	C27	158
B-Stoff	—	C17	131
<i>B. suis</i>	A291	C24	158
BT	—	C29	158
BT2275000	A226	Precursor	137
BTX	A274	C22	153
BTX	A273	C22	153
Bubonic Plague	A324	C25	158

Agent	Agent Index #	Class Index #	NAERG
Bueno	A116	Industrial	151
Bueno 6	A116	Industrial	151
Bufen	A156	Industrial	151
Bullneck Disease	A297	C24	158
Bungarotoxin, $\beta$ -	A275	C22	153
Bungarotoxin, beta-	A275	C22	153
Burese	—	C16	154
<i>Burkholderia mallei</i>	A301	C27	158
<i>Burkholderia pseudomallei</i>	A317	C24	158
Burodex	—	C16	154
Busan 1020	A145	Industrial	—
Butter of Arsenic	A033	C14	157
((Butylthio)methyl) O,O-Diethyl Phosphorodithioate	A199	Industrial	131
Buzz	A055	C16	154
BZ	A055	C16	154

C

C	—	C16	154
C	—	C07	153
C1	A076	C20	151
C1	A064	C17	153
C2	A079	C20	152
C 709	A171	Industrial	152
C 1414	A192	Industrial	152
CA	A059	C17	159
Cacodylic Acid	A106	Industrial	151
Cadmium Oxides (fume)	A037	C15	154
CAF	A064	C17	153
Calar	A107	Industrial	151
Calar-E-Rad	A112	Industrial	151
Calcium Acid Methane Arsonate	A107	Industrial	151
Calcium Acid Methanearsonate	A107	Industrial	151
Calcium Arsenate	A108	Industrial	151
Calcium Arsenite	A109	Industrial	151
Calcium Hydrogen Methanearsonate	A107	Industrial	151
CAMA	A107	Industrial	151
Camelpox	—	C27	158
Camite	A059	C17	159
Camp Fever	A342	C25	158
Canogard	A137	Industrial	152
CAP	A064	C17	153
Capsaicin	A070	C18	159
Capsyn	A070	C18	159
Caradate 30	A092	Industrial	156
Carapata Disease	A328	C25	158
Carbam	A145	Industrial	—
Carbam, Sodium Salt	A145	Industrial	—
Carbamic Acid, Dimethyl-, 1-Isopropyl-3-methyl-pyrazol-5-yl Ester	A127	Industrial	151

Agent	Agent Index #	Class Index #	NAERG
Carbamic Acid, Methyl-, 2,3-(Dimethylmethylenedioxy)phenyl Ester	A122	Industrial	131
Carbamic Acid, Methyl-, 2,3-(Isopropylidenedioxy)phenyl Ester	A122	Industrial	131
Carbamic Acid, Methyl-, 4-(Dimethylamino)-3-methylphenyl Ester	A121	Industrial	151
Carbamic Acid, Methyl-, 4-(Dimethylamino)-meta-tolyl Ester	A121	Industrial	151
Carbamic Acid, Methyl-, 4-(Dimethylamino)-m-tolyl Ester	A121	Industrial	151
Carbamic Acid, N-Methyldithio-, Monosodium Salt	A145	Industrial	—
Carbicron	A171	Industrial	152
Carbofuran	A123	Industrial	151
Carbon Bisulfide	A089	Industrial	131
Carbon Bisulfuret	A089	Industrial	131
Carbon Bisulphide	A089	Industrial	131
Carbon Chlorosulfide	A071	C17	157
Carbon Dichloride Oxide	A048	C14	125
Carbon Disulfide	A089	Industrial	131
Carbon Disulphide	A089	Industrial	131
Carbon Hydride Nitride	A030	C12	117
Carbon Nitride	A027	C12	119
Carbon Oxychloride	A048	C14	125
Carbon Sulfide	A089	Industrial	131
Carbon Sulphide	A089	Industrial	131
Carbone	A089	Industrial	131
Carbone (Oxychlorure de)	A048	C14	125
Carbone (Sulfure de)	A089	Industrial	131
Carbonic Acid Dichloride	A048	C14	125
Carbonic Chloride Fluoride	—	C14	—
Carbonic Dichloride	A048	C14	125
Carbonic Difluoride	—	C14	125
Carbonio	A089	Industrial	131
Carbonio (Ossiclorure di)	A048	C14	125
Carbonio (Solfuro di)	A089	Industrial	131
Carbonochloridic Acid, Trichloromethyl Ester	A044	C14	125
Carbonythioic Dichloride	A071	C17	157
Carbonyl Chloride	A048	C14	125
Carbonyl Chlorofluoride	—	C14	—
Carbonyl Dichloride	A048	C14	125
Carbonyl Fluoride	—	C14	125
Carbonylchlorid	A048	C14	125
Carbophenothion	A163	Industrial	152
Carbothialdine	A135	Industrial	171
Cardiotoxin	A276	C22	153
Cardiotoxin (Naja naja atra)	A276	C22	153
Carfene	A160	Industrial	152
Carfentanil	—	C16	154
Carrie	—	C16	154
Caryolysin	A020	C09	153
Carzol	A126	Industrial	151

Agent	Agent Index #	Class Index #	NAERG
Caswell Number 009	A056	C18	131P
Caswell Number 010	A081	Industrial	131P
Caswell Number 112	A036	C14	154
Caswell Number 179	A038	C14	124
Caswell Number 267	A028	C12	125
Caswell Number 287	A132	Industrial	159
Caswell Number 439	A139	Industrial	154
Caswell Number 483	A030	C12	117
Caswell Number 484	A097	Industrial	125
Caswell Number 486	A096	Industrial	125
Caswell Number 507	A235	Precursor	129
Caswell Number 555	A142	Industrial	123
Caswell Number 688A	A252	Precursor	157
Caswell Number 713A	A144	Industrial	127P
Caswell Number 758	A256	Precursor	157
Caswell Number 813	A202	Industrial	125
Caswell Number 815	A203	Industrial	137
Cattle Plague	—	C27	158
Cavern Disease	A305	C24	158
Cavi-Trol	A257	Industrial	154
CB	—	C12	157
CB1	A017	C07	153
CB2	A017	C07	153
CB3	A014	C08	153
CB4	—	C07	153
CB5	A019	C09	153
C 6-Base	A021	C09	153
CBR	A052	C14	—
<i>C. burnetti</i>	A327	C24	158
CC	A028	C12	125
CC1	A048	C14	125
CC2	A038	C14	124
CDA	A079	C20	152
<i>C. diphtheriae</i>	A297	C24	158
Cecil	—	C16	154
Cederite	—	C17	—
Cekusan	A137	Industrial	152
Cekusil	A156	Industrial	151
Cekusil Universal C	A155	Industrial	151
CELA 2957	A166	Industrial	152
Celamerck S-2957	A166	Industrial	152
Celathion	A166	Industrial	152
Celmer	A156	Industrial	151
Celmid	A139	Industrial	154
Celphide	A133	Industrial	139
Celphos	A133	Industrial	139
Celphos	A143	Industrial	119
Central Asia Hemorrhagic Fever	A295	C25	158
<i>Ceratitis capitata</i>	—	C28	—
Ceresan	A155	Industrial	151
Ceresan Universal	A156	Industrial	151
Ceresan Universal Nazbeize	A155	Industrial	151

Agent	Agent Index #	Class Index #	NAERG
Ceresan-Universal Nassbeize	A155	Industrial	151
Ce-Stoff	—	C12	157
CFS1	—	C21	136
CFS2	—	C21	136
CG	A048	C14	125
CG1225000	A118	Industrial	151
CG3325000	A105	Industrial	151
CG3675000	A119	Industrial	151
CH	A068	C18	159
Charbon	A290	C24	158
Checkmate	A257	Industrial	154
Chem Pels C	A119	Industrial	151
Chemical Blister Gas No. 1	A017	C07	153
Chemical Blister Gas No. 2	A017	C07	153
Chemical Blister Gas No. 3	A014	C08	153
Chemical Blister Gas No. 4	—	C07	153
Chemical Blister Gas No. 5	A019	C09	153
Chemical Choking Gas No. 1	A048	C14	125
Chemical Choking Gas No. 2	A038	C14	124
Chemical Flame Smoke No. 1	—	C21	136
Chemical Flame Smoke No. 2	—	C21	136
Chemical Mace	A064	C17	153
Chemical Nerve Gas No. 1	A004	C01	153
Chemical Nerve Gas No. 2	A030	C12	117
Chemical Nerve Gas No. 3	A028	C12	125
Chemical Nerve Gas No. 4	A007	C01	153
Chemical Screening Smoke No. 1	—	C21	137
Chemical Screening Smoke No. 5	—	C21	137
Chemical Tear Gas No. 1	A064	C17	153
Chemical Tear Gas No. 2	A066	C19	159
Chemical Tear Gas No. 3	A067	C19	159
Chemical Tear Gas No. 4	A065	C19	159
Chemical Vomiting Gas No. 1	A073	C20	152
Chemical Vomiting Gas No. 2	A076	C20	151
Chemifluor	A257	Industrial	154
Chemonite	A111	Industrial	151
Chem-Sen 56	A119	Industrial	151
CHIK	A292	C25	158
Chikungunya	A292	C25	158
Chikungunya Virus Disease	A292	C25	158
Chipco Crab Kleen	A112	Industrial	151
<i>Chlamydia psittaci</i>	A326	C27	158
Chloor	A038	C14	124
Chloorpikrine	A041	C14	154
Chloorwaterstof	A096	Industrial	125
Chlor	A038	C14	124
Chloral	A048	C14	125
Chloramin	A020	C09	153
Chloramine	A020	C09	153
Chlorbenzal	A058	C17	156
Chlorcyan	A028	C12	125
Chlore	A038	C14	124

Agent	Agent Index #	Class Index #	NAERG
Chloretazine	A020	C09	153
Chlorex	A084	Industrial	152
Chlorfenvinphos	A164	Industrial	152
Chloride of Sulfur	A262	Precursor	137
Chloride of Sulfur	A261	Precursor	137
Chlorine	A038	C14	124
Chlorine Cyanide	A028	C12	125
Chlorine Mol	A038	C14	124
Chlorine Sulfide	A261	Precursor	137
Chlorine Trifluoride	A040	C14	124
Chlormefos	A165	Industrial	152
Chlormephos	A165	Industrial	152
Chlormephos-ethyl	A165	Industrial	152
Chlormethine	A020	C09	153
Chloro-2( $\beta$ -chloroethoxy)ethane	A084	Industrial	152
Chloroacetone	—	C17	131
Chloroacetophenone	A064	C17	153
Chloro-2(beta-chloroethoxy)ethane	A084	Industrial	152
Chloro(chloromethoxy) Methane	A034	C14	153
Chlorocyan	A028	C12	125
Chlorocyanide	A028	C12	125
Chlorocyanogen	A028	C12	125
Chlorodiphenylarsine	A076	C20	151
Chloroethanol	A211	Precursor	131
Chloroethyl Ether	A084	Industrial	152
Chloroethylowy Alkohol	A211	Precursor	131
Chloroform, Nitro-	A041	C14	154
Chloroformyl Chloride	A048	C14	125
Chlorohydric Acid	A096	Industrial	125
(Chloro-1-methoxyethoxy)phenol Methylcarbamate	A124	Industrial	151
Chloro(2-methoxyethyl)mercury	A155	Industrial	151
(Chloromethyl)benzene	A058	C17	156
Chloromethyl Chloroformate	—	C17	157
(Chloro-4-methyl-7-coumarinyl) O,O-Diethyl Phosphorothioate	A167	Industrial	152
Chloromethyl Ether	A034	C14	153
(Chloromethyl) O,O-Diethyl Phosphorodithioate	A165	Industrial	152
Chloromethyl O,O-Diethyl Phosphorothiolothionate	A165	Industrial	152
Chloromethyl Phenyl Ketone	A064	C17	153
Chloromethylbenzene	A058	C17	156
Chloromethylchloroformate	—	C17	157
Chlorophenylmethane	A058	C17	156
Chloro-1-phthalimidoethyl) O,O-Diethylphosphorodithioate	A170	Industrial	152
Chlor-O-Pic	A041	C14	154
Chloropicrin	A041	C14	154
Chloropicrina	A041	C14	154
Chloropicrine	A041	C14	154
Chloro-2-propanone	—	C17	131
Chlorosarin	—	Precursor	153

Agent	Agent Index #	Class Index #	NAERG
Chlorosoman	—	Precursor	153
Chlorosulfane	A262	Precursor	137
Chlorosulfonic Acid	A090	Industrial	137
Chlorotrifluoride	A040	C14	124
Chlorovinylarsine Dichloride	A014	C08	153
Chlorowodor	A096	Industrial	125
Chlorpikrin	A041	C14	154
Chlorschwefel	A262	Precursor	137
Chlorthiophos	A166	Industrial	152
Chlorthiophos I	A166	Industrial	152
Chlorure de Benzyle	A058	C17	156
Chlorure de Bore	A086	Industrial	125
Chlorure de Cyanogene	A028	C12	125
Chlorure de Methallyle	A134	Industrial	129P
Chlorure d'Ethylene	A140	Industrial	129
Chlorure d'Hydrogene	A096	Industrial	125
Chlorure d'Hydrogene Anhydre	A096	Industrial	125
Chloruro de Hidrogene	A096	Industrial	125
Chloruro de Hifrogeno Anhidro	A096	Industrial	125
Chlorvinphos	A137	Industrial	152
Chlorwasserstoff	A096	Industrial	125
Choix Fever	A331	C25	158
Cholera	A293	C26	158
Cholly	—	C16	154
Choking Gas No. 1	A048	C14	125
Choking Gas No. 2	A038	C14	124
Chromar	A235	Precursor	129
CI-395	—	C16	154
CI-581	—	C16	154
C I	A076	C20	151
Cianuro di Sodio	A256	Precursor	157
Cianuro di Vinile	A081	Industrial	131P
Ciba 570	A195	Industrial	152
Cici	A034	C14	153
C II	A079	C20	152
<i>C. immitis</i>	A294	C24	158
(-)-cis-3-Methyl-1-phenethyl-4-(N-phenylpropionamido)isonipectic Acid Methyl Ester	—	C16	154
Citram	—	C02	153
CK	A028	C12	125
CI	A038	C14	124
CL 47031	A194	Industrial	152
CL 64475	A183	Industrial	152
Clairsite	A047	C14	157
Clark 1	A076	C20	151
Clark 2	A079	C20	152
Clark I	A076	C20	151
Clark II	A079	C20	152
Classic Typhus	A342	C25	158
Classic Typhus Fever	A342	C25	158
Claudelite	A105	Industrial	151

Agent	Agent Index #	Class Index #	NAERG
Clean Crop MSMA 6 Plus	A116	Industrial	151
Clean Crop MSMA 6.6	A116	Industrial	151
Clifton Sulfur	A259	Precursor	133
Cloethocarb	A124	Industrial	151
Clorex	A084	Industrial	152
Cloro	A038	C14	124
Cloruro di Ethene	A140	Industrial	129
Cloruro di Metallile	A134	Industrial	129P
C-Lost	—	C10	153
<i>Clostridium botulinum</i> Toxins	A273	C22	153
<i>Clostridium perfringens</i>	A300	C24	158
<i>Clostridium perfringens</i> Toxin	A300	C24	158
<i>Clostridium tetani</i>	A288	C22	153
<i>Clostridium welchii</i>	A300	C24	158
CMPF	A001	C01	153
CM-S 2957	A166	Industrial	152
CN	A064	C17	153
CN1	A004	C01	153
CN2	A030	C12	117
CN3	A028	C12	125
CN4	A007	C01	153
CNB	A067	C19	159
CNC	A066	C19	159
CNS	A065	C19	159
(-)-Cocaine	—	C16	154
Cocaine	—	C16	154
Cocaine Free Base	—	C16	154
<i>Coccidioides ganuloma</i>	A294	C24	158
<i>Coccidioides immitis</i>	A294	C24	158
<i>Coccidioidomycosis</i>	A294	C24	158
<i>Cochliobolus miyabeanus</i>	—	C28	158
Coke	—	C16	154
<i>Colletotrichum coffeanum</i> var. <i>virulans</i>	—	C28	158
<i>Colletotrichum coffeanum</i> variant <i>virulans</i>	—	C28	158
<i>Colletotrichum kanawae</i>	—	C28	158
Colognite	A048	C14	125
Colloidal Sulfur	A259	Precursor	133
Colloidal-S	A259	Precursor	133
Collokit	A259	Precursor	133
Collongite	A053	C14	—
Colsul	A259	Precursor	133
Combat Gas	A048	C14	125
Combi-Schutz	A235	Precursor	129
Compound 1080	A159	Industrial	151
Compound 1861	A157	Industrial	153
Compound 4072	A164	Industrial	152
Congo Virus	A295	C25	158
Congo-Crimean Hemorrhagic Fever	A295	C25	158
Conor and Bruch's Disease	A316	C25	158
Conotoxin, $\alpha$ -	A277	C22	153
Conotoxin, alpha-	A277	C22	153
Contagious abortion	A291	C24	158

Agent	Agent Index #	Class Index #	NAERG
Contra Creme	A156	Industrial	151
Contraven	A199	Industrial	131
Cooper Del-Tox Delnav	A173	Industrial	152
Copper Acetoarsenite	A110	Industrial	151
Copper Arsenite	A111	Industrial	151
Co-Ral	A167	Industrial	152
Corine	—	C16	154
Corosal D and S	A259	Precursor	133
Corosul D and S	A259	Precursor	133
<i>Corynebacterium diphtheriae</i>	A297	C24	158
Cosan	A259	Precursor	133
Cosan 80	A259	Precursor	133
Cosan PMA	A156	Industrial	151
Cotneon	A160	Industrial	152
Cotnion	A160	Industrial	152
Cotnion-Methyl	A160	Industrial	152
Coumafos	A167	Industrial	152
Coumaphos	A167	Industrial	152
Coumaphoscumafos	A167	Industrial	152
Counter	A199	Industrial	131
Counter 15G	A199	Industrial	131
Counter 15G Soil Insecticide	A199	Industrial	131
Counter 15G Soil Insecticide-Nematicide	A199	Industrial	131
<i>Coxiella burnetti</i>	A327	C24	158
<i>Coxiella burnettii</i>	A327	C24	158
Coxiellosis	A327	C24	158
<i>C. perfringens</i>	A300	C24	158
<i>C. psittaci</i>	A326	C27	158
CR	A063	C18	159
Crab-E-Rad	A112	Industrial	151
Crack	—	C16	154
Crag	A135	Industrial	171
Crag 85w	A135	Industrial	171
Crag 974	A135	Industrial	171
Credo	A257	Industrial	154
Crimean-Congo Hemorrhagic Fever	A295	C25	158
Crisfuran	A123	Industrial	151
Crotonal	A091	Industrial	131P
Crotonaldehyde	A091	Industrial	131P
Crotonic Aldehyde	A091	Industrial	131P
Crotoxin	A278	C22	153
Crotylaldehyde	A091	Industrial	131P
Crude Arsenic	A105	Industrial	151
Crying Gas No. 1	A064	C17	153
Crystex	A259	Precursor	133
Crysthion 2L	A160	Industrial	152
Crysthyon	A160	Industrial	152
Crysthyon 2L	A160	Industrial	152
CS	A060	C17	159
CS1	A061	C17	159
CS1	—	C21	137
CS2	A061	C17	159

Agent	Agent Index #	Class Index #	NAERG
CS5	—	C21	137
C 6-Salz (HCl salt)	A021	C09	153
CSX	A062	C19	159
CT1	A064	C17	153
CT2	A066	C19	159
CT3	A067	C19	159
CT4	A065	C19	159
<i>C. tetani</i>	A288	C22	153
Cubes	—	C16	154
Cumafos	A167	Industrial	152
Cupric Arsenite	A111	Industrial	151
Curafume	A142	Industrial	123
Curaterr	A123	Industrial	151
Curly Top of Sugar Beets Virus	—	C28	158
CV1	A073	C20	152
CV2	A076	C20	151
CVP	A164	Industrial	152
<i>C. welchii</i>	A300	C24	158
CX	A024	C11	154
Cyaanwaterstor	A030	C12	117
Cyanguinosin	A280	C22	153
Cyanide of Potassium	A252	Precursor	157
Cyanide of Sodium	A256	Precursor	157
Cyanides	A252	Precursor	157
Cyanobrik	A256	Precursor	157
Cyanoethylene	A081	Industrial	131P
Cyanofenphos	A168	Industrial	152
Cyanofornate esters	—	C14	—
Cyanogen	A027	C12	119
Cyanogen Bromide	—	C12	157
Cyanogen Chloride	A028	C12	125
Cyanogene	A027	C12	119
Cyanogen Gas	A027	C12	119
Cyanogran	A256	Precursor	157
(Cyanophenyl) O-Ethyl Phenylphosphonothioate	A168	Industrial	152
Cyanophos	A137	Industrial	152
Cyanure de Potassium	A252	Precursor	157
Cyanure de Sodium	A256	Precursor	157
Cyanure de Vinyle	A081	Industrial	131P
Cyanwasserstoff	A030	C12	117
Cyclic Propylene (Diethoxyphosphinyl)dithioimidocarbonate	A186	Industrial	152
Cyclite	—	C17	—
Cyclohexyl Ester of Methylphosphonofluoridic Acid	A001	C01	153
Cyclohexyl Methylphosphonofluoridate	A001	C01	153
Cyclohexylmethylfluorophosphonate	A001	C01	153
Cyclon	—	C04	117
Cyclone B	A030	C12	117
Cyclosarin	A001	C01	153
Cyjanowodor	A030	C12	117
Cylan	A194	Industrial	152

Agent	Agent Index #	Class Index #	NAERG
Cymag	A256	Precursor	157
Cyolane	A194	Industrial	152
CYP	A168	Industrial	152
Cypona	A137	Industrial	152
Cytrolane	A186	Industrial	152
Cztereoetylek Olowiu	A204	Industrial	131

*D*

D	—	C10	153
D4	A226	Precursor	137
D-4	A224	Precursor	132
D-7	A007	C01	153
D 1410	A130	Industrial	151
D Substance	A048	C14	125
DA	A076	C20	151
DA 759	—	C16	154
Daconate 6	A116	Industrial	151
Dadex	—	C16	154
Dal-E-Rad	A116	Industrial	151
Dal-E-Rad 100	A112	Industrial	151
Dalf	A189	Industrial	152
Daltogen	A266	Precursor	None
d-Amfetasul	—	C16	154
Dandy Fever	A296	C25	158
Dapotum	—	C16	154
Darling's Disease	A305	C24	158
Dasanit	A181	Industrial	152
d-Ate Ph. 747	—	C16	154
Dazomet	A135	Industrial	171
DBCP	A132	Industrial	159
DBD	A160	Industrial	152
d-Betaphedrine Cendex Cenules	—	C16	154
DC	A079	C20	152
DC	A243	Precursor	137
DCEE	A084	Industrial	152
d-Citramine Cradex	—	C16	154
d-Cocaine	—	C16	154
DD2064000	A209	Precursor	154
Ddevikol	A137	Industrial	152
DDVF	A137	Industrial	152
DDVP	A137	Industrial	152
Deacetylandromedotoxin	A279	C22	153
Deacetylanhydroandromedotoxin	A279	C22	153
DEAE	A213	Precursor	132
DEAEDEAFP	—	C03	153
DEAEDMAFP	—	C03	153
Deconate	A116	Industrial	151
Dedevap	A137	Industrial	152
Deer Fly Fever	A339	C25	158
Deerfly Fever	A339	C25	158
Dehydasaal	A213	Precursor	132

Agent	Agent Index #	Class Index #	NAERG
Delanov	A173	Industrial	152
Delevap	A137	Industrial	152
Delicia	A133	Industrial	139
Delicia	A143	Industrial	119
Delnatex	A173	Industrial	152
Delnav	A173	Industrial	152
delta-1 Tetrahydrocannabinol	—	C16	154
delta-1 THC	—	C16	154
delta-9 Tetrahydrocannabinol	—	C16	154
delta-9 THC	—	C16	154
delta-Chloroethanol	A211	Precursor	131
Deltic	A173	Industrial	152
Delysid	—	C16	154
Demeton	A169	Industrial	152
Demeton+	A169	Industrial	152
Demox	A169	Industrial	152
Dengue	A296	C25	158
Dengue Fever	A296	C25	158
Dengue Fever Virus	A296	C25	158
Dengue Hemorrhagic Fever	A296	C25	158
Dengue Shock Syndrome	A296	C25	158
Dengue Virus	A296	C25	158
Denox	A169	Industrial	152
Deriban	A137	Industrial	152
Dermaton	A164	Industrial	152
Dermotypho	A342	C25	158
Derriban	A137	Industrial	152
Derribante	A137	Industrial	152
Desert Fever	A294	C24	158
Desert Rheumatism	A294	C24	158
Desiccant L-10	A104	Industrial	154
Desmodur 44	A092	Industrial	156
Desmodur T80	A206	Industrial	156
D-Ester	A017	C07	153
Destruxol Borer-Sol	A140	Industrial	129
Detia	A143	Industrial	119
Detia	A133	Industrial	139
Detia Gas Ex-M	A142	Industrial	123
<i>Deuterophoma tracheiphila</i>	—	C28	158
Dew of Death	A014	C08	153
Dexalone	—	C16	154
Dexamfetamine	—	C16	154
Dexamphetamine	—	C16	154
Dexedrine	—	C16	154
Dex-OB	—	C16	154
Dex-sule	—	C16	154
Dexten	—	C16	154
Dextroamphetamine	—	C16	154
Dextrone X	A173	Industrial	152
Dextrostat	—	C16	154
Dextrosule	—	C16	154
DF	A244	C05	154

Agent	Agent Index #	Class Index #	NAERG
DFP	—	C01	153
DHF	A296	C25	158
Di(beta-chloroethyl) Ether	A084	Industrial	152
Di(chloroethyl)methylamine	A020	C09	153
Di(thiophosphoric) Acid, Tetraethyl Ester	A198	Industrial	153
Di-2-chloroethyl Sulfide	A017	C07	153
Di-2-chloroethyl Sulphide	A017	C07	153
Diaethylaminoethanol	A213	Precursor	132
Dialifor	A170	Industrial	152
Dialifos	A170	Industrial	152
Diarsen	A112	Industrial	151
Diarsenic Oxide	A105	Industrial	151
Diarsenic Trioxide	A105	Industrial	151
Diarsonic Trioxide	A105	Industrial	151
Dibenz-(b,f)-1,4-oxazepine	A063	C18	159
Di (2-(beta-Chloroethylthio)ethyl) Ether	A022	C07	153
Dibromchloropropan	A132	Industrial	159
Dibromochloropropane	A132	Industrial	159
Dibromoformoxime	—	C11	154
Dibromomethane	A136	Industrial	160
Dibromure d'Ethylene	A139	Industrial	154
DIC	A210	Precursor	154
DIC Hydrochloride	A210	Precursor	154
Dicarzol	A126	Industrial	151
Dichloorvo	A137	Industrial	152
Dichlor Amine	A020	C09	153
Dichloremulsion	A140	Industrial	129
Dichloren	A020	C09	153
Dichlor-ethylfosfin	A230	Precursor	135
Dichlorfos	A137	Industrial	152
Dichlorman	A137	Industrial	152
Dichlor-mulsion	A140	Industrial	129
Di-chlor-mulsion	A140	Industrial	129
Dichloro	A243	Precursor	137
Dichloro(2-chlorovinyl)arsine	A014	C08	153
Dichloro-(2-chlorovinyl)arsine	A014	C08	153
Dichloro(dimethylamino)phosphine	A224	Precursor	132
Di(beta-chloroethyl) Ether	A084	Industrial	152
Di(2-chloroethyl) Ether	A084	Industrial	152
Di(2-chloroethyl)methylamine	A020	C09	153
Di (2-(beta-Chloroethylthio)ethyl) Ether	A022	C07	153
Di (2-(2-Chloroethylthio)ethyl) Ether	A022	C07	153
Dichloro-1-nitroethane	A131	Industrial	153
Dichloro-4-(methylthio)phenyl O,O-Diethyl Phosphorothioate	A166	Industrial	152
Dichlorodiethyl Sulfide	A017	C07	153
Dichloro-diethyl-sulphide	A017	C07	153
Dichlorodimethyl Ether	A034	C14	153
Dichlorodimethyl Ether, Symmetrical	A034	C14	153
Dichloroethenyl Dimethyl Phosphate	A137	Industrial	152
Dichloroether	A084	Industrial	152
Dichloroethyl Ether	A084	Industrial	152

Agent	Agent Index #	Class Index #	NAERG
Dichloroethyl Oxide	A084	Industrial	152
Dichloroethyl Sulfide	A017	C07	153
Dichloroethylarsine	A013	C08	151
Dichloroethylphosphine	A230	Precursor	135
Dichloroformoxime	A024	C11	154
Dichloromethyl Chloroformate	—	C17	—
Dichloromethyl Phosphine Oxide	A243	Precursor	137
Dichloromethylarsine	A016	C08	152
Dichloromethylphosphine	A240	Precursor	135
Dichloromethylphosphine Oxide	A243	Precursor	137
Dichloronitroethane	A131	Industrial	153
Dichlorophenylarsine	A023	C08	152
Dichlorophos	A137	Industrial	152
Dichlorophosphoric Dimethylamide	A226	Precursor	137
Dichlorosulfane	A261	Precursor	137
Dichlorovas	A137	Industrial	152
Dichlorovinyl Dimethyl Phosphate	A137	Industrial	152
Dichlorovos	A137	Industrial	152
Dichlorphos	A137	Industrial	152
Dichlorvos	A137	Industrial	152
Dick	A013	C08	151
Dicrotophos	A171	Industrial	152
Dicyan	A027	C12	119
Dicyanogen	A027	C12	119
Didi	A245	C05	136
Diethanol Sulfide	A264	Precursor	None
Diethanolethylamine	A229	Precursor	None
Diethanolmethylamine	A239	Precursor	None
Diethoxyphosphine Oxide	A217	Precursor	128
Diethyl Acid Phosphite	A217	Precursor	128
Diethylamine, 2,2'-Dichloro-N-methyl-	A020	C09	153
(Diethylamino)ethanol	A213	Precursor	132
Diethylaminoethanol	A213	Precursor	132
Diethyl 3-Chloro-4-methylumbelliferyl Thionophosphate	A167	Industrial	152
Diethyl 1,3-Dithiolan-2-ylidenephosphoramidate	A194	Industrial	152
Diethyldithiophosphorylacetic Acid, N-Monoisopropylamide	A196	Industrial	152
Diethyl Ethanephosphonate	A214	Precursor	128
Diethylethanolamine	A213	Precursor	132
Diethyl Ethylphosphonate	A214	Precursor	128
Diethylethylphosphonate	A214	Precursor	128
Diethylfluorophosphate	—	C01	153
Diethyl Hydrogen Phosphite	A217	Precursor	128
Diethyl Hydrogen Phosphonate	A217	Precursor	128
Diethyl(2-hydroxyethyl)amine	A213	Precursor	132
Diethyl Methanephosphonate	A215	Precursor	128
Diethyl Methylphosphonate	A215	Precursor	128
Diethyl Methylphosphonite	A216	Precursor	128
Diethylmonoethanolamine	A213	Precursor	132
Diethyl O-(3-Chloro-4-methyl-2-oxo-2H-1-benzopyran-7-yl) Phosphorothioate	A167	Industrial	152

Agent	Agent Index #	Class Index #	NAERG
Diethyl-para-nitrophenyl Monothiophosphate	A177	Industrial	152
Diethylphosphite	A217	Precursor	128
Diethyl Phosphite	A217	Precursor	128
Diethyl Phosphonate	A217	Precursor	128
Diethyl Phosphorofluoridate	—	C01	153
Diethyl-p-nitrophenyl Monothiophosphate	A177	Industrial	152
Diethyl S-(2-(1-Methylethyl)amino-2-oxoethyl) Phosphorodithioate	A196	Industrial	152
Diethyl S-(2-Chloro-1-phthalimidoethyl) Phosphorodithioate	A170	Industrial	152
Diethyl S-(Chloromethyl) Dithiophosphate	A165	Industrial	152
Diethyl S-(N-Isopropylcarbamoymethyl) Phosphorodithioate	A196	Industrial	152
Diethyl S-2-Diethylaminoethyl Phosphorothioate	—	C02	153
Diethyl Sulfide, 2,2'-Dichloro	A017	C07	153
Difenil-metan-diisocianato	A092	Industrial	156
Difenylmethaan-dissocyanat	A092	Industrial	156
Difluoro	A244	CO5	154
Difluoromethylphosphine Oxide	A244	CO5	154
Difosgene	A044	C14	125
Dihydrogen Monosulfide	A032	C12	117
Dihydrogen Sulfide	A032	C12	117
Dihydrooxirene	A141	Industrial	119
Di(2-hydroxyethyl) Sulfide	A264	Precursor	None
Dihydroxyethyl Sulfide	A264	Precursor	None
Di-isocyanate de Toluylene	A206	Industrial	156
Di-(4-isocyanatophenyl)methane	A092	Industrial	156
Di-iso-cyanatoluene	A206	Industrial	156
Diisocyanat-toluol	A206	Industrial	156
Diisopropyl Phosphorofluoridate	—	C01	153
Diisopropylamine	A218	Precursor	132
Diisopropylaminothanol	A219	Precursor	132
Diisopropylidamidophosphoryl Fluoride	A191	Industrial	152
Diisopropylethanolamine	A220	Precursor	132
Di-isopropylethanolamine	A220	Precursor	132
Diisopropylfluorophosphate	—	C01	153
Diisopropylphosphorodiamidic Fluoride	A191	Industrial	152
Diisoproylamine	A218	Precursor	132
DIK	A076	C20	151
Dilic	A106	Industrial	151
Dimecron	A195	Industrial	152
Dimefox	A172	Industrial	152
Dimethoxymethylphosphine Oxide	A223	Precursor	128
Dimethoxyphosphine Oxide	A225	Precursor	128
Dimethyl Acid Phosphite	A225	Precursor	128
Dimethylamidoethoxyphosphoryl Cyanide	A007	C01	153
Dimethylamidophosphoric Acid Dichloride	A226	Precursor	137
(Dimethylamido)phosphoric Dichloride	A226	Precursor	137
Dimethylamidophosphoric Dichloride	A226	Precursor	137
Dimethylamine	A221	Precursor	118
Dimethylamine Hydrochloride	A221	Precursor	118

Agent	Agent Index #	Class Index #	NAERG
Dimethylamino-1-(methylthio)glyoxal O-Methylcarbamoylmonoxime	A130	Industrial	151
(Dimethylamino)dichlorophosphine	A224	Precursor	132
Dimethylaminodichlorophosphine	A224	Precursor	132
Dimethylaminoethoxy-cyanophosphine Oxide	A007	C01	153
(Dimethylamino)-meta-tolyl Methylcarbamate	A121	Industrial	151
(Dimethylamino)-3-methylphenyl Methylcarbamate	A121	Industrial	151
(Dimethylamino)-m-tolyl Methylcarbamate	A121	Industrial	151
(Dimethylamino)phosphonic Dichloride	A226	Precursor	137
Dimethylaminophosphoryl Dichloride	A224	Precursor	132
Dimethyl-1,3-benzodioxol-4-yl Methylcarbamate	A122	Industrial	131
Dimethyl 1,3-Bis(carboxethoxy)-1-propen-2-yl Phosphate	A161	Industrial	152
Dimethylcarbamic Acid 1-[(Dimethylamino)carbonyl]-5-methyl-1H-pyrazol-3-yl Ester	A125	Industrial	151
Dimethylcarbamic Acid 3-Methyl-1-(1-methylethyl)-1H-pyrazol-5-yl Ester	A127	Industrial	151
Dimethylcarbinol	A235	Precursor	129
Dimethyl 1,3-di(carbomethoxy)-1-propen-2-yl Phosphate	A161	Industrial	152
Dimethyl 1,3-Dicarbomethoxy-1-propen-2-yl Phosphate	A161	Industrial	152
Dimethyl 2,2-Dichloroethenyl Phosphate	A137	Industrial	152
Dimethyl-1,1'-dichloroether	A034	C14	153
Dimethyl-1,1-dichloroether	A034	C14	153
Dimethyl 2,2-Dichlorovinyl Phosphate	A137	Industrial	152
Dimethyl Dichlorovinyl Phosphate	A137	Industrial	152
Dimethyl 2-Dimethylcarbamoyl-1-methylvinyl Phosphate	A171	Industrial	152
Dimethyl 1-Dimethylcarbamoyl-1-propen-2-yl Phosphate	A171	Industrial	152
Dimethyldithiophosphoric Acid N-Methylbenzazimide Ester	A160	Industrial	152
Dimethylene Oxide	A141	Industrial	119
Dimethylester Kyseliny Fosforite	A225	Precursor	128
Dimethylester Kyseliny Sirove	A012	C07	156
Dimethyl Ester of Methylphosphonic Acid	A223	Precursor	128
Dimethyl Ethylphosphonate	A222	Precursor	128
((Dimethylethylthio)methyl) O,O-Diethyl Phosphorodithioate	A199	Industrial	131
Dimethylethylphosphonate	A222	Precursor	128
Dimethylfluorophosphate	—	C01	153
Dimethylformocarbothialdine	A135	Industrial	171
Dimethylfosfit	A225	Precursor	128
Dimethylfosfonat	A225	Precursor	128
Dimethylheptylpyran	—	C16	154
Dimethylhydrogen Phosphite	A225	Precursor	128
Dimethylhydrogenphosphite	A225	Precursor	128
Dimethyl 3-Hydroxyglutaconate Dimethyl Phosphate	A161	Industrial	152

Agent	Agent Index #	Class Index #	NAERG
Dimethyl Hydrogen Phosphite	A225	Precursor	128
Dimethyl-5-(isopropyl-3-methyl-pyrazolyl)carbamate	A127	Industrial	151
Dimethyl Methanephosphonate	A223	Precursor	128
Dimethyl 2-Methylcarbamoyl-1-methylvinyl Phosphate	A192	Industrial	152
Dimethyl Methylphosphonate	A223	Precursor	128
Dimethyl-4-(methylthio)phenyl Methylcarbamate	A128	Industrial	151
Dimethyl Monosulfate	A012	C07	156
Dimethyl O,O-Dichlorovinyl-2,2-phosphate	A137	Industrial	152
Dimethyl Parathion	A189	Industrial	152
Dimethyl Phosphite	A225	Precursor	128
Dimethylphosphite	A225	Precursor	128
Dimethyl Phosphonate	A225	Precursor	128
Dimethylphosphoramidic Dichloride	A226	Precursor	137
Dimethylphosphoramidic Dichloride	A224	Precursor	132
Dimethylphosphoroamidocyanidic Acid	A007	C01	153
Dimethyl Phosphorofluoridate	—	C01	153
Dimethyl S-(3-(Mercaptomethyl)-1,2,3-benzotriazin-4(3H)-one) Phosphorodithioate	A160	Industrial	152
Dimethyl-S-(5-methoxypropionyl-2-methyl)thiophosphate	A175	Industrial	152
Dimethyl S-((4-Oxo-1,2,3-benzotriazin-3(4H)-yl)methyl) Phosphorodithioate	A160	Industrial	152
Dimethyl Sulfate	A012	C07	156
Dimethyl Sulphate	A012	C07	156
Dimethylsulfaat	A012	C07	156
Dimethylsulfat	A012	C07	156
Dimethylsulfate	A012	C07	156
Dimetilan	A125	Industrial	151
Dimetilsolfato	A012	C07	156
Dimetox	A172	Industrial	152
Dinate	A112	Industrial	151
Diolice	A167	Industrial	152
Dioxamyl	A130	Industrial	151
Dioxan-2,3-diyl-bis(O,O-diethylphosphorothiolothionate)	A173	Industrial	152
Dioxane Phosphate	A173	Industrial	152
Dioxane-2,3-diyl O,O,O',O'-Tetraethyl Phosphorodithioate	A173	Industrial	152
Dioxanedithiol S,S-Bis(O,O-diethyl Phosphorodithioate)	A173	Industrial	152
Dioxathion	A173	Industrial	152
Dioxation	A173	Industrial	152
Dioxothion	A173	Industrial	152
DIPA	A218	Precursor	132
Diphenyl Methane Diisocyanate	A092	Industrial	156
Diphenyl Methylphosphonate	—	Precursor	—
Diphenylamine Chlorarsine	A073	C20	152
Diphenylaminechloroarsine	A073	C20	152
Diphenylaminochloroarsine	A073	C20	152

Agent	Agent Index #	Class Index #	NAERG
Diphenylarsinous Cyanide	A079	C20	152
Diphenylchloroarsine	A076	C20	151
Diphenylcyanoarsine	A079	C20	152
Diphenylglycolic Acid	A209	Precursor	154
Diphenylmethan-4,4'-diisocyanat	A092	Industrial	156
Diphenylmethane Diisocyanate	A092	Industrial	156
Diphenylmethane-4,4'-diisocyanate	A092	Industrial	156
Diphenylmethane-4-diisocyanate	A092	Industrial	156
Diphosgene	A044	C14	125
Diphosphoramidate, Octamethyl-	A197	Industrial	152
Diphosphoric Acid Tetraethyl Ester	A200	Industrial	152
Diphosphorous Acid, Tetraethyl Ester	A200	Industrial	152
Di-phosphorus Pentasulfide	A249	Precursor	139
Diphtheria	A297	C24	158
Dipping acid	A203	Industrial	137
Direkt-Lost	A017	C07	153
Di-s-butyl Phosphorofluoridate	—	C01	153
Di-s-butylfluorophosphate	—	C01	153
Di-sec-butyl Phosphorofluoridate	—	C01	153
Di-sec-butylfluorophosphate	—	C01	153
Di-secondary-butyl Phosphorofluoridate	—	C01	153
Di-secondary-butylfluorophosphate	—	C01	153
Disodium Difluoride	A257	Industrial	154
Disodium Methanearsenate	A112	Industrial	151
Disodium Methyl Arsonate	A112	Industrial	151
Disodium Methylarsonate	A112	Industrial	151
Disodium Monomethylarsonate	A112	Industrial	151
Disodium Sulfide	A258	Precursor	135
Distilled Mustard	A017	C07	153
Disulfoton	A174	Industrial	152
Disulfur Decafluoride	A045	C14	154
Disulfur Dichloride	A262	Precursor	137
Disulfur Tetrachloride	A261	Precursor	137
Disulphur Decafluoride	A045	C14	154
Di-Syston	A174	Industrial	152
Di-Tac	A112	Industrial	151
Dithio	A198	Industrial	153
Dithio (Pesticide)	A198	Industrial	153
Dithio Insecticidal Smoke	A198	Industrial	153
Dithiocarbonic Anhydride	A089	Industrial	131
Dithiodemeton	A174	Industrial	152
Dithiodiphosphoric Acid, Tetraethyl Ester	A198	Industrial	153
Dithiofos	A198	Industrial	153
Dithion	A198	Industrial	153
Dithione	A198	Industrial	153
Dithiophos	A198	Industrial	153
Dithiophosphoric Acid O,O'-Dimethyl-S-[(2-methoxy-1,3,4-thiadiazol-5(4H)-on-4-yl)methyl] Ester	A188	Industrial	152
Dithiophosphoric Acid O,O'-Dimethyl-S-[(5-methoxy-1,3,4-thiadiazol-2(3H)-one-3-yl] Ester	A188	Industrial	152
Dithiopyrophosphate de Tetraethyle	A198	Industrial	153

Agent	Agent Index #	Class Index #	NAERG
Dithiopyrophosphoric Acid, Tetraethyl Ester	A198	Industrial	153
Dithiosystox	A174	Industrial	152
Dithiotep	A198	Industrial	153
Divipan	A137	Industrial	152
DJ	A023	C08	152
DL	A017	C07	153
D-Lost	A017	C07	153
d-LSD	—	C16	154
d-Lysergic Acid Diethylamide	—	C16	154
DM	A073	C20	152
DMA	A112	Industrial	151
DMA 100	A112	Industrial	151
DMAEDEAFP	—	C03	153
DMAEDMAFP	A002	C03	153
DMAPDEAFP	—	C03	153
DMAPDMAFP	A003	C03	153
DMHP	A225	Precursor	128
DMMP	A223	Precursor	128
DMP	A225	Precursor	128
DMPADC	A226	Precursor	137
DMS	A012	C07	156
DMSA	A112	Industrial	151
DMTT	A135	Industrial	171
DNTP	A177	Industrial	152
Docurb	—	C16	154
Dojyopicrin	A041	C14	154
Dolochlor	A041	C14	154
Domafate	—	C16	154
Doppelost	A017	C07	153
Dormol	A094	Industrial	132
Dotan	A165	Industrial	152
<i>Dothidella ulei</i>	—	C28	158
Double Red Star	—	C12	—
Dowfume MC-2	A142	Industrial	123
Dowfume MC-2 Fumigant	A142	Industrial	123
Dowfume MC-2R	A142	Industrial	123
Dowfume MC-33	A142	Industrial	123
Dowfume W-85	A139	Industrial	154
DP	A044	C14	125
DPX 1410	A130	Industrial	151
DPX 1410 L	A130	Industrial	151
Draza	A128	Industrial	151
Drexar 530	A116	Industrial	151
Drexel MSMA 6 Plus	A116	Industrial	151
Drexel MSMA 6.6	A116	Industrial	151
Drexel Plant Bed Gas	A142	Industrial	123
DSDP	—	C02	153
DSMA	A112	Industrial	151
DSS	A296	C25	158
D-Stoff	A012	C07	156
Du Pont 1410	A130	Industrial	151
Duo-Kill	A137	Industrial	152

Agent	Agent Index #	Class Index #	NAERG
Duragesic	—	C16	154
Duraphat	A257	Industrial	154
Duraphos	A190	Industrial	152
Duravos	A137	Industrial	152
Durham Nematicode EM 17.1	A132	Industrial	159
Dutch Liquid	A140	Industrial	129
Dutch Oil	A140	Industrial	129
Dwubromoetan	A139	Industrial	154
Dwuchlorodwuetylowy Eter	A084	Industrial	152
Dwumetylowy Siarczan	A012	C07	156
Dyanacide	A156	Industrial	151
Dycarb	A122	Industrial	131
Dyfonate	A182	Industrial	152

*E*

E	—	C07	153
E393	A198	Industrial	153
E 601	A189	Industrial	152
E 605	A177	Industrial	152
E-1059	A169	Industrial	152
EA 1034	A014	C08	153
EA 1205	A007	C01	153
EA 1208	A004	C01	153
EA 1210	A005	C01	153
EA 1212	A001	C01	153
EA 1251	A244	C05	154
EA 1253	A243	Precursor	137
EA 1356	—	C01	153
EA 1476	—	C16	154
EA 1664	A009	C02	153
EA 1699	A008	C02	153
EA 1701	A010	C02	153
EA 1779	A060	C17	159
EA 2148	—	C16	154
EA 2223	—	C01	153
EA 2277	A055	C16	154
EA 302196(B)	—	C16	154
EA 3148	—	C02	153
EA 3167	—	C16	154
EA 3317	—	C02	153
EA 3443	—	C16	154
EA 3534	—	C01	153
EA 3547	A063	C18	159
EA 3580A	—	C16	154
EA 3580B	—	C16	154
EA 3834A	—	C16	154
EA 3834B	—	C16	154
EA 3887	—	C06	153
EA 3990	—	C06	153
EA 4352	—	C01	153
EA 4923	A068	C18	159

Agent	Agent Index #	Class Index #	NAERG
EA 5365	A002	C03	153
EA 5366	—	C03	153
EA 5414	A003	C03	153
EA 5488	—	C03	153
Earth	—	C16	154
Eastern Encephalitis	A298	C25	158
Eastern Equine Encephalitis	A298	C25	158
Eastern Equine Encephalomyelitis	A298	C25	158
EBA	A019	C09	153
EBO	A299	C24	158
Ebola	A299	C24	158
Ebola Hemorrhagic Fever	A299	C24	158
Ebola Virus Hemorrhagic Fever	A299	C24	158
Ecgonine, Methyl Ester, Benzoate	—	C16	154
Ecgonine, Methyl Ester, Benzoate (Ester)	—	C16	154
<i>E. coli</i> O157:H7	A304	C26	158
<i>E. coli</i> , Serotype O157:H7	A304	C26	158
ECO157:H7	A304	C26	158
Ecstasy	—	C16	154
ED	A013	C08	151
ED7400000	A085	Industrial	157
EDB	A139	Industrial	154
EDB-85	A139	Industrial	154
EDC	A140	Industrial	129
EDCO	A142	Industrial	123
Edemo	A009	C02	153
Edemo-3	A009	C02	153
EDMP	A227	C05	128
EEE	A298	C25	158
EHEC	A304	C26	158
EI 3911	A193	Industrial	152
EI 47031	A194	Industrial	152
EI 47470	A186	Industrial	152
Ektafos	A171	Industrial	152
El Tor	A293	C26	158
EL2276000	A250	Precursor	127
Elinol	—	C16	154
Elosal	A259	Precursor	133
Embafume	A142	Industrial	123
Embichin	A020	C09	153
Emerald Green	A110	Industrial	151
Emisan 6	A155	Industrial	151
EMPTA	A228	Precursor	153
Endemic Typhus	A341	C25	158
Endemic-Epidemic Hemorrhagic Virosis	A307	C24	158
Endocide	A175	Industrial	152
Endothion	A175	Industrial	152
Engraver's Acid	A100	Industrial	157
ENT 54	A081	Industrial	131P
ENT 1656	A140	Industrial	129
ENT 4504	A084	Industrial	152
ENT 15108	A177	Industrial	152

Agent	Agent Index #	Class Index #	NAERG
ENT 15349	A139	Industrial	154
ENT 16273	A198	Industrial	153
ENT 17957	A167	Industrial	152
ENT 18771	A200	Industrial	152
ENT 20738	A137	Industrial	152
ENT 22374	A190	Industrial	152
ENT 22879	A173	Industrial	152
ENT 22897	A173	Industrial	152
ENT 23233	A160	Industrial	152
ENT 23347	A174	Industrial	152
ENT 24042	A193	Industrial	152
ENT 24482	A171	Industrial	152
ENT 24833	A161	Industrial	152
ENT 24980-X	—	C02	153
ENT 25294	A020	C09	153
ENT 25515	A195	Industrial	152
ENT 25644	A178	Industrial	152
ENT 25784	A121	Industrial	151
ENT 25830	A194	Industrial	152
ENT 25991	A186	Industrial	152
ENT 26263	A141	Industrial	119
ENT 27093	A120	Industrial	151
ENT 27129	A192	Industrial	152
ENT 27396	A187	Industrial	152
ENT 27920	A199	Industrial	131
ENT 172921	A189	Industrial	152
Enteric Fever	A340	C26	158
Enteritis Necroticans	A300	C24	158
Enterohemorrhagic <i>Escherichia coli</i> , Serotype O157:H7	A304	C26	158
EPA Pesticide Chemical Code 000701	A056	C18	131P
EPA Pesticide Chemical Code 008701	A036	C14	154
EPA Pesticide Chemical Code 011301	A132	Industrial	159
EPA Pesticide Chemical Code 016401	A089	Industrial	131
EPA Pesticide Chemical Code 020501	A038	C14	124
EPA Pesticide Chemical Code 025801	A028	C12	125
EPA Pesticide Chemical Code 042002	A139	Industrial	154
EPA Pesticide Chemical Code 042501	A144	Industrial	127P
EPA Pesticide Chemical Code 045601	A097	Industrial	125
EPA Pesticide Chemical Code 045801	A030	C12	117
EPA Pesticide Chemical Code 045901	A096	Industrial	125
EPA Pesticide Chemical Code 047501	A235	Precursor	129
EPA Pesticide Chemical Code 053201	A142	Industrial	123
EPA Pesticide Chemical Code 074002	A256	Precursor	157
EPA Pesticide Chemical Code 077601	A202	Industrial	125
EPA Pesticide Chemical Code 078001	A203	Industrial	137
EPA Pesticide Chemical Code 599600	A252	Precursor	157
Epidemic Hemorrhagic Fever	A303	C24	158
Epidemic Typhus	A342	C25	158
Epizootic Abortion	A291	C24	158
Epizootic Aphthae	—	C27	158
EPN	A176	Industrial	152

Agent	Agent Index #	Class Index #	NAERG
Epoxypropane	A144	Industrial	127P
Equigard	A137	Industrial	152
Equigel	A137	Industrial	152
Equiguard	A137	Industrial	152
Equine Nasal Phthisis	A301	C27	158
Eritroxilina	—	C16	154
<i>Erwinia carotovora</i>	—	C28	158
<i>Erysiphe graminis</i>	—	C28	158
Erytroxylin	—	C16	154
<i>Escherichia coli</i> O157:H7	A304	C26	158
<i>Escherichia coli</i> , Serotype O157:H7	A304	C26	158
Estrosel	A137	Industrial	152
Estrosol	A137	Industrial	152
Ethanamine, 2-Chloro-N-(2-chloroethyl)-N-methyl-	A020	C09	153
Ethanamine, 2-Chloro-N-(2-chloroethyl)-N-ethyl-	A019	C09	153
Ethanamine, 2-Chloro-N,N-bis(2-chloroethyl)-	A021	C09	153
Ethane Dichloride	A140	Industrial	129
Ethane, 1,2-Dibromo-	A139	Industrial	154
Ethane, 1,2-Dichloro-	A140	Industrial	129
Ethane, 1,1-Dichloro-1-nitro-	A131	Industrial	153
Ethane, 1,1'-Oxybis(2-chloro-	A084	Industrial	152
Ethane, 1,1'-Thiobis(2-chloro-	A017	C07	153
Ethanedinitrile	A027	C12	119
Ethanephosphonic Acid Diethyl Ester	A214	Precursor	128
Ethanephosphonic Dichloride	A232	Precursor	154
Ethanimidothioic Acid, 2-(Dimethylamino)-N-[[[(methylamino)carbonyl]oxy]-2-oxo-, Methyl Ester	A130	Industrial	151
Ethanol, 2-[Bis(1-methylethyl)amino]-	A220	Precursor	132
Ethanol, 2-Chloro-	A211	Precursor	131
Ethanol, 2-(Diethylamino)-	A213	Precursor	132
Ethanol, 2-(Diisopropylamino)-	A220	Precursor	132
Ethanol, 2,2'-(Ethylimino)bis-	A229	Precursor	None
Ethanol, 2,2'-(Ethylimino)di-	A229	Precursor	None
Ethanol, 2,2'-(Methylimino)bis-	A239	Precursor	None
Ethanol, 2,2'-(Methylimino)di-	A239	Precursor	None
Ethanol, 2,2',2''-Nitrilotri-	A266	Precursor	None
Ethanol, 2,2',2''-Nitrilotris-	A266	Precursor	None
Ethanol, 2,2'-Thiobis-	A264	Precursor	None
Ethanol, 2,2'-Thiodi-	A264	Precursor	None
Ethanone, 2-Chloro-1-phenyl-	A064	C17	153
Ethene, Chlorohydrin	A211	Precursor	131
Ethenol, 2,2-Dichloro-, Dimethyl Phosphate	A137	Industrial	152
Ether, Bis(2-chloroethyl)	A084	Industrial	152
Ether Dichlore	A084	Industrial	152
Ethide	A131	Industrial	153
Ethylamine, Bis(2-hydroxyethyl)-	A229	Precursor	None
Ethylbis(β-chloroethyl)amine	A019	C09	153
Ethylbis(2-chloroethyl)amine	A019	C09	153
Ethylbis(2-hydroxyethyl)amine	A229	Precursor	None
Ethylbis(beta-chloroethyl)amine	A019	C09	153

Agent	Agent Index #	Class Index #	NAERG
Ethyl Bromoacetate	—	C17	155
Ethylchlorohydrin	A211	Precursor	131
Ethyl Chlorosulfonate	—	C07	156
Ethyl dibromoarsine	—	C08	151
Ethyl dichloroarsine	A013	C08	151
Ethyl Dichloroarsine	A013	C08	151
Ethyl dichlorophosphine	A230	Precursor	135
Ethyl diethanolamine	A229	Precursor	None
Ethyl (2-Diisopropylaminoethyl) Methylphosphonite	A227	C05	128
Ethyl dimethylaminocyanophosphonate	A007	C01	153
Ethyl Dimethylamidofluorophosphate	—	C01	153
Ethyl Dimethylphosphoramidocyanidate	A007	C01	153
Ethylene-chlorohydrine	A211	Precursor	131
Ethylene dichloride	A140	Industrial	129
Ethylene Bis-β-chloroethylsulfide	A025	C07	153
Ethylene Bis-beta-chloroethylsulfide	A025	C07	153
Ethylene Bromide	A139	Industrial	154
Ethylene Chlorohydrin	A211	Precursor	131
Ethylene Chloride	A140	Industrial	129
Ethylene Chlorohydrin	A211	Precursor	131
Ethylene Dibromide	A139	Industrial	154
Ethylene Dichloride	A140	Industrial	129
Ethylene Glycol, Chlorohydrin	A211	Precursor	131
Ethylene Oxide	A141	Industrial	119
Ethylene Oxide, Methyl-	A144	Industrial	127P
Ethyl Ester of Dimethylphosphoroamidocyanidic Acid	A007	C01	153
Ethyl Ethoxy S-2-(N,N-Diethylaminoethyl) Thiophosphonate	—	C02	153
Ethyl Formate	A138	Industrial	129
Ethylformiaat	A138	Industrial	129
Ethyle (Formiate d')	A138	Industrial	129
Ethyl Formic Ester	A138	Industrial	129
Ethyl Iodoacetate	—	C17	—
Ethyl Methanoate	A138	Industrial	129
Ethyl-3-methyl-4-(methylthio)phenyl(1-methylethyl)phosphoramidate	A179	Industrial	152
Ethyl 4-(Methylthio)-meta-tolyl Isopropylphosphoramidate	A179	Industrial	152
Ethyl 4-(Methylthio)-m-tolyl Isopropylphosphoramidate	A179	Industrial	152
Ethyl N-(2-Chloroethyl)-N-nitrosocarbamate	—	C09	153
Ethyl N,N-Dimethylphosphoramidocyanidate	A007	C01	153
Ethyl N-Dimethylphosphoramidocyanidate	A007	C01	153
Ethyl O-(2,4,5-Trichlorophenyl) Ethylphosphonothioate	A180	Industrial	152
Ethyl para-Nitrophenyl Benzenethiophosphonate	A176	Industrial	152
Ethyl Parathion	A177	Industrial	152
Ethyl Phosphinyl Dichloride	A230	Precursor	135
Ethylphosphinyl Dichloride	A230	Precursor	135
Ethyl Phosphinyl Difluoride	A231	Precursor	136

Agent	Agent Index #	Class Index #	NAERG
Ethyl Phosphite	A267	Precursor	129
Ethyl Phosphite	A217	Precursor	128
Ethyl Phosphonate	A217	Precursor	128
Ethylphosphonic Dichloride	A232	Precursor	154
Ethylphosphonodithioic Acid O-Ethyl S-Phenyl Ester	A182	Industrial	152
Ethylphosphonothioic Acid O-Ethyl O-(2,4,5-Trichlorophenyl) Ester	A180	Industrial	152
Ethylphosphonothioic Dichloride	A233	Precursor	154
Ethyl Phosphonothioic Dichloride	A233	Precursor	154
Ethyl Phosphonothioic Dichloride, Anhydrous	A233	Precursor	154
Ethyl Phosphonous Dichloride, Anhydrous	A230	Precursor	135
Ethylphosphonyl Dichloride	A232	Precursor	154
Ethyl Phosphonyl Dichloride	A232	Precursor	154
Ethyl Phosphonyl Difluoride	—	Precursor	—
Ethylphosphoric Dichloride	A232	Precursor	154
Ethyl Phosphorodichloride	A232	Precursor	154
Ethylphosphorodimethylamidocyanidate Ethyl Ester	A007	C01	153
Ethyl Phosphorus Dichloride	A232	Precursor	154
Ethyl p-Nitrophenyl Benzenethiophosphonate	A176	Industrial	152
Ethyl Pyrophosphate	A200	Industrial	152
Ethyl Pyrophosphate, Tetra-	A200	Industrial	152
Ethyl-S	A019	C09	153
Ethyl Sarin	—	C01	153
Ethyl-S-dimethylaminoethyl Methylphosphonothiolate	A010	C02	153
Ethyl Thio	A198	Industrial	153
Ethyl Thiopyrophosphate	A198	Industrial	153
Etile (Formiato di)	A138	Industrial	129
Etilon	A177	Industrial	152
ETO	A141	Industrial	119
Etylenu Tlenek	A141	Industrial	119
European Typhus	A342	C25	158
Eutectic White Phosphorous	—	C21	136
Evercyn	A030	C12	117
EWP	—	C21	136
Excelsior	—	C20	—
Exolit Lpkn	—	C21	136
Exolit VPK-N 361	—	C21	136
Extraintestinal Yersiniosis	A348	C26	158

*F*

F	A048	C14	125
FAC	A196	Industrial	152
FAC 20	A196	Industrial	152
Falisan	A155	Industrial	151
Famfos	A178	Industrial	152
Famine Fever	A328	C25	158

Agent	Agent Index #	Class Index #	NAERG
Famophos	A178	Industrial	152
Famphur	A178	Industrial	152
Fannoform	A094	Industrial	132
Farcy	A301	C27	158
Far East Spring-Summer Encephalitis	A332	C25	158
Far Eastern Tickborne Encephalitis	A332	C25	158
Farmer's Lung	—	C29	158
Fast Death Factor	A280	C22	153
Fatsco Ant Poison	A118	Industrial	151
FC1240000	A122	Industrial	131
FC2200000	A145	Industrial	—
FDA 0101	A257	Industrial	154
FDf	A280	C22	153
Febre Maculosa	A331	C25	158
Fecama	A137	Industrial	152
Fekama	A137	Industrial	152
FEMA # 2929	A235	Precursor	129
Femma	A156	Industrial	151
Fenamiphos	A179	Industrial	152
Fennosan B 100	A135	Industrial	171
Fenophosphon	A180	Industrial	152
Fensulfothion	A181	Industrial	152
Fentanest	—	C16	154
Fentanyl	—	C16	154
FF6650000	A089	Industrial	131
Ficam	A122	Industrial	131
Ficam 80 W	A122	Industrial	131
Ficam D	A122	Industrial	131
Ficam Plus	A122	Industrial	131
Ficam ULV	A122	Industrial	131
Ficam W	A122	Industrial	131
Fiebre Manchada	A331	C25	158
Fiebre Petequial	A331	C25	158
Filariol	A162	Industrial	152
Fisons NC 6897	A122	Industrial	131
Flame Smoke No. 1	—	C21	136
Flame Smoke No. 2	—	C21	136
Flea Typhus	A341	C25	158
Fleaborne Typhus	A341	C25	158
Fleckfieber	A342	C25	158
Flo-mor	A102	Industrial	133
Floridine	A257	Industrial	154
Florocid	A257	Industrial	154
Florocide	A257	Industrial	154
Flour Sulfur	A259	Precursor	133
Flowers of Sulfur	A259	Precursor	133
Flowers of Sulphur	A259	Precursor	133
Flozenges	A257	Industrial	154
Flridine	A257	Industrial	154
Fluonatril	A257	Industrial	154

Agent	Agent Index #	Class Index #	NAERG
Fluophosphoric Acid di(Dimethylamide)	A172	Industrial	152
Fluor	A093	Industrial	124
Fluoraday	A257	Industrial	154
Fluoral	A257	Industrial	154
Fluorid Sodny	A257	Industrial	154
Fluoride, Sodium	A257	Industrial	154
Fluorident	A257	Industrial	154
Fluorigard	A257	Industrial	154
Fluorine	A093	Industrial	124
Fluorineed	A257	Industrial	154
Fluorinse	A257	Industrial	154
Fluoritab	A257	Industrial	154
Fluorlost	—	C07	153
Fluoro	A093	Industrial	124
Fluoroacetic Acid, Sodium Salt	A159	Industrial	151
Fluorobis(isopropylamino)phosphine Oxide	A191	Industrial	152
Fluorocid	A257	Industrial	154
Fluor-O-Kote	A257	Industrial	154
Fluorol	A257	Industrial	154
Fluoromethylpinacolyloxyphosphine Oxide	A005	C01	153
Fluoros	A257	Industrial	154
Fluorowodor	A097	Industrial	125
Fluortabun	—	C01	153
Fluorure de Bore	A087	Industrial	125
Fluorure de Potassium	A253	Precursor	154
Fluorure de Sodium	A257	Industrial	154
Fluorure de Sulfuryle	A146	Industrial	123
Fluorure d'Hydrogene Anhydre	A097	Industrial	125
Fluorures Acide	A093	Industrial	124
Fluoruri Acidi	A093	Industrial	124
Fluoruro de Hidrogeno Anhidro	A097	Industrial	125
Fluorwasserstoff	A097	Industrial	125
Fluorwaterstof	A097	Industrial	125
Fluothane	—	C16	154
Fluphenazine	—	C16	154
Flura	A257	Industrial	154
Flura Drops	A257	Industrial	154
Flura-Gel	A257	Industrial	154
Flura-Loz	A257	Industrial	154
Flurcare	A257	Industrial	154
Flurexal	A257	Industrial	154
Flursol	A257	Industrial	154
Flux	A257	Industrial	154
Fly Bait Grits	A161	Industrial	152
Fly Fighter	A137	Industrial	152
Fly-Die	A137	Industrial	152
FM	—	C21	137
FMA	A156	Industrial	151
FMD	—	C27	158
Folidol	A177	Industrial	152
Folidol-M	A189	Industrial	152
Fonofos	A182	Industrial	152

Agent	Agent Index #	Class Index #	NAERG
Foot and Mouth Disease	—	C27	158
Forestite	A030	C12	117
Formagene	A102	Industrial	133
Formaldehyde	A094	Industrial	132
Formaldehyde (solution)	A094	Industrial	132
Formalin	A094	Industrial	132
Formalith	A094	Industrial	132
Formetanate	A126	Industrial	151
Formetanate HCl	A126	Industrial	151
Formetanate Hydrochloride	A126	Industrial	151
Formic Acid, Chloro-, Trichloromethyl Ester	A044	C14	125
Formic Acid, Ethyl Ester	A138	Industrial	129
Formic Aldehyde	A094	Industrial	132
Formic Anammonide	A030	C12	117
Formol	A094	Industrial	132
Formonitrile	A030	C12	117
Fosferno	A177	Industrial	152
Fosforo (Pentacloruro di)	A248	Precursor	137
Fosforo (Tricloruro di)	A201	Industrial	137
Fosforo Bianco	—	C21	136
Fosforo(pentacloruro di)	A248	Precursor	137
Fosforowodor	A143	Industrial	119
Fosforoxychlorid	A247	Precursor	137
Fosforpentachloride	A248	Precursor	137
Fosfortrichloride	A201	Industrial	137
Fosgeen	A048	C14	125
Fosgen	A048	C14	125
Fosgen Oksim	A024	C11	154
Fosgene	A048	C14	125
Fosthietan	A183	Industrial	152
Fostion	A196	Industrial	152
Fosvel	A185	Industrial	152
Fosvex	A200	Industrial	152
Fowl Plague	—	C27	158
Fraissite	—	C17	—
Francis Disease	A339	C25	158
<i>Francisella tularensis</i>	A339	C25	158
Fratol	A159	Industrial	151
French Green	A110	Industrial	151
Freon 150	A140	Industrial	129
Frumin AL	A174	Industrial	152
Frumin G	A174	Industrial	152
FS	—	C21	137
F1-Tabs	A257	Industrial	154
<i>F. tularensis</i>	A339	C25	158
Fuam	A122	Industrial	131
Fugu Poison	A289	C22	153
Fumagon	A132	Industrial	159
Fumazon 86	A132	Industrial	159
Fumazone	A132	Industrial	159
Fumazone 86E	A132	Industrial	159
Fumic Acid	—	C21	137

Agent	Agent Index #	Class Index #	NAERG
Fumigant-1	A142	Industrial	123
Fumitoxin	A133	Industrial	139
Fungicide R	A156	Industrial	151
Fungitox	A156	Industrial	151
Fungitox OR	A156	Industrial	151
Fungol B	A257	Industrial	154
Furadan	A123	Industrial	151
Fusariotoxin T-2	A287	C23	153
FX5730000	A090	Industrial	137
Fyde	A094	Industrial	132

G

G	A007	C01	153
G25	A041	C14	154
G 22870	A125	Industrial	151
G-23611	A127	Industrial	151
GA	A007	C01	153
Gallotox	A156	Industrial	151
gamma-Aminopyridine	A157	Industrial	153
gamma-Chloroethanol	A211	Precursor	131
gamma-Chloroisobutylene	A134	Industrial	129P
gamma-Lewisit	—	C08	153
Garrathion	A163	Industrial	152
Garrotillo	A297	C24	158
Garvox	A122	Industrial	131
Gas Gangrene	A300	C24	158
Gas-Ex-B	A143	Industrial	119
Gastoxin	A133	Industrial	139
Gatorooter	A145	Industrial	—
GB	A004	C01	153
GB2	—	C05	153
GB-2	A274	C22	153
GC 3707	A161	Industrial	152
GD	A005	C01	153
GE	—	C01	153
Gel II	A257	Industrial	154
Gelan	A007	C01	153
Gelan I	A007	C01	153
Gelan III	A004	C01	153
Gelber Phosphor	—	C21	136
Gelbkreuz	A017	C07	153
Gelbkreuz 1	A035	C14	—
Gelbkreuz 1 (second filling)	—	C08	151
Gelbring-1	A017	C07	153
Gelbring-2	A018	C07	153
Gelution	A257	Industrial	154
GF	A001	C01	153
G I	A279	C22	153
Gibraltar Fever	A291	C24	158
G II	A279	C22	153
G III	A279	C22	153

Agent	Agent Index #	Class Index #	NAERG
Girl	—	C16	154
Glanders	A301	C27	158
Gleem	A257	Industrial	154
Glicol Monocloridrina	A211	Precursor	131
Glycol Bromide	A139	Industrial	154
Glycol Chlorohydrin	A211	Precursor	131
Glycol Dibromide	A139	Industrial	154
Glycol Dichloride	A140	Industrial	129
Glycol Monochlorohydrin	A211	Precursor	131
Glycolmonochloorhydrine	A211	Precursor	131
Glycomonochlorohydrin	A211	Precursor	131
Glycomonochlorohydrin	A211	Precursor	131
Glycine A	A264	Precursor	None
GN630000	A167	Industrial	152
Goat Pox	—	C27	158
Gold Dust	—	C16	154
Golden Dew	A259	Precursor	133
Gothnion	A160	Industrial	152
GP	A002	C03	153
Gramisan	A155	Industrial	151
Granosan	A140	Industrial	129
Grayanotoxins	A279	C22	153
Green Cross	A048	C14	125
Green Cross	A044	C14	125
Green Monkey Disease	A315	C24	158
Green Star	A042	C14	—
Grisol	A200	Industrial	152
Gro-Tone Nematode Granular	A132	Industrial	159
Ground Vocle Sulfur	A259	Precursor	133
Grun 1	A048	C14	125
Grun 3	A005	C01	153
Grunkreuz	A044	C14	—
Grunkreuz	A044	C14	125
Grunkreuz 1	—	C14	—
Grunkreuz 2	A050	C14	—
Grunkreuz 3	—	C14	—
Grunring 1	A021	C09	153
Grunring 2	A048	C14	125
Grunring 3	A007	C01	153
Grunring 4	A004	C01	153
Grunring 5	A030	C12	117
GS 13005	A188	Industrial	152
GS-13332	A125	Industrial	151
GT-23	—	C02	153
GT-23 (Russian)	—	C02	153
Guanarito	A302	C24	158
Guanarito Hemorrhagic Fever	A302	C24	158
Gusathion	A160	Industrial	152
Gusathion 25	A160	Industrial	152
Gusathion K	A160	Industrial	152
Gusathion M	A160	Industrial	152
Gusathion Methyl	A160	Industrial	152

Agent	Agent Index #	Class Index #	NAERG
Gusathion-20	A160	Industrial	152
Gusthion M	A160	Industrial	152
Guthion	A160	Industrial	152
Gution	A160	Industrial	152
Gypsine	A113	Industrial	151

H

H	A017	C07	153
H 321	A128	Industrial	151
Halon 1001	A142	Industrial	123
Halothane	—	C16	154
Haltox	A142	Industrial	123
Hanane	A172	Industrial	152
Hantaan	A303	C24	158
Hantavirus Adult Respiratory Distress Syndrome	A335	C24	158
Hantavirus Pulmonary Syndrome	A335	C24	158
Happy Dust	—	C16	154
Hartosol	A235	Precursor	129
Hautwurm	A301	C27	158
<i>H. capsulati</i>	A305	C24	158
<i>H. capsulatum</i>	A305	C24	158
HD	A017	C07	153
<i>H. duboisii</i>	A305	C24	158
Heavenly Blue	—	C16	154
<i>Helminthosporium oryzae</i>	—	C28	158
Hemorrhagic Colitis	A304	C26	158
Hemorrhagic Nephrosonephritis	A303	C24	158
HEPT	A200	Industrial	152
Herb-All	A116	Industrial	151
Hercules 14503	A170	Industrial	152
Hercules 528	A173	Industrial	152
Hercules AC528	A173	Industrial	152
Herkal	A137	Industrial	152
Herkol	A137	Industrial	152
Hetamine	—	C16	154
Hexachlorodimethyl Oxalate	—	C14	—
Hexamite	A200	Industrial	152
Hexasul	A259	Precursor	133
HFRS	A303	C24	158
Hiberno-Vernal Bronchopneumonia	A327	C24	158
Higosan	A155	Industrial	151
<i>Histoplasma capsulatum</i>	A305	C24	158
Histoplasmosis	A305	C24	158
<i>Histoplasmosis capsulati</i>	A305	C24	158
Historic Typhus	A342	C25	158
Histotoxic Infections	A300	C24	158
His-Werner Disease	A338	C25	158
Hi-Yield Desiccant H-10	A104	Industrial	154
HL	—	C10	153
HL-331	A156	Industrial	151
HN1	A019	C09	153

Agent	Agent Index #	Class Index #	NAERG
HN2	A020	C09	153
HN3	A021	C09	153
HOG	—	C16	154
Hog Cholera	—	C27	158
Homomartonite	—	C17	—
Hong Nien	A156	Industrial	151
Hoof and Mouth Disease	—	C27	158
Hostaquik	A156	Industrial	151
Hot Stuff	A017	C07	153
HP	—	C07	153
HPS	A335	C24	158
HQ	—	C07	153
HS	A017	C07	153
HT	—	C07	153
Human Typhus	A342	C25	158
Hun Stoffe	A017	C07	153
HVY	—	C19	—
Hydrochloric Acid Gas	A096	Industrial	125
Hydrochloride	A096	Industrial	125
Hydrocyanic Acid	A030	C12	117
Hydrocyanic Acid Sodium Salt	A256	Precursor	157
Hydrocyanic Acid, Potassium Salt	A252	Precursor	157
Hydrocyanic Acid, Sodium Salt	A256	Precursor	157
Hydrogen Arsenide	A026	C13	119
Hydrogen Bromide	A095	Industrial	125
Hydrogen Bromide, Anhydrous	A095	Industrial	125
Hydrogen Chloride	A096	Industrial	125
Hydrogen Chloride (Anhydrous)	A096	Industrial	125
Hydrogen Cyanide	A030	C12	117
Hydrogen Diethyl Phosphite	A217	Precursor	128
Hydrogen Dimethyl Phosphite	A225	Precursor	128
Hydrogen Fluoride	A097	Industrial	125
Hydrogen Fluoride, Anhydrous	A097	Industrial	125
Hydrogen Nitrate	A100	Industrial	157
Hydrogen Phosphide	A143	Industrial	119
Hydrogen Potassium Fluoride	A251	Precursor	154
Hydrogen Sulfate	A203	Industrial	137
Hydrogen Sulfide	A032	C12	117
Hydrogen Sulfure	A032	C12	117
Hydrogen Sulphide	A032	C12	117
Hydrogene Sulphure	A032	C12	117
Hydrophobia	A313	C24	158
Hydrosulfuric Acid	A032	C12	117
Hydroxy-2-pentanedioic Acid, Dimethyl Ester, Dimethyl Phosphate	A161	Industrial	152
Hydroxyglutaconic Acid, Dimethyl Ester, Dimethyl Phosphate	A161	Industrial	152
Hylene M50	A092	Industrial	156
Hylene T	A206	Industrial	156
Hylene TLC	A206	Industrial	156
Hyperite	A017	C07	153

Agent	Agent Index #	Class Index #	NAERG
<i>I</i>			
Idrogeno Solforato	A032	C12	117
IE	—	C28	158
IM4025000	A218	Precursor	132
Imsol A	A235	Precursor	129
India Tick Typhus	A316	C25	158
Infectious Abortion	A291	C24	158
Infectious Ovine Encephalomyelitis	A311	C25	158
Infectious Porcine Encephalomyelitis	—	C27	158
Inferno	—	C02	153
Insecticide 1179	A129	Industrial	151
Insecticide-Nematicide 1410	A130	Industrial	151
Insectigas D	A137	Industrial	152
Intestinal Yersiniosis	A348	C26	158
Iodoacetone	—	C17	—
Iodomethylbenzene	—	C17	156
IP8750000	A221	Precursor	118
IPA	A235	Precursor	129
Iprit	A017	C07	153
i-Propanol	A235	Precursor	129
i-Propyl Alcohol	A235	Precursor	129
i-Propylalkohol	A235	Precursor	129
Iradicav	A257	Industrial	154
Isanol	A235	Precursor	129
Isobrome	A142	Industrial	123
Isobrome D	A139	Industrial	154
Isobutenyl Chloride	A134	Industrial	129P
Isocyanate de Methyl	A098	Industrial	155
Isocyanatomethane	A098	Industrial	155
Iso-Cyanatomethane	A098	Industrial	155
Isocyanic Acid, Methylenedi-para-phenylene Ester	A092	Industrial	156
Isocyanic Acid, Methylenedi-p-phenylene Ester	A092	Industrial	156
Isocyanic Acid, Methyl Ester	A098	Industrial	155
Isocyanic Acid, 4-Methyl-meta-phenylene Ester	A206	Industrial	156
Isocyanic Acid, 4-Methyl-m-phenylene Ester	A206	Industrial	156
Isofenphos	A184	Industrial	152
Isohol	A235	Precursor	129
Isolan	A127	Industrial	151
Isonate 125 MF	A092	Industrial	156
Isonate 125M	A092	Industrial	156
Isopestox	A191	Industrial	152
Isophenphos	A184	Industrial	152
Isopropanol	A235	Precursor	129
Isopropenol	A235	Precursor	129
Isopropilamina	A237	Precursor	132
Isopropoxymethylphosphonyl Fluoride	A004	C01	153
Isopropoxymethylphosphoryl Fluoride	A004	C01	153
Isopropyl Alcohol	A235	Precursor	129

Agent	Agent Index #	Class Index #	NAERG
Isopropyl Alcohol (Mfg-Strong Acid Process)	A235	Precursor	129
Isopropyl Alcohol, Rubbing	A235	Precursor	129
iso-Propylalkohol	A235	Precursor	129
Isopropylamine	A237	Precursor	132
Isopropyl Amine	A237	Precursor	132
Isopropylamino-O-ethyl-(4-methylmercapto-3-methylphenyl)phosphate	A179	Industrial	152
Isopropyl((diethyldithio)phosphoryl)acetamide	A196	Industrial	152
Isopropyl Ester of Methylphosphonofluoridic Acid	A004	C01	153
(Isopropylidenedioxy)phenyl N-Methylcarbamate	A122	Industrial	131
Isopropyl Methylfluorophosphate	A004	C01	153
Isopropyl Methylfluorophosphonate	A004	C01	153
Isopropyl Methylphosphonofluoridate	A004	C01	153
Isopropyl-3-methylpyrazol-5-yl Dimethylcarbamate	A127	Industrial	151
Isopropylmethylpyrazolyl Dimethylcarbamate	A127	Industrial	151
Isopropyl N,N-Dimethylphosphoramidocyanidate	—	C01	153
Isopropylphosphoramidic Acid, 4-(Methylthio)-meta-tolyl Ethyl Ester	A179	Industrial	152
Isopropylphosphoramidic Acid, 4-(Methylthio)-m-tolyl Ethyl Ester	A179	Industrial	152
It is a sudden overtaking by a spirit	A296	C25	158
Ivalon	A094	Industrial	132

*J*

Jail Fever	A342	C25	158
Japanese Encephalitis Type B	A306	C25	158
Japanese B Encephalitis	A306	C25	158
Japanese Encephalitis	A306	C25	158
Japanese Encephalitis Virus	A306	C25	158
Japanese River Fever	A343	C25	158
JBR	A031	C12	—
JE	A306	C25	158
JL	—	C12	—
Jones Ant Killer	A118	Industrial	151
Jon-trol	A112	Industrial	151
Jungle Yellow Fever	A347	C25	158
Junin Disease	A307	C24	158
Junin Hemorrhagic Fever	A307	C24	158
JYF	A347	C25	158

*K*

K	A021	C09	153
K62-105	A185	Industrial	152
K125	A263	Precursor	—
Kalium Cyanid	A252	Precursor	157

Agent	Agent Index #	Class Index #	NAERG
Kalium-Cyanid	A252	Precursor	157
Kampfstoff "Lost"	A017	C07	153
Karbation	A145	Industrial	—
Karidium	A257	Industrial	154
Karigel	A257	Industrial	154
Kari-Rinse	A257	Industrial	154
Kavadel	A173	Industrial	152
Kayafume	A142	Industrial	123
KB-10	—	C09	153
KB-16	—	C09	153
Kenya Fever	A316	C25	158
Kenya Tick Typhus	A316	C25	158
Ketaject	—	C16	154
Ketalar	—	C16	154
Ketamine	—	C16	154
Ketanest	—	C16	154
Ketaset	—	C16	154
Ketavet	—	C16	154
Ketokil No. 52	A160	Industrial	152
KFD	A308	C25	158
K-Granate	—	C17	—
KhAf	A064	C17	153
Ki Denga Pepo	A296	C25	158
Kill-All	A119	Industrial	151
Killax	A200	Industrial	152
Kilmite 40	A200	Industrial	152
Kimputu	A328	C25	158
King of Battle Gases	A017	C07	153
King of Gases	A017	C07	153
KK0875000	A211	Precursor	131
KK5950000	A220	Precursor	132
KK9800000	A229	Precursor	None
KL7525000	A239	Precursor	None
KL9275000	A266	Precursor	None
Klark-1	A076	C20	151
Klop	A041	C14	154
Klorpikrin	A041	C14	154
Klortsian	A028	C12	125
KM2975000	A264	Precursor	None
Kohlendisulfid	A089	Industrial	131
Kohlendisulfid (Schwefelkohlenstoff)	A089	Industrial	131
Kokain	—	C16	154
Kokan	—	C16	154
Kokayeen	—	C16	154
Kolloidschwefel 95	A259	Precursor	133
Kolo 100	A259	Precursor	133
Kolofog	A259	Precursor	133
Kolospray	A259	Precursor	133
Koolstofdisulfide	A089	Industrial	131
Koolstofdisulfide (Zwavelkoolstof)	A089	Industrial	131
Koolstofoxychloride	A048	C14	125
Kop-Fume	A139	Industrial	154

Agent	Agent Index #	Class Index #	NAERG
Korean Hemorrhagic Fever	A303	C24	158
Koreberon	A257	Industrial	154
Krecalvin	A137	Industrial	152
Kromfax Solvent	A264	Precursor	None
Krystal	—	C16	154
KSK	—	C19	—
K2-Stoff	A044	C14	125
K-Stoff	—	C17	—
Kumulus	A259	Precursor	133
Kumulus 5	A259	Precursor	133
Kumulus S	A259	Precursor	133
Kwiksan	A156	Industrial	151
Kyanid Sodny	A256	Precursor	157
Kyasanur Forest	A308	C25	158
Kyasanur Forest Disease	A308	C25	158
Kyasanur Tropical Fever	A308	C25	158
Kyselina Dusicne	A100	Industrial	157

L

L	—	C07	153
L1	A048	C14	125
Lacrymite	A071	C17	157
Lacrymite	A072	C17	—
Lance	A124	Industrial	151
Lannate	A129	Industrial	151
Lanox	A129	Industrial	151
La Petite Verole	A336	C24	158
Larmine	A059	C17	159
Larvacide	A041	C14	154
Larvacide 100	A041	C14	154
Lassa Fever	A309	C24	158
Late Blight of Potato	—	C28	158
Lavacol	A235	Precursor	129
LCM	A312	C24	158
LCMV	A312	C24	158
l-Cocain	—	C16	154
l-Cocaine	—	C16	154
LD	A310	C24	158
Le-100	A007	C01	153
Lea-Cov	A257	Industrial	154
Lead Arsenate	A113	Industrial	151
Lead Tetraethyl	A204	Industrial	131
Lead Tetramethyl	A205	Industrial	131
Lead, Tetramethyl-	A205	Industrial	131
Legionella	A310	C24	158
<i>Legionella pneumophila</i>	A310	C24	158
Legionellosis	A310	C24	158
Legionnaire's Disease	A310	C24	158
Lemoflur	A257	Industrial	154
Leptanal	—	C16	154
Lepton	A185	Industrial	152

Agent	Agent Index #	Class Index #	NAERG
Leptophos	A185	Industrial	152
Leptophos Oxon	A185	Industrial	152
Leptophoxon	A185	Industrial	152
Les-Cav	A257	Industrial	154
Lethalaire G-52	A200	Industrial	152
Lethalaire G-57	A198	Industrial	153
Lethalaire G-59	A197	Industrial	152
Levinstein Mustard	A017	C07	153
Levinsteinlost	A017	C07	153
Lewisite	A014	C08	153
Lewisite 1	A014	C08	153
Lewisite 2	—	C08	153
Lewisite 3	—	C08	153
Lewisite I	A014	C08	153
Lewisite II	—	C08	153
Lewisite III	—	C08	153
Leytosan	A156	Industrial	151
LF	A309	C24	158
L-Fume	A133	Industrial	139
L I	A014	C08	153
Lignite Wax, Bleached	A263	Precursor	None
L II	—	C08	153
L III	—	C08	153
Lindanmafu	A137	Industrial	152
Liquid CS	A062	C19	159
Liquiflur	A257	Industrial	154
Liquiphene	A156	Industrial	151
Lirohex	A200	Industrial	152
LO	—	C28	158
Lockjaw	A288	C22	153
Lofentanil	—	C16	154
Loramine AMB 13	A213	Precursor	132
Lost	A017	C07	153
Louping Ill	A311	C25	158
Louseborne Typhus	A342	C25	158
Lowedex	—	C16	154
<i>L. pneumophila</i>	A310	C24	158
LSA	—	C16	154
(+)-LSD	—	C16	154
LSD	—	C16	154
LSD-25	—	C16	154
Lung Gas No. 1	A048	C14	125
Luride	A257	Industrial	154
Luride Lozi-Tabs	A257	Industrial	154
Luride-SF	A257	Industrial	154
Lutosol	A235	Precursor	129
<i>Lymphocytic choriomeningitis</i>	A312	C24	158
<i>Lymphocytic choriomeningitis Virus</i>	A312	C24	158
Lyogen	—	C16	154
Lysergamide	—	C16	154
Lysergic Acid Amide	—	C16	154
Lysergic Acid Diethylamide	—	C16	154

Agent	Agent Index #	Class Index #	NAERG
Lysergic Acid Diethylamide-25	—	C16	154
(+)-Lysergide	—	C16	154
Lysergide	—	C16	154
Lysergsaure Diethylamid	—	C16	154
Lysoform	A094	Industrial	132
Lyssa	A313	C24	158
Lyvizit	A014	C08	153

M

M	A074	C20	—
M	A073	C20	152
M 30	A075	C20	—
M 49	A075	C20	—
MAA	A114	Industrial	151
MAA, Disodium Salt	A112	Industrial	151
Mace	A064	C17	153
Mace (Lacrimator)	A064	C17	153
Machupo	A314	C24	158
Machupo Hemorrhagic Fever	A314	C24	158
Machupo Virus	A314	C24	158
Macular Fever	A331	C25	158
Maculotoxin	A289	C22	153
MAFU	A137	Industrial	152
MAFU Strip	A137	Industrial	152
Magic Mushrooms	—	C16	154
Magnetic 6	A259	Precursor	133
Magnetic 70	A259	Precursor	133
Magnetic 90	A259	Precursor	133
Magnetic 95	A259	Precursor	133
Mal de Rastrojos	A307	C24	158
Maladie Charbonneuse	A290	C24	158
Maliasmus	A301	C27	158
Malignant Carbuncle	A290	C24	158
Malignant Edema	A290	C24	158
Malignant Edema	A300	C24	158
Malignant Pustule	A290	C24	158
<i>Malleomyces mallei</i>	A301	C27	158
Malleus	A301	C27	158
Malonotrile, (o-Chlorobenzylidene)-	A060	C17	159
Malonotrile, (ortho-Chlorobenzylidene)-	A060	C17	159
Malta Fever	A291	C24	158
MAMA	A115	Industrial	151
Manchurian Fever	A303	C24	158
Mandrax	—	C16	154
Manganite	A031	C12	—
Maposol	A145	Industrial	—
Marburg	A315	C24	158
Marburg Hemorrhagic Fever	A315	C24	158
Marseilles Fever	A316	C25	158
Martonite	—	C17	—
Marvex	A137	Industrial	152

Agent	Agent Index #	Class Index #	NAERG
Matacil	A121	Industrial	151
Mathane, Oxybischloro	A034	C14	153
Matting acid	A203	Industrial	137
Matting Acid	A203	Industrial	137
Mauguinite	A028	C12	125
Maxiton	—	C16	154
MB	A142	Industrial	123
MBA	A020	C09	153
MBC Soil Fumigant	A142	Industrial	123
MBC-33 Soil Fumigant	A142	Industrial	123
MBCP	A185	Industrial	152
MBG	A315	C24	158
M-B-R 98	A142	Industrial	123
MBX	A142	Industrial	123
MC2288	A165	Industrial	152
M-44 Capsules (Potassium Cyanide)	A252	Precursor	157
M-Cresol, 4-(Dimethylamino)-, Methylcarbamate	A121	Industrial	151
M-44 Cyanide Capsules	A256	Precursor	157
MD	A016	C08	152
MDEA	A239	Precursor	None
MDI	A092	Industrial	156
MDM	—	C16	154
MDMA	—	C16	154
MeBr	A142	Industrial	123
Mechlorethamine	A020	C09	153
Medemo	A008	C02	153
Medex	—	C16	154
Medfly	—	C28	—
Medikus	A016	C08	152
Mediterranean Exanthematic Fever	A316	C25	158
Mediterranean Fever	A291	C24	158
Mediterranean Fruit Fly	—	C28	—
Mediterranean Spotted Fever	A316	C25	158
Mediterranean Tick Fever	A316	C25	158
Meldane	A167	Industrial	152
Meldone	A167	Industrial	152
Melioidosis	A317	C24	158
MEMA	A154	Industrial	151
MEMC	A155	Industrial	151
Mephosfolan	A186	Industrial	152
Meracen	A156	Industrial	151
Mercaptan Methylique	A099	Industrial	117
Mercaptodimethur	A128	Industrial	151
Mercaptomethane	A099	Industrial	117
Mercaptophos	A169	Industrial	152
Merchlorate	A155	Industrial	151
Mercuriphenyl Acetate	A156	Industrial	151
Mercuron	A156	Industrial	151
Mergal A25	A156	Industrial	151
Merge	A116	Industrial	151
Merge 823	A116	Industrial	151
Mersolite	A156	Industrial	151

Agent	Agent Index #	Class Index #	NAERG
Mersolite 8	A156	Industrial	151
Mesamate	A116	Industrial	151
Mescaline	—	C16	154
MesuroI	A128	Industrial	151
Metabrom	A142	Industrial	123
Metacide	A189	Industrial	152
Metacil	A121	Industrial	151
Metam S.A.U.	A145	Industrial	—
Metam Sodium	A145	Industrial	—
Metam-Fluid BASF	A145	Industrial	—
Metaphos	A189	Industrial	152
Metasol 30	A156	Industrial	151
Metasol MMH	A153	Industrial	151
meta-Toluene Diisocyanate	A206	Industrial	156
meta-Tolylene Diisocyanate	A206	Industrial	156
Methaanthiol	A099	Industrial	117
Methacrylates	A263	Precursor	—
Methallyl Chloride	A134	Industrial	129P
Metham	A145	Industrial	—
Metham Sodium	A145	Industrial	—
Methamidophos	A187	Industrial	152
Methanal	A094	Industrial	132
Methanamine, N-Methyl-	A221	Precursor	118
Methane Arsonate	A116	Industrial	151
Methane Arsonate	A112	Industrial	151
Methane Arsonic Acid	A114	Industrial	151
Methane, Bromo-	A142	Industrial	123
Methane, Isocyanato-	A098	Industrial	155
Methane, Trichloronitro-	A041	C14	154
Methanearsonic Acid Na	A112	Industrial	151
Methanearsonic Acid Sodium Salt	A116	Industrial	151
Methanearsonic Acid, Calcium Salt (2:1)	A107	Industrial	151
Methanearsonic Acid, Disodium Salt	A112	Industrial	151
Methanearsonic Acid, Monoammonium Salt	A115	Industrial	151
Methanearsonic Acid, Monosodium Salt	A116	Industrial	151
Methanephosphonic Acid	A242	Precursor	154
Methanephosphonic Acid Dichloride	A243	Precursor	137
Methanephosphonic Acid, Dimethyl Ester	A223	Precursor	128
Methanephosphonic Dichloride	A243	Precursor	137
Methanephosphonodichloridic Acid	A243	Precursor	137
Methanephosphonyl Chloride	A243	Precursor	137
Methanesulfonyl Chloride, Trichloro-	A047	C14	157
Methanethiol	A099	Industrial	117
Methanthiol	A099	Industrial	117
Methar	A112	Industrial	151
Methar 30	A112	Industrial	151
Metharsan	A112	Industrial	151
Metharsinat	A112	Industrial	151
Methidathion	A188	Industrial	152
Methiocarb	A128	Industrial	151
Methogas	A142	Industrial	123
Meth-O-Gas	A142	Industrial	123

Agent	Agent Index #	Class Index #	NAERG
Methomyl	A129	Industrial	151
Methoxy-2-(dimethoxyphosphinylthio- methyl)pyrone-4	A175	Industrial	152
Methoxyethyl Mercuric Chloride	A155	Industrial	151
Methoxyethyl Mercury Acetate	A154	Industrial	151
Methoxyethyl Mercury Chloride	A155	Industrial	151
Methoxyflurane	—	C16	154
(Methoxy-4-pyron-2-ylmethyl)dimethyl Phosphorothioate	A175	Industrial	152
((Methoxy-4-pyron-2-yl)methyl)-O,O-dimethyl- monothiophosphate	A175	Industrial	152
Methoxy-4-(pyron-2-ylmethyl) O,O-Dimethyl Phosphorothioate	A175	Industrial	152
((Methoxy-4-oxo-4H-pyran-2-yl)methyl) O,O- Dimethyl Phosphorothioate	A175	Industrial	152
Methoxy-4-oxopyran-2-ylmethyl Dimethyl Phosphorothioate	A175	Industrial	152
Methvtiolo	A099	Industrial	117
Methyl Aldehyde	A094	Industrial	132
Methyl Allyl Chloride	A134	Industrial	129P
Methylallyl Chloride	A134	Industrial	129P
Methylaminodithioformic Acid, Sodium Salt	A145	Industrial	—
Methylaminomethanethionothiolic Acid, Sodium Salt	A145	Industrial	—
Methylarsenic Acid, Sodium Salt	A116	Industrial	151
Methylarsine Dichloride	A016	C08	152
Methylarsonic Acid	A114	Industrial	151
Methylarsonic Acid, Calcium Salt (2:1)	A107	Industrial	151
Methylarsonic Acid, Disodium Salt	A112	Industrial	151
Methylarsonic Acid, Monosodium Salt	A116	Industrial	151
Methylaziphos	A160	Industrial	152
Methyl Benzilate	A238	Precursor	154
Methylbenzoylepgonine	—	C16	154
Methyl 3-beta-Hydroxy-1-alpha-H,5-alpha-H- tropane-2-beta-carboxylate Benzoate	—	C16	154
Methyl 3-beta-Hydroxy-1-alpha-H,5-alpha-H- tropane-2-beta-carboxylate Benzoate (Ester)	—	C16	154
Methylbis(beta-chloroethyl)amine	A020	C09	153
Methylbis(beta-chloroethyl)amine	A020	C09	153
Methylbis(2-chloroethyl)amine	A020	C09	153
Methylbis(chloroethylamine)	A020	C09	153
Methylbis(2-hydroxyethyl)amine	A239	Precursor	None
Methyl Bromide	A142	Industrial	123
Methylbromide	A142	Industrial	123
Methyl Bromide Rodent Fumigant (with Chloropicrin)	A142	Industrial	123
Methylcarbamic Acid, 2-(2-Chloro-1- methoxyethoxy)phenyl Ester	A124	Industrial	151
Methyl Carbamic Acid 2,3-Dihydro2,2-Dimethyl- 7-benzofuranyl Ester	A123	Industrial	151
Methylcarbamic Acid 4-(Dimethylamino)-meta- tolyl Ester	A121	Industrial	151

Agent	Agent Index #	Class Index #	NAERG
Methylcarbamic Acid 4-(Dimethylamino)-m-tolyl Ester	A121	Industrial	151
Methylcarbamic Acid, 2,3-(Dimethylmethylenedioxy)-phenyl Ester	A122	Industrial	131
Methylcarbamic Acid 2,3-(Isopropylidenedioxy)phenyl Ester	A122	Industrial	131
Methylcarbamic Acid 4-(Methylthio)-3,5-xylyl Ester	A128	Industrial	151
Methylcarbomodithioic Acid Sodium Salt	A145	Industrial	—
Methyl-Carbomodithioic Acid, Monosodium Salt	A145	Industrial	—
Methylcarbylamine	A098	Industrial	155
Methyl Chlorosulfonate	—	C07	156
Methyl Cyclohexylfluorophosphonate	A001	C01	153
Methyldi(2-chloroethyl)amine	A020	C09	153
Methyldichloroarsine	A016	C08	152
Methyldichlorophosphine	A240	Precursor	135
Methyl-Dick	A016	C08	152
Methyldiethanolamine	A239	Precursor	None
Methyldiethoxyphosphine	A216	Precursor	128
Methyl Difluorophosphite	A244	C05	154
Methyl 1-(Dimethylcarbamoyl)-N-(methylcarbamoyloxy)thioformimidate	A130	Industrial	151
Methyl 2-(Dimethylamino)-N-[[[(methylamino)carbonyl]oxy]-2-oxoethanimidothioate	A130	Industrial	151
Methyl 3-(Dimethoxyphosphinyloxy)crotonate	A190	Industrial	152
Methyl Diphenylglycolate	A238	Precursor	154
Methyl Disulfide	A089	Industrial	131
Methyldithiocarbamic Acid Sodium Salt	A145	Industrial	—
Methyl Ethylene Oxide	A144	Industrial	127P
Methylene Oxide	A094	Industrial	132
Methylenebis(4-isocyanatobenzene)	A092	Industrial	156
Methylene Bis(4-phenylisocyanate)	A092	Industrial	156
Methylenebis(4-phenyl Isocyanate)	A092	Industrial	156
Methylenebis(para-phenyl Isocyanate)	A092	Industrial	156
Methylenebis(para-phenylene Isocyanate)	A092	Industrial	156
Methylenebis(4-phenylisocyanate)	A092	Industrial	156
Methylene Bisphenyl Isocyanate	A092	Industrial	156
Methylenebis(phenylisocyanate)	A092	Industrial	156
Methylenebis(4-phenylene Isocyanate)	A092	Industrial	156
Methylenebis(p-phenyl Isocyanate)	A092	Industrial	156
Methylenebis(p-phenylene Isocyanate)	A092	Industrial	156
Methylene Dibromide	A136	Industrial	160
Methylenedioxyamphetamine	—	C16	154
Methylenedi-para-phenylene Diisocyanate	A092	Industrial	156
Methylene Di-para-phenylene Isocyanate	A092	Industrial	156
Methylenedi-para-phenylene Isocyanate	A092	Industrial	156
Methylenedi-p-phenylene Diisocyanate	A092	Industrial	156
Methylene Di-p-phenylene Isocyanate	A092	Industrial	156
Methylenedi-p-phenylene Isocyanate	A092	Industrial	156
Methyle (Sulfate de)	A012	C07	156
Methylfluorocyclohexylphosphonate	A001	C01	153

Agent	Agent Index #	Class Index #	NAERG
Methylfluorophosphonic Acid, Isopropyl Ester	A004	C01	153
Methylfluoropinacolylphosphonate	A005	C01	153
Methyl Fume	A142	Industrial	123
Methyl Gusathion	A160	Industrial	152
Methyl Guthion	A160	Industrial	152
Methyl 3β-Hydroxy-1αH,5αH-tropane-2β-carboxylate Benzoate	—	C16	154
Methyl 3β-Hydroxy-1αH,5αH-tropane-2β-carboxylate Benzoate (Ester)	—	C16	154
Methyliminodiethanol	A239	Precursor	None
Methylisocyanat	A098	Industrial	155
Methyl Isocyanat	A098	Industrial	155
Methyl Isocyanate	A098	Industrial	155
Methylisopropoxfluorophosphine Oxide	A004	C01	153
Methylmercaptaan	A099	Industrial	117
Methylmercaptan	A099	Industrial	117
Methyl Mercaptan	A099	Industrial	117
Methyl Mercury Acetate	A151	Industrial	151
Methylmercury Acetate	A151	Industrial	151
Methyl Mercury Benzoate	A150	Industrial	151
Methyl Mercury Hydroxide	A148	Industrial	151
Methylmercury 8-Hydroxyquinolate	A153	Industrial	151
Methyl Mercury Nitriole	A149	Industrial	151
Methyl Mercury Propionate	A152	Industrial	151
Methylmercury Propionate	A152	Industrial	151
Methylmercury Quinolinolate	A153	Industrial	151
Methyl Mercury Quinolinolate	A153	Industrial	151
Methyl-2-(Methylthio)Propionaldehyde O-(Methylcarbamoyl)Oxime	A120	Industrial	151
Methyl N-(2-Chloroethyl)-N-nitrosocarbamate	—	C09	153
Methyl N',N'-Dimethyl-N-((methylcarbamoyl)oxy)-1-thiooxamimidate	A130	Industrial	151
Methyl-N-vanillyl-6-nonenamide, (E)-	A070	C18	159
Methyl O-(Methylcarbamoyl)thiolacetohydroxamate	A129	Industrial	151
Methylloxirane	A144	Industrial	127P
Methyl Oxirane	A144	Industrial	127P
Methyl Parathion	A189	Industrial	152
Methyl Phosphinyl Dichloride	A240	Precursor	135
Methylphosphinothioic Dichloride	A246	Precursor	154
Methylphosphinyl Dichloride	A240	Precursor	135
Methylphosphinyl Difluoride	A241	Precursor	136
Methyl Phosphite	A268	Precursor	129
Methyl Phosphonate	A225	Precursor	128
Methylphosphonic Acid	A242	Precursor	154
Methylphosphonic Acid Dichloride	A243	Precursor	137
Methylphosphonic Acid Dimethyl Ester	A223	Precursor	128
Methyl Phosphonic Acid, Dimethyl Ester	A223	Precursor	128
Methyl Phosphonic Dichloride	A243	Precursor	137
Methylphosphonic Dichloride	A243	Precursor	137
Methylphosphonic Difluoride	A244	C05	154
Methylphosphonodichloridic Acid	A243	Precursor	137

Agent	Agent Index #	Class Index #	NAERG
Methylphosphonofluoridic Acid, Cyclohexyl Ester	A001	C01	153
Methylphosphonothioic Acid S-(2-Bis(1-methylethyl)aminoethyl) O-Ethyl Ester	A010	C02	153
Methylphosphonothioic Dichloride	A246	Precursor	154
Methyl Phosphonothioic Dichloride	A246	Precursor	154
Methyl Phosphonous Acid, 2-(Bis(1-methylethyl) Amino) Ethyl Ethyl Ester	A227	C05	128
Methylphosphonous Dichloride	A240	Precursor	135
Methyl Phosphonous Dichloride	A240	Precursor	135
Methylphosphonyl Chloride	A243	Precursor	137
Methylphosphonyl Dichloride	A243	Precursor	137
Methyl Phosphonyl Dichloride	A243	Precursor	137
Methyl Phosphonyl Difluoride	A244	C05	154
Methylphosphonyl Difluoride	A244	C05	154
Methylphosphonyldifluoride	A244	C05	154
Methylphosphoryldifluoride	A244	C05	154
Methylpinacolyloxyfluorophosphine Oxide	A005	C01	153
Methylpinacolyloxyphosphonyl Fluoride	A005	C01	153
Methyl(propanoato-O)mercury	A152	Industrial	151
Methyl(8-Quinololato-N(1),O(8))Mercury	A153	Industrial	151
Methyl Sulfate	A012	C07	156
Methyl Sulphhydrate	A099	Industrial	117
Methylthiophosphonic Dichloride	A246	Precursor	154
(Methylthio)-3,5-xyllyl Methylcarbamate	A128	Industrial	151
Metil Isocianato	A098	Industrial	155
Metilmercaptano	A099	Industrial	117
Metiltriaozotion	A160	Industrial	152
Metmercapturon	A128	Industrial	151
Metofane	—	C16	154
Metramac	—	C02	153
Metramatic	—	C02	153
Metron	A189	Industrial	152
Metylu Bromek	A142	Industrial	123
Mevinphos	A190	Industrial	152
Mezcaline	—	C16	154
Mianeh Fever	A328	C25	158
Micofume	A135	Industrial	171
Micowetsulf	A259	Precursor	133
<i>Microcylus ulei</i>	—	C28	158
Microcystin	A280	C22	153
Microcystin LR	A280	C22	153
Microflotox	A259	Precursor	133
Milzbrand	A290	C24	158
Minute-Gel	A257	Industrial	154
MIPA	A237	Precursor	132
Mipafox	A191	Industrial	152
Mirolysin	A041	C14	154
Mitacil	A121	Industrial	151
Miteborne Typhus	A343	C25	158
Miteborne Typhus Fever	A343	C25	158
Mitis Green	A110	Industrial	151

Agent	Agent Index #	Class Index #	NAERG
Mobisyl	A266	Precursor	None
Modecate	—	C16	154
Moditen	—	C16	154
Moditen Enanthate	—	C16	154
Moditen-Retard	—	C16	154
Monate Merge 823	A116	Industrial	151
Mondur TD	A206	Industrial	156
Mondur TD-80	A206	Industrial	156
Mondur TDS	A206	Industrial	156
<i>Monilia rorei</i>	—	C28	158
<i>Moniliophthora rorei</i>	—	C28	158
Monitor	A187	Industrial	152
Monkey Pox	A318	C27	158
Monoammonium Methane Arsonate	A115	Industrial	151
Monobromomethane	A142	Industrial	123
Mono-Calcium Arsenite	A109	Industrial	151
Monochlorhydrine du Glycol	A211	Precursor	131
(Monochloromethyl) Ether	A034	C14	153
Monochlorosulfuric Acid	A090	Industrial	137
Monocron	A192	Industrial	152
Monocrotophos	A192	Industrial	152
Monoisopropylamine	A237	Precursor	132
Monomethylarsonic Acid	A114	Industrial	151
Mononitrogen Monoxide	A101	Industrial	124
Monosodium Acid Methanearsonate	A116	Industrial	151
Monosodium Acid Metharsonate	A116	Industrial	151
Monosodium Methane Arsonate	A116	Industrial	151
Monosodium Methanearsonate	A116	Industrial	151
Monosodium Methyl Arsonate	A116	Industrial	151
Monosodium Methylarsonate	A116	Industrial	151
Monosulfur Dichloride	A261	Precursor	137
Montan Wax, Bleached	A263	Precursor	None
Mopari	A137	Industrial	152
Morbicid	A094	Industrial	132
Moropal	A200	Industrial	152
Morphia	—	C16	154
Morphina	—	C16	154
Morphine	—	C16	154
Morphium	—	C16	154
Mortopal	A200	Industrial	152
Morve	A301	C27	158
Motor Fuel Anti-knock Compound	A204	Industrial	131
MPOD	A243	Precursor	137
Mrowczan Etylu	A138	Industrial	129
MSMA	A116	Industrial	151
MST-1 Continus	—	C16	154
m-Toluene Diisocyanate	A206	Industrial	156
m-Tolylene Diisocyanate	A206	Industrial	156
Multamat	A122	Industrial	131
Multimet	A122	Industrial	131
Murine Typhus	A341	C25	158
Murray Valley Encephalitis	A319	C25	158

Agent	Agent Index #	Class Index #	NAERG
Muscatox	A167	Industrial	152
Mustard	A017	C07	153
Mustard Gas	A017	C07	153
Mustard HD	A017	C07	153
Mustard, Sulfur	A017	C07	153
Mustard-T Mixture	—	C07	153
Mustard Vapor	A017	C07	153
Mustargen	A020	C09	153
Mustine	A020	C09	153
Mutagen	A020	C09	153
Mycoplasma Mycoides	—	C27	158
Mycotoxin T-2	A287	C23	153
Mylone	A135	Industrial	171
Mylone 85	A135	Industrial	171

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N	A044	C14	125
N	A290	C24	158
N1	A030	C12	117
N 521	A135	Industrial	171
N-869	A145	Industrial	—
N-2790	A182	Industrial	152
NA 9206	A243	Precursor	137
Na Frinse	A257	Industrial	154
Nacconate 300	A092	Industrial	156
Nafeen	A257	Industrial	154
Nafpak	A257	Industrial	154
Nalcon 243	A135	Industrial	171
Namate	A112	Industrial	151
Navadel	A173	Industrial	152
N-Bis(2-hydroxyethyl)-N-ethylamine	A229	Precursor	None
NC	A043	C14	—
NC 6897	A122	Industrial	131
NC 6897 INE	A122	Industrial	131
N-(2-Chloroethyl)diisopropylamine Hydrochloride	A210	Precursor	154
N-(2-Chloroethyl)-N-(1-methylethyl)-2-propaneamine, Hydrochloride	A210	Precursor	154
NCI-C00066	A160	Industrial	152
NCI-C00113	A137	Industrial	152
NCI-C00395	A173	Industrial	152
NCI-C00500	A132	Industrial	159
NCI-C00511	A140	Industrial	129
NCI-C00522	A139	Industrial	154
NCI-C00533	A041	C14	154
NCI-C05591	A089	Industrial	131
NCI-C07360	A058	C17	156
NCI-C09640	A120	Industrial	151
NCI-C09662	A167	Industrial	152
NCI-C50088	A141	Industrial	119
NCI-C50099	A144	Industrial	127P

Agent	Agent Index #	Class Index #	NAERG
NCI-C50135	A211	Precursor	131
NCI-C50215	A081	Industrial	131P
NCI-C50533	A206	Industrial	156
NCI-C50668	A092	Industrial	156
NCI-C54762	A223	Precursor	128
NCI-C54773	A225	Precursor	128
NCI-C54820	A134	Industrial	129P
NCI-C54988	A204	Industrial	131
NCI-C55107	A064	C17	153
NCI-C551188	A060	C17	159
NCI-C55221	A257	Industrial	154
NCI-C56371	—	C16	154
NC-Mixture	A043	C14	—
N-(Diethylamino)ethanol	A213	Precursor	132
N-Diethylaminoethanol	A213	Precursor	132
NE	A259	Precursor	133
Neantina	A156	Industrial	151
Nefis	A139	Industrial	154
Nefrafos	A137	Industrial	152
Nefusan	A135	Industrial	171
Negashunt	A167	Industrial	152
Nemabrom	A132	Industrial	159
Nemacur	A179	Industrial	152
Nemacur P	A179	Industrial	152
Nemafume	A132	Industrial	159
Nemagon	A132	Industrial	159
Nemagon 20	A132	Industrial	159
Nemagon 20G	A132	Industrial	159
Nemagon 90	A132	Industrial	159
Nemagon 206	A132	Industrial	159
Nemagon Soil Fumigant	A132	Industrial	159
Nemanax	A132	Industrial	159
Nemanex	A132	Industrial	159
Nemapaz	A132	Industrial	159
Nemaset	A132	Industrial	159
Nemasol	A145	Industrial	—
Nem-A-Tak	A183	Industrial	152
Nematicide 1410	A130	Industrial	151
Nematocide EM 12.1	A132	Industrial	159
Nematocide EM 15.1	A132	Industrial	159
Nematocide Solution EM 17.1	A132	Industrial	159
Nemazon	A132	Industrial	159
Nephis	A139	Industrial	154
<i>Nephropathia epidemica</i>	A303	C24	158
Nerkol	A137	Industrial	152
Nerve Gas No. 1	A030	C12	117
Nerve Gas No. 1	A004	C01	153
Nerve Gas No. 2	A030	C12	117
Nerve Gas No. 3	A028	C12	125
Nerve Gas No. 4	A007	C01	153
Netherlandshyl	A160	Industrial	152
N-Ethylcarbazole	—	C18	—

Agent	Agent Index #	Class Index #	NAERG
N-Ethyldiethanolamine	A229	Precursor	None
N-Ethyl-2,2'-iminodiethanol	A229	Precursor	None
Netzschwefel	A259	Precursor	133
Neurocaine	—	C16	154
New World Spotted Fever	A331	C25	158
Newcastle Disease	A320	C27	158
Nexagan	A162	Industrial	152
N-H	A083	Industrial	125
NH-Lost	A019	C09	153
NIA 10242	A123	Industrial	151
Nichel Tetracarbonile	A046	C14	131
Nickel Carbonyl	A046	C14	131
Nickel Carbonyle	A046	C14	131
Nickel Tetracarbonyl	A046	C14	131
Nickel Tetracarbonyle	A046	C14	131
Nicotine Sulfate	A158	Industrial	151
Niespulver	—	C17	—
Nifos	A200	Industrial	152
Nifos T	A200	Industrial	152
Nifost	A200	Industrial	152
Nikkeltetracarbonyl	A046	C14	131
Nildew AC 30	A156	Industrial	151
Nilox	—	C16	154
Nine Mile Fever	A327	C24	158
Niomil	A122	Industrial	131
Niran	A177	Industrial	152
Ni-Shrapnell	—	C17	—
N-Isopropyl-1-amino-2-methylethane	A218	Precursor	132
N-Isopropyl-isopropylamine	A218	Precursor	132
Nital	A100	Industrial	157
Nitric Acid	A100	Industrial	157
Nitric Acid, Fuming	A100	Industrial	157
Nitric Oxide	A101	Industrial	124
Nitrichloroform	A041	C14	154
Nitrile Acrilico	A081	Industrial	131P
Nitrile Acrylique	A081	Industrial	131P
Nitriloacetonitrile	A027	C12	119
Nitrioltriethanol	A266	Precursor	None
Nitrilo-2,2,2-triethanol	A266	Precursor	None
Nitrilo-2,2',2"-triethanol	A266	Precursor	None
Nitrioltris(ethanol)	A266	Precursor	None
Nitrinal	A160	Industrial	152
Nitrochloroform	A041	C14	154
Nitrogen Dioxide	—	C14	124
Nitrogen Monoxide	A101	Industrial	124
Nitrogen Mustard	A020	C09	153
Nitrogen Mustard-1	A019	C09	153
Nitrogen Mustard-2	A020	C09	153
Nitrogen Mustard-3	A021	C09	153
Nitrogen Mustard Hydrochloride-Ethanamine	A020	C09	153
Nitrogen Oxide	A101	Industrial	124
Nitrogen Oxides	—	C14	124

Agent	Agent Index #	Class Index #	NAERG
Nitrogen Trioxide	—	C14	124
Nitro-Sil	A083	Industrial	125
Nitrotrichloromethane	A041	C14	154
Nitrous Fumes	A100	Industrial	157
Nitrox 80	A189	Industrial	152
Nitryl Hydroxide	A100	Industrial	157
NK 711	A185	Industrial	152
NL	A021	C09	153
N-Lost	A020	C09	153
N-Lost	A021	C09	153
NM	A260	Precursor	133
N-[4-(Methoxymethyl)-1-[2-(2-thienyl)ethyl]-4-piperidinyl]-N-phenylpropanamide	—	C16	154
N-[4-(Methoxymethyl)-1-[2-(2-thienyl)ethyl]-4-piperidyl]propionanilide	—	C16	154
N-[[[(Methylamino)carbonyl]oxy]ethanimidothioic Acid Methyl Ester	A129	Industrial	151
N-Methylaminodiglycol	A239	Precursor	None
N-Methylaminodithioformic Acid Sodium Salt	A145	Industrial	—
N-Methylaminomethanethionothiolic Acid Sodium Salt	A145	Industrial	—
N-Methylbenzazimide,	A160	Industrial	152
Dimethyldithiophosphoric Acid Ester			
N-Methylbis(beta-chloroethyl)amine	A020	C09	153
N-Methyl-bis-(beta-chloroethyl)amine	A020	C09	153
N-Methylbis(beta-chloroethyl)amine	A020	C09	153
N-Methyl-bis-(beta-chloroethyl)amine	A020	C09	153
N-Methylbis(2-chloroethyl)amine	A020	C09	153
N-Methyl-bis(2-chloroethyl)amine	A020	C09	153
N-Methyl-bis-chloroethylamin	A020	C09	153
N-Methylcarbamate de 4-Dimethylamino 3-Methyl Phenyle	A121	Industrial	151
N-Methylcarbamoyloxime, 2-Methyl-2-methylsulfinylpropionaldehyde	A120	Industrial	151
N-Methylcarbamoyloxime, 2-Methylthio-2-methylpropionaldehyde	A120	Industrial	151
N-[(Methylcarbamoyl)oxy]thioacetimidic Acid Methyl Ester	A129	Industrial	151
N-Methyl-2,2'-Dichlorodiethylamine	A020	C09	153
N-Methyldiethanolamine	A239	Precursor	None
N-Methyldiethanolimine	A239	Precursor	None
N-(1-Methylethyl)-2-propanamine	A218	Precursor	132
N-Methyl-3-hydroxypiperidine	A234	Precursor	129
N-Methylimino-2,2'-diethanol	A239	Precursor	None
N-Methyl-2,2'-iminodiethanol	A239	Precursor	None
N-Methyl-2,2'-iminodiethanol	A239	Precursor	None
N-Methyliminodiethanol	A239	Precursor	None
N-Methyl-Lost	A020	C09	153
N-Methylmethanamine	A221	Precursor	118
N-Methyl-3-piperidinol	A234	Precursor	129
N-Methyl-4-piperidyl	—	C16	154
Cyclopentylphenylglycolate			

Agent	Agent Index #	Class Index #	NAERG
N,N-Bis(2-chloroethyl)methylamine	A020	C09	153
N,N-Bis(2-hydroxyethyl)ethylamine	A229	Precursor	None
N,N-Bis(2-hydroxyethyl)methylamine	A239	Precursor	None
N,N'-Bis(1-methylethyl)phosphorodiamidic Fluoride	A191	Industrial	152
N,N-Di(chloroethyl)methylamine	A020	C09	153
N,N-Diethyl-2-aminoethanol	A213	Precursor	132
N,N-Diethylaminoethanol	A213	Precursor	132
N,N-Diethyl-d-lysergamide	—	C16	154
N,N-Diethylethanolamine	A213	Precursor	132
N,N-Diethyl-2-hydroxyethylamine	A213	Precursor	132
N,N-Diethyllysergamide	—	C16	154
N,N-Diethylmonoethanolamine	A213	Precursor	132
N,N-Diethyl-N-( $\beta$ -hydroxyethyl)amine	A213	Precursor	132
N,N-Diethyl-N-(beta-hydroxyethyl)amine	A213	Precursor	132
N,N-Diisopropylamine	A218	Precursor	132
N,N-Diisopropyl- $\beta$ -amino-ethanol	A220	Precursor	132
N,N-Diisopropyl-2-amino-ethanol	A220	Precursor	132
N,N-Diisopropylaminoethanol	A220	Precursor	132
N,N-Diisopropyl- $\beta$ -aminoethyl Chloride Hydrochloride	A210	Precursor	154
N,N-Diisopropyl-2-aminoethyl Chloride Hydrochloride	A210	Precursor	154
N,N-Diisopropyl-(beta)-amino-ethanol	A220	Precursor	132
N,N-Diisopropyl-(beta)-aminoethyl Chloride Hydrochloride	A210	Precursor	154
N,N'-Diisopropylamidophosphoryl Fluoride	A191	Industrial	152
N,N-Diisopropyl Ethanolamine	A220	Precursor	132
N,N-Diisopropylethanolamine	A220	Precursor	132
N,N'-Diisopropylphosphorodiamidic Fluoride	A191	Industrial	152
N,N-Dimethyl-alpha-methylcarbamoxyloxyimino-alpha-(methylthio)acetamide	A130	Industrial	151
N,N-Dimethyl-alpha-methylcarbamoyloxyimino-alpha-(methylthio)acetamide	A130	Industrial	151
N,N-Dimethylamine	A221	Precursor	118
N,N-Dimethyl- $\alpha$ -methylcarbamoxyloxyimino- $\alpha$ -(methylthio)acetamide	A130	Industrial	151
N,N-Dimethyl- $\alpha$ -methylcarbamoyloxyimino- $\alpha$ -(methylthio)acetamide	A130	Industrial	151
N,N-Dimethyl-2-methylcarbamoyloxyimino-2-(methylthio)acetamide	A130	Industrial	151
N',N'-Dimethyl-N-((methylcarbamoyl)oxy)-1-thioxamimidic Acid Methyl Ester	A130	Industrial	151
N,N-Dimethyl Phosphoramidic Dichloride	A226	Precursor	137
N,N-Dimethylphosphoramidic Dichloride	A226	Precursor	137
N,N-Dimethylphosphoramidodichloridate	A226	Precursor	137
No. 4 (French)	A031	C12	—
No. 4B (French)	A029	C12	—
No. 5 (French)	A053	C14	—
No. 6 (French)	—	C17	—

Agent	Agent Index #	Class Index #	NAERG
No. 7 (French)	A043	C14	—
No. 8 (French)	A057	C18	—
No. 9 (French)	—	C17	—
No. 9B (French)	—	C17	—
No. 10 (French)	—	C17	—
No. 11 (French)	—	C17	—
No. 12 (French)	—	C17	—
No. 13 (French)	—	C17	—
No. 14 (French)	—	C17	—
No. 15 (French)	A072	C17	—
No. 16 (French)	—	C07	156
No. 20 (French)	A017	C07	153
No. 21 (French)	A059	C17	159
Nogos	A137	Industrial	152
Nogos 50	A137	Industrial	152
Nogos 50 EC	A137	Industrial	152
Nogos G	A137	Industrial	152
No-Name Virus	A335	C24	158
Nonenamide, 8-Methyl-N-vanillyl- (E)-	A070	C18	159
Nonenamide, N-((4-Hydroxy-3-methoxyphenyl)methyl)-8-methyl- (E)-	A070	C18	159
No-Pest	A137	Industrial	152
No-Pest Strip	A137	Industrial	152
NOR Nitrogen Mustard	A019	C09	153
Nordhausen acid	A203	Industrial	137
Norforms	A156	Industrial	151
normal-Propan-2-ol	A235	Precursor	129
North American Tick Typhus	A331	C25	158
North Queensland Fever	A327	C24	158
Northwestern Buenos Aires Hemorrhagic Virosis	A307	C24	158
Novichok	—	C04	153
Novichok 5	—	C04	153
Novichok 7	—	C04	153
Novotox	A137	Industrial	152
NOx	—	C14	124
N-(1-Phenethyl-4-piperidiny)-N-phenylpropionamide	—	C16	154
N-(1-Phenethyl-4-piperidyl)propionanilide	—	C16	154
N-Phenyl-N-[1-(phenylethyl)-4-piperidiny]propanamide	—	C16	154
n-Propan-2-ol	A235	Precursor	129
NSC 762	A020	C09	153
NSC 8819	A056	C18	131P
NSC 10873	A019	C09	153
N-Stoff	A040	C14	124
NT8050000	A235	Precursor	129
NT8400000	A237	Precursor	132
Nudrin	A129	Industrial	151
Nufluor	A257	Industrial	154
Nuodex PMA 18	A156	Industrial	151
NUVA	A137	Industrial	152
Nuvacron	A192	Industrial	152

Agent	Agent Index #	Class Index #	NAERG
Nuvan	A137	Industrial	152
Nuvan 7	A137	Industrial	152
Nuvan 100 EC	A137	Industrial	152
Nylmerate	A156	Industrial	151
N-Yperit	A021	C09	153

O

O	A017	C07	153
O1	—	C21	136
OA	—	C10	156
OB	—	C07	153
Obesonil	—	C16	154
Obscuring Smoke No. 1	—	C21	136
Obsedrin	—	C16	154
O-(4-Bromo-2,5-dichlorophenyl) O,O-Diethyl Phosphorothioate	A162	Industrial	152
O-(4-Bromo-2,5-dichlorophenyl) O-Methyl Phenylphosphonothioate	A185	Industrial	152
O-(4-Bromo-2,5-dichlorophenyl) O-Methylphenylphosphorothioate	A185	Industrial	152
OC	A069	C19	159
OCBM	A060	C17	159
(o-Chlorobenzal) Malononitrile	A060	C17	159
o-Chlorobenzylidene Malononitrile	A060	C17	159
o-Chlorobenzylmalononitrile	A060	C17	159
O-(3-Chloro-4-methyl-2-oxo-2H-1-benzopyran-7-yl) O,O-Diethyl Phosphorothioate	A167	Industrial	152
O-3-Chloro-4-methyl-7-coumarinyl O,O-Diethyl Phosphorothioate	A167	Industrial	152
O-(3-Chloro-4-methylcoumarin-7-yl) OO-Diethyl Phosphorothioate	A167	Industrial	152
OCS	—	C21	137
Octafluoroisobutylene	—	C14	—
Octafluoro-sec-butene	—	C14	—
Octafluoro-sec-butylene	—	C14	—
Octafluoro-secondary-butene	—	C14	—
Octafluoro-secondary-butylene	—	C14	—
Octahydro-12-(hydroxymethyl)-2-imino-5,9:7,10a-dimethano-10H-(1,3)dioxocino(6,5-d)pyrimidine-4,7,10,11,12-pentol	A289	C22	153
Octamethyl Pyrophosphortetramide	A197	Industrial	152
Octamethyl Tetramido Pyrophosphate	A197	Industrial	152
Octamethyldiphosphoramidate	A197	Industrial	152
Octamethylpyrophosphoramidate	A197	Industrial	152
O-(4-Cyanophenyl) O-Ethyl Phenylphosphonothioate	A168	Industrial	152
O-Cyclohexyl Methylphosphonofluoridothiate	—	C01	153
O-Cyclohexylmethylphosphonofluoridate	A001	C01	153
O-Cyclopentyl S-(2-Diethylaminoethyl) Methylphosphonothioate	—	C02	153

Agent	Agent Index #	Class Index #	NAERG
O-Cyclopentyl S-(2-Diisopropylaminoethyl) Methylphosphonothioate	—	C02	153
O-Cyclopentyl-S-(2-(dimethylamino)methyl)methyl Phosphonothiolate	—	C02	153
o-Dianisidine Chlorosulfonate	—	C17	—
O-(2,5-Dichloro-4-bromophenyl) O-Methyl Phenylthiophosphonate	A185	Industrial	152
O-(2,2-Dichlorovinyl)-O,O-dimethylphosphat	A137	Industrial	152
O-(2,2-Dichlorovinyl)-O,O-dimethylphosphate	A137	Industrial	152
O-(2-Diisopropylaminoethyl) O'-Ethyl Methylphosphonite	A227	C05	128
Oel-UP/9	A021	C09	153
O-Ethyl 2-Diisopropylaminoethyl Methylphosphonite	A227	C05	128
O-Ethyl Methylphosphonothioate	A228	Precursor	153
O-Ethyl Methylphosphonothioic Acid	A228	Precursor	153
O-Ethyl O-2-Diisopropylaminoethyl Methylphosphonite	A227	C05	128
O-Ethyl O-2-Isopropoxycarbonylphenyl Isopropylphosphoramidothioate	A184	Industrial	152
O-Ethyl O-para-Nitrophenyl Phenylphosphonothioate	A176	Industrial	152
O-Ethyl O-p-Nitrophenyl Phenylphosphonothioate	A176	Industrial	152
O-Ethyl O-(2,4,5-Trichlorophenyl) Ethylphosphonothioate	A180	Industrial	152
O-Ethyl-S-(2-(diethylamino)ethyl)cyclohexyl Phosphonothiolate	—	C02	153
O-Ethyl-S-(2-(diethylamino)ethyl)ethyl Phosphonothiolate	—	C02	153
O-Ethyl-S-(2-(diethylamino)ethyl)isopropyl Phosphonothiolate	—	C02	153
O-Ethyl-S-(2-(diethylamino)ethyl)methyl Phosphonothiolate	—	C02	153
O-Ethyl-S-(2-(diethylamino)ethyl)-n-butyl Phosphonothiolate	—	C02	153
O-Ethyl-S-(2-(diethylamino)ethyl)-n-hexyl Phosphonothiolate	—	C02	153
O-Ethyl-S-(2-(diethylamino)ethyl)-normal-butyl Phosphonothiolate	—	C02	153
O-Ethyl-S-(2-(diethylamino)ethyl)-normal-hexyl Phosphonothiolate	—	C02	153
O-Ethyl-S-(2-(diethylamino)ethyl)-normal-propyl Phosphonothiolate	—	C02	153
O-Ethyl-S-(2-(diethylamino)ethyl)-n-propyl Phosphonothiolate	—	C02	153
O-Ethyl-S-(2-diethylaminoethyl) Methyl Phosphonothiolate	—	C02	153
O-Ethyl-S-[2-(diethylamino)ethyl] Ethylphosphonothioate	—	C02	153

Agent	Agent Index #	Class Index #	NAERG
O-Ethyl-S-[2-(diethylamino)ethyl] Methylphosphonothioate	A009	C02	153
O-Ethyl-S-2-diisopropylaminoethylester Kyseliny Methylthiofosfonove	A010	C02	153
O-Ethyl-S-(2-diisopropylaminoethyl)methyl Phosphonothiolate	A010	C02	153
O-Ethyl-S-(2-diisopropylaminoethyl) Methyl Phosphonothiolate	A010	C02	153
O-Ethyl S-(2-(Diisopropylamino)ethyl)methyl-phosphonothioate	A010	C02	153
O-Ethyl S-(2-Diisopropylaminoethyl) Methylphosphonothioate	A010	C02	153
O-Ethyl S-(2-Diisopropylaminoethyl) Methylphosphonothiolate	A010	C02	153
O-Ethyl S-(2-Diisopropylaminoethyl) Methylthiolphosphonoate	A010	C02	153
O-Ethyl-S-(2-(dimethylamino)ethyl)ethyl Phosphonothiolate	—	C02	153
O-Ethyl-S-(2-dimethylaminoethyl)methyl Phosphonothiolate	A008	C02	153
O-Ethyl-S-[2-(N-methyl-N-phenyl)aminoethyl]methyl Phosphonothiolate	—	C02	153
O-Ethyl S-Phenyl Ethylphosphonothiolothionate	A182	Industrial	152
O-Ethyl-S-(2-(piperidylamino)ethyl)ethyl Phosphonothiolate	—	C02	153
Oftanol	A184	Industrial	152
OG25	A041	C14	154
Ohara Disease	A339	C25	158
OHF	A321	C25	158
O'Higgins Disease	A307	C24	158
OHS83006	—	C02	153
Oil of Vitriol	A203	Industrial	137
O-Isopropyl Methylisopropoxfluorophosphine Oxide	A004	C01	153
O-Isopropyl Methylphosphonochloridate	—	Precursor	153
O-Isopropyl Methylphosphonofluoridate	A004	C01	153
O-Isopropyl-S-(2-(diethylamino)ethyl)methyl Phosphonothiolate	—	C02	153
O-Isopropyl-S-(2-(dimethylamino)ethyl)methyl Phosphonothiolate	—	C02	153
OKM	—	C07	153
OKO	A137	Industrial	152
Oksilidin	A055	C16	154
OL	A017	C07	153
Oleofac	A196	Industrial	152
Oleophosvel	A185	Industrial	152
Oleoresin Capsicum	A069	C19	159
OI-F	A044	C14	125
O-Lost	A017	C07	153
OM	—	C07	153
Omca	—	C16	154

Agent	Agent Index #	Class Index #	NAERG
omega,omega'-Dihydroxyethyl Sulfide	A264	Precursor	None
omega-Bromotoluene	—	C17	156
omega-Chloroacetophenone	A064	C17	153
omega-Chlorotoluene	A058	C17	156
omega-Salz	A064	C17	153
O-Methyl O-2,5-Dichloro-4-bromophenyl Phenylthiophosphonate	A185	Industrial	152
O-Methyl-O-(4-bromo-2,5- dichlorophenyl)phenyl Thiophosphonate	A185	Industrial	152
O-Methyl-S-(2-(diethylamino)ethyl)methyl Phosphonothiolate	—	C02	153
OMPA	A197	Industrial	152
Ompacide	A197	Industrial	152
Ompatox	A197	Industrial	152
Ompax	A197	Industrial	152
OMS 14	A137	Industrial	152
OMS-771	A120	Industrial	151
OMS-1394	A122	Industrial	131
OMS 1438	A185	Industrial	152
Omsk Hemorrhagic Fever	A321	C25	158
O-Mustard	A022	C07	153
o-Nitrobenzyl Chloride	—	C17	—
ONN	A322	C25	158
O'nyong-nyong	A322	C25	158
O,O-Diethyl 3-Chloro-4-methyl-7-umbelliferone Thiophosphate	A167	Industrial	152
O,O-Diethyl-O-(3-chloro-4-methyl-cumarin-7- yl)monothiofosfaat	A167	Industrial	152
O,O-Diethyl-O-(3-chloro-4-methyl-cumarin-7-yl)- monothiophosphat	A167	Industrial	152
O,O-Diethyl O-[2-Chloro-1-(2,4- dichlorophenyl)vinyl] Phosphate	A164	Industrial	152
O,O-Diethyl O-(3-Chloro-4-methyl-2-oxo-2H-1- benzopyran-7-yl) Phosphorothioate	A167	Industrial	152
O,O-Diethyl O-(3-Chloro-4-methyl-2-oxo-2H-1- benzopyran-7-yl)phosphorothioate	A167	Industrial	152
O,O-Diethyl O-(3-Chloro-4-methyl-2-oxo-2H- benzopyran-7-yl)phosphorothioate	A167	Industrial	152
O,O-DiethylO-(3-Chloro-4-methyl-7-coumarinyl) Phosphorothioate	A167	Industrial	152
O,O-Diethyl O-(3-Chloro-4-methyl-7- coumarinyl)phosphorothioate	A167	Industrial	152
O,O-Diethyl O-(3-Chloro-4-methylcoumarinyl-7) Thiophosphate	A167	Industrial	152
O,O-Diethyl O-(3-Chloro-4-methylumbelliferone)	A167	Industrial	152
O,O-Diethyl O-(3-Chloro-4-methylumbelliferone) Thiophosphate	A167	Industrial	152
O,O-Diethyl O-(3-Chloro-4- methylumbelliferyl)phosphorothioate	A167	Industrial	152
O,O-Diethyl O-[para-(Methylsulfinyl)phenyl] Phosphorothioate	A181	Industrial	152

Agent	Agent Index #	Class Index #	NAERG
O,O-Diethyl O-para-Nitrophenyl Phosphorothioate	A177	Industrial	152
O,O-Diethyl O-[p-(Methylsulfinyl)phenyl] Phosphorothioate	A181	Industrial	152
O,O-Diethyl O-p-Nitrophenyl Phosphorothioate	A177	Industrial	152
O,O-Diethyl Phosphonate	A217	Precursor	128
O,O'-Diethyl S-(beta-Diethylamino)ethyl Phosphorothioate	—	C02	153
O,O-Diethyl S-(2-Chloro-1-Phthalimidoethyl)phosphorodithioate	A170	Industrial	152
O,O'-Diethyl S-(β-Diethylamino)ethyl Phosphorothioate	—	C02	153
O,O-Diethyl S-2-Diethylaminoethyl Phosphorothioate	—	C02	153
O,O'-Diethyl S-[2-(Diethylamino)ethyl]phosphorothioate	—	C02	153
O,O-Diethyl S-Diethylaminoethyl Phosphorothioate	—	C02	153
O,O-Diethyl S-(2-Diethylaminoethyl)thiophosphate	—	C02	153
O,O-Diethyl S-[[1,1-Dimethylethyl]thio]methyl] Phosphorodithioate	A199	Industrial	131
O,O-Diethyl S-(((1,1-Dimethylethyl)thio)methyl)phosphorodithioic Acid	A199	Industrial	131
O,O-Diethyl S-ethylmercaptoethyl Dithiophosphate	A174	Industrial	152
O,O-Diethyl S-Ethylmercaptomethyl Dithiophosphate	A193	Industrial	152
O,O-Diethyl S-(Ethylthio)methyl Phosphorodithioate	A193	Industrial	152
O,O-Diethyl S-(2-((1-Methylethyl)amino)-2-oxoethyl) Phosphorodithioate	A196	Industrial	152
O,O'-Diethyl S-2-(N-Methyl-N-phenylamino)ethyl Phosphorothioate	—	C02	153
O,O-Diethyl S-(para-Chlorophenylthio)methyl Phosphorodithioate	A163	Industrial	152
O,O-Diethyl S-(p-Chlorophenylthio)methyl Phosphorodithioate	A163	Industrial	152
O,O-Diethyl S-(t-Butylthio)methyl Phosphorodithioate	A199	Industrial	131
O,O-Diethyl S-(tert-Butylthio)methyl Phosphorodithioate	A199	Industrial	131
O,O-Diethyl S-(tertiary-Butylthio)methyl Phosphorodithioate	A199	Industrial	131
O,O-Diethyl-O-(3-chloro-4-metil-cumarin-7-il-monotiofosfato)	A167	Industrial	152
O,O-Diethyl-O-(3-cloro-4-metil-cumarin-7-il-monotiofosfato)	A167	Industrial	152
O,O-Dimethyl 1-Carbomethoxy-1-propen-2-yl Phosphate	A190	Industrial	152

Agent	Agent Index #	Class Index #	NAERG
O,O-Dimethyl 2,2-Dichlorovinyl Phosphate	A137	Industrial	152
O,O-Dimethyl Dichlorovinyl Phosphate	A137	Industrial	152
O,O-Dimethyl O-2,2-Dichlorovinyl Phosphate	A137	Industrial	152
O-O-Dimethyl-O(2,2-dichlorovinyl)phosphate	A137	Industrial	152
O,O-Dimethyl-O-(2,2-dichlor-vinyl)-phosphat	A137	Industrial	152
O,O-Dimethyl-O,para-(dimethylsulfamoyl)phenyl Phosphorothioate	A178	Industrial	152
O,O-Dimethyl O-para-Nitrophenyl Phosphorothioate	A189	Industrial	152
O,O-Dimethyl O-para-Nitrophenyl Thiophosphate	A189	Industrial	152
O,O-Dimethyl O-p-Nitrophenyl Phosphorothioate	A189	Industrial	152
O,O-Dimethyl O-p-Nitrophenyl Thiophosphate	A189	Industrial	152
O,O-Dimethyl-O,p-(dimethylsulfamoyl)phenyl Phosphorothioate	A178	Industrial	152
O,O-Dimethyl Phosphonate	A225	Precursor	128
O,O-Dimethyl-S-(benzaziminomethyl) Dithiophosphate	A160	Industrial	152
O,O-Dimethyl-S-(1,2,3-benzotriazinyl-4-keto)methyl Phosphorodithioate	A160	Industrial	152
O,O-Dimethyl S-(3,4-Dihydro-4-keto-1,2,3-benzotriazinyl-3-methyl) Dithiophosphate	A160	Industrial	152
O,O'-Dimethyl-S-[(2-methoxy-1,3,4-thiadiazol-5(4H)-one-4-yl)methyl] Dithiophosphate	A188	Industrial	152
O,O-Dimethyl S-4-Oxo-1,2,3-benzotriazin-3(4H)-ylmethyl Phosphorodithioate	A160	Industrial	152
O,O-Dimethyl-S-(4-oxobenzotriazin-3-methyl)-dithiophosphat	A160	Industrial	152
O,O-Dimethyl S-(4-Oxobenzotriazino-3-methyl)phosphorodithioate	A160	Industrial	152
O,O-Dimethyl S-(4-Oxo-1,2,3-benzotriazino(3)-methyl) Thiothionophosphate	A160	Industrial	152
O,O-Dimethyl S-(4-Oxo-3H-1,2,3-benzotriazine-3-methyl)phosphorodithioate	A160	Industrial	152
O,O-Dimethyl-S-((4-oxo-3H-1,2,3-benzotriazin-3-yl)-metil)-ditiofosfato	A160	Industrial	152
O,O-Dimethyl-S-((4-oxo-3H-1,2,3-benzotriazin-3-yl)-methyl)-dithiofosfaat	A160	Industrial	152
O,O-Dimethyl-S-((4-oxo-3H-1,2,3-benzotriazin-3-yl)-methyl)-dithiophosphat	A160	Industrial	152
O,O,O,O-Tetraethyl-dithionopyrophosphat	A198	Industrial	153
O,O,O,O-Tetraethyl Dithiopyrophosphate	A198	Industrial	153
O,O,O',O'-Tetraethyl Pyrophosphate	A200	Industrial	152
O,O,O,O-Tetraethyl-dithio-difosfaat	A198	Industrial	153
O,O,O,O-Tetraetil-ditio-pirofosfato	A198	Industrial	153
O,O,O',O'-Tetraethyl Dithiopyrophosphate	A198	Industrial	153
OPA	A236	Precursor	132
O-Pinacolyl Methylphosphonochloridate	—	Precursor	153
O-Pinalcolyl Methylphosphonofluoridate	A005	C01	153

Agent	Agent Index #	Class Index #	NAERG
OR	—	C07	153
Ornithosis	A326	C27	158
Oropouche Virus Disease	A323	C25	158
Ortho 9006	A187	Industrial	152
Ortho LM	A153	Industrial	151
(ortho-Chlorobenzal) Malononitrile	A060	C17	159
ortho-Chlorobenzylidene Malononitrile	A060	C17	159
ortho-Chlorobenzylmalononitrile	A060	C17	159
ortho-Dianisidine Chlorosulfonate	—	C17	—
ortho-Nitrobenzyl Chloride	—	C17	—
Orvinylcarbinol	A082	Industrial	131
OS 1897	A132	Industrial	159
OS-2046	A190	Industrial	152
O-Salz	A064	C17	153
O,S-DimethylPhosphoramidothioate	A187	Industrial	152
Ossalin	A257	Industrial	154
Ossin	A257	Industrial	154
Osteofluor	A257	Industrial	154
Osteopor-F	A257	Industrial	154
OV6475000	A156	Industrial	151
OW0875000	A155	Industrial	151
Oxacyclopropane	A141	Industrial	119
Oxalic Acid Dinitrile	A027	C12	119
Oxalonitrile	A027	C12	119
Oxalyl Cyanide	A027	C12	119
Oxamimidic Acid, N',N'-Dimethyl-N- ((methylcarbamoyl)oxy)-1-methylthio-	A130	Industrial	151
Oxamimidic Acid, N',N'-Dimethyl-N- [(methylcarbamoyl)oxy]-1-thio-, Methyl Ester	A130	Industrial	151
Oxamyl	A130	Industrial	151
Oxamyl (pesticide)	A130	Industrial	151
Oxane	A141	Industrial	119
Oxidoethane	A141	Industrial	119
Oxiraan	A141	Industrial	119
Oxiran	A141	Industrial	119
Oxirane	A141	Industrial	119
Oxirane, Methyl-	A144	Industrial	127P
Oxirene, Dihydro-	A141	Industrial	119
Oxol	A264	Precursor	None
Oxollost	A017	C07	153
Oxomethane	A094	Industrial	132
Oxy DBCP	A132	Industrial	159
Oxybis(2-chloroethane)	A084	Industrial	152
Oxybis[chloromethane]	A034	C14	153
Oxychlorid Fosforecny	A247	Precursor	137
Oxyde de Chlorethyle	A084	Industrial	152
Oxyde de Propylene	A144	Industrial	127P
Oxyde Nitrique	A101	Industrial	124
Oxygen Mustard	A084	Industrial	152
Oxymethylene	A094	Industrial	132
Ozone	—	C16	154

Agent	Agent Index #	Class Index #	NAERG
<i>P</i>			
P	A030	C12	117
PA2625000	A116	Industrial	151
Pacinol	—	C16	154
Palite	—	C17	—
Palytoxin	A281	C22	153
p-Aminopyridine	A157	Industrial	153
Pamisan	A156	Industrial	151
Panaplate	A137	Industrial	152
Panogen	A154	Industrial	151
Panogen M	A154	Industrial	151
Papite	A057	C18	—
para-Aminopyridine	A157	Industrial	153
para-Dioxane-2,3-diyl Ethyl Phosphorodithioate	A173	Industrial	152
Paraform	A102	Industrial	133
Paraformaldehyde	A102	Industrial	133
Paraforsn	A102	Industrial	133
Paralytic Shellfish Poisoning	A283	C22	153
Paramyxovirus 1	A320	C27	158
para,para'-Diphenylmethane Diisocyanate	A092	Industrial	156
para,para'-Methylenebis(phenyl Isocyanate)	A092	Industrial	156
Paraphos	A177	Industrial	152
Parathion	A177	Industrial	152
Parathion-methyl	A189	Industrial	152
Paris Green	A110	Industrial	151
Parrot Fever	A326	C27	158
<i>Pasteurella pestis</i>	A324	C25	158
<i>Pasteurella tularensis</i>	A339	C25	158
PbTx	A274	C22	153
PCP	—	C16	154
PD	A023	C08	152
p-Dioxane-2,3-diyl Ethyl Phosphorodithioate	A173	Industrial	152
PE	A325	C25	158
Peace Pil	—	C16	154
Pearly Gates	—	C16	154
Pediaflor	A257	Industrial	154
Pedident	A257	Industrial	154
Pelleaps	—	C16	154
Pencal	A108	Industrial	151
Penite	A119	Industrial	151
Pennad 150	A213	Precursor	132
Penncap-M	A189	Industrial	152
Pennwhite	A257	Industrial	154
Pentaboran Nonahydride	A103	Industrial	135
Pentaborane	A103	Industrial	135
Pentaborane (9)	A103	Industrial	135
Pentachlorophosphorane	A248	Precursor	137
Pentachlorophosphorus	A248	Precursor	137
Pentanyl	—	C16	154
Penthrane	—	C16	154

Agent	Agent Index #	Class Index #	NAERG
Pentrane	—	C16	154
Pepper Spray	A069	C19	159
Perchloromethyl Formate	A044	C14	125
Perchloromethyl Mercaptan	A047	C14	157
Perdilaton	A213	Precursor	132
Perfluoroisobutylene	—	C14	—
Pergantene	A257	Industrial	154
Permitil	—	C16	154
Persistent CS	A061	C17	159
Perstoff	A044	C14	125
Pest	A324	C25	158
Pest of Small Ruminants	—	C27	158
Peste Des Petits Ruminants	—	C27	158
Pestilential Fever	A324	C25	158
Pestis	A324	C25	158
Pestmaster	A142	Industrial	123
Pestmaster EDB-85	A139	Industrial	154
Pestmaster Soil Fumigant-1	A142	Industrial	123
Pestox	A197	Industrial	152
Pestox III	A197	Industrial	152
Pestox XIV	A172	Industrial	152
Pestox XV	A191	Industrial	152
Petechial Fever	A331	C25	158
Petrohol	A235	Precursor	129
PFIB	—	C14	—
Pfiffikus	A023	C08	152
PFMP	A005	C01	153
PG	A286	C22	153
PG	A051	C14	—
Phenacylchloride	A064	C17	153
Phenamiphos	A179	Industrial	152
Phenarsazine Chloride	A073	C20	152
Phencyclidine	—	C16	154
Phenmad	A156	Industrial	151
Phenol, 2-(2-Chloro-1-methoxyethoxy)-, Methylcarbamate	A124	Industrial	151
Phenol, 4-(Dimethylamino)-3-methyl-, Methylcarbamate	A121	Industrial	151
Phenol, 4-(Dimethylamino)-3-methyl-, Methylcarbamate (Ester)	A121	Industrial	151
Phenomercuric Acetate	A156	Industrial	151
Phentanyl	—	C16	154
Phenyl Carbylamine Chloride	—	C17	—
Phenyl Chloromethylketone	A064	C17	153
Phenyl Dichlorasine	A023	C08	152
Phenyl Dichloroarsine	A023	C08	152
Phenyl Mercury Acetate	A156	Industrial	151
Phenylaceyl Chloride	A064	C17	153
Phenylarsinedichloride	A023	C08	152
Phenylcarbylamine Chloride	—	C14	151
Phenylchloromethylketone	A064	C17	153
Phenylcyclidene Hydrochloride	—	C16	154

Agent	Agent Index #	Class Index #	NAERG
Phenylclidine	—	C16	154
Phenyldibromoarsine	—	C08	152
Phenyldichloroarsine	A023	C08	152
Phenylisocyanide Dichloride	—	C14	151
Phenylmercuriacetate	A156	Industrial	151
Phenylmercuric Acetate	A156	Industrial	151
Phenylmercury Acetate	A156	Industrial	151
Phenylmercury(II)acetate	A156	Industrial	151
Phenylphosphonothioic Acid O-(4-Bromo-2,5-dichlorophenyl) O-Methyl Ester	A185	Industrial	152
Phenylphosphonothioic Acid O-(4-Cyanophenyl) O-Ethyl Ester	A168	Industrial	152
Phenylphosphonothioic Acid O-Ethyl O-para-Nitrophenyl Ester	A176	Industrial	152
Phenylphosphonothioic Acid O-Ethyl O-p-Nitrophenyl Ester	A176	Industrial	152
Philips 1861	A157	Industrial	153
Phix	A156	Industrial	151
<i>Phoma tracheiphila</i>	—	C28	158
Phorate	A193	Industrial	152
Phosdrin	A190	Industrial	152
Phos-Flur	A257	Industrial	154
Phosfolan	A194	Industrial	152
Phosgen	A048	C14	125
Phosgene	A048	C14	125
Phosgene Oxime	A024	C11	154
Phos-Kill	A133	Industrial	139
Phosphamidon	A195	Industrial	152
Phosphate 100	A175	Industrial	152
Phosphate de Dimethyle et de 2,2-Dichlorovinyle	A137	Industrial	152
Phosphate, 2,2-Dichlorovinyl Dimethyl	A137	Industrial	152
Phosphine	A143	Industrial	119
Phosphine, Dichloroethyl-	A230	Precursor	135
Phosphine, Dichloro-Methylthio-	A246	Precursor	154
Phosphine, (Difluoro)methyl-	A241	Precursor	136
Phosphine Oxide, Fluoro-, Bis(isopropylamino)-	A191	Industrial	152
Phosphine, Trichloro-	A201	Industrial	137
Phospholan	A194	Industrial	152
Phosphonic Acid, Dimethyl Ester	A225	Precursor	128
Phosphonic Acid, Methyl-	A242	Precursor	154
Phosphonic Acid, Methyl-, Bis(3-(trimethoxysilyl)propyl) Ester	—	Precursor	—
Phosphonic Dichloride, Methyl-	A243	Precursor	137
Phosphonic Difluoride, Methyl-	A244	C05	154
Phosphonodifluoridic Acid, Methyl-	A244	C05	154
Phosphonodithioimidocarbonic Acid Cyclic Ethylene P,P-Diethyl Ester	A194	Industrial	152
Phosphonodithioimidocarbonic Acid Cyclic Methylene P,P-Diethyl Ester	A183	Industrial	152
Phosphonodithioimidocarbonic Acid Cyclic Propylene P,P-Diethyl Ester	A186	Industrial	152

Agent	Agent Index #	Class Index #	NAERG
Phosphonofluoridic Acid, Methyl-, 1-Methylethyl Ester	A004	C01	153
Phosphonofluoridic Acid, Methyl-, Isopropyl Ester	A004	C01	153
Phosphonofluoridic Acid, Methyl-, 1,2,2-Trimethylpropyl Ester	A005	C01	153
Phosphonothioic Acid, Methyl-, S-(2-Bis(1-methylethylamino)ethyl) O-Ethyl Ester	A010	C02	153
Phosphonothioic Acid, Phenyl-, O-(4-Bromo-2,5-dichlorophenyl) O-Methyl Ester	A185	Industrial	152
Phosphonothioic Dichloride, Ethyl-	A233	Precursor	154
Phosphonothioic Dichloride, Methyl-	A246	Precursor	154
Phosphonous Acid, Methyl-, 2-[Bis(1-methylethyl)amino]ethyl Ethyl Ester	A227	C05	128
Phosphonous Dichloride, Ethyl-	A230	Precursor	135
Phosphonous Dichloride, Methyl-	A240	Precursor	135
Phosphopyron	A175	Industrial	152
Phosphoramidic Dichloride, Dimethyl-	A226	Precursor	137
Phosphoramidothioic Acid O,S-Dimethyl Ester	A187	Industrial	152
Phosphoramidous Dichloride, Dimethyl-	A224	Precursor	132
Phosphorane, Pentachloro-	A248	Precursor	137
Phosphore (Pentachlorure de)	A248	Precursor	137
Phosphore (Trichlorure de)	A201	Industrial	137
Phosphore Blanc	—	C21	136
Phosphore(pentachlorure de)	A248	Precursor	137
Phosphoretted Hydrogen	A143	Industrial	119
Phosphoric Acid 2,2-Dichloroethenyl Dimethyl Ester	A137	Industrial	152
Phosphoric Acid 2,2-Dichlorovinyl Dimethyl Ester	A137	Industrial	152
Phosphoric Acid 2-Chloro-1-(2,4-dichlorophenyl)ethenyl Diethyl Ester	A164	Industrial	152
Phosphoric Acid 2-Chloro-3-(dimethylamino)-1-methyl-3-oxo-1-propenyl Dimethyl Ester	A195	Industrial	152
Phosphoric Acid 3-(Dimethylamino)-1-methyl-3-oxo-1-propenyl dimethyl Ester	A171	Industrial	152
Phosphoric Acid Dimethyl [1-Methyl-3-(methylamino)-3-oxo-1-propenyl] Ester	A192	Industrial	152
Phosphoric Acid, 2,2-Dichloroethenyl Dimethyl Ester	A137	Industrial	152
Phosphoric Acid, 2,2-Dichlorovinyl Dimethyl Ester	A137	Industrial	152
Phosphoric Acid, 2-Dichloroethenyl Dimethyl Ester	A137	Industrial	152
Phosphoric Acid, Tetraethyl Ester	A200	Industrial	152
Phosphoric Chloride	A247	Precursor	137
Phosphoric Chloride	A248	Precursor	137
Phosphoric Perchloride	A248	Precursor	137
Phosphoric Sulfide	A249	Precursor	139
Phosphoric Trichloride	A247	Precursor	137
Phosphoroamidic Acid, Isopropyl-, 4-(Methylthio)-meta-tolyl Ethyl Ester	A179	Industrial	152

Agent	Agent Index #	Class Index #	NAERG
Phosphoroamidic Acid, Isopropyl-, 4-(Methylthio)-m-tolyl Ethyl Ester	A179	Industrial	152
Phosphorodi(isopropylamidic) Fluoride	A191	Industrial	152
Phosphorodithioic Acid, O,O-Diethyl S-(((1,1-Dimethylethyl)thio)methyl) Ester	A199	Industrial	131
Phosphorodithioic Acid, O,O-Diethyl S-[(1,1-dimethylethyl)thio]methyl Ester	A199	Industrial	131
Phosphorodithioic Acid O,O-Diethyl S-[(Ethylthio)methyl] Ester	A193	Industrial	152
Phosphorodithioic Acid O,O-Diethyl S-[2-(Ethylthio)ethyl] Ester	A174	Industrial	152
Phosphorodithioic Acid O,O-Diethyl S-[2-[(1-Methylethyl)amino]-2-oxoethyl] Ester	A196	Industrial	152
Phosphorodithioic Acid O,O-Dimethyl S-[(4-Oxo-1,2,3-benzotriazin-3(4H)-yl)methyl] Ester	A160	Industrial	152
Phosphorodithioic Acid S-[2-Chloro-1-(1,3-dihydro-1,3-dioxo-2H-isoindol-2-yl)ethyl] O,O-Diethyl Ester	A170	Industrial	152
Phosphorodithioic Acid S-(Chloromethyl) O,O-Diethyl Ester	A165	Industrial	152
Phosphorodithioic Acid S-[(4-Chlorophenyl)thio]methyl] O,O-Diethyl Ester	A163	Industrial	152
Phosphorodithioic Acid, S-(2-Chloro-1-phthalimidoethyl) O,O-Diethyl Ester	A170	Industrial	152
Phosphorodithioic Acid S-[[[(1,1-Dimethylethyl)thio]methyl] O,O-Diethyl Ester	A199	Industrial	131
Phosphorodithioic Acid, S-[[[(1,1-Dimethylethyl)thio]methyl] O,O-Diethyl Ester	A199	Industrial	131
Phosphorodithioic Acid S,S'-1,4-Dioxane-2,3-diyl O,O,O',O'-Tetraethyl Ester	A173	Industrial	152
Phosphorodithioic Acid S,S'-para-Dioxane-2,3-diyl O,O,O',O'-Tetraethyl Ester	A173	Industrial	152
Phosphorodithioic Acid S,S'-p-Dioxane-2,3-diyl O,O,O',O'-Tetraethyl Ester	A173	Industrial	152
Phosphorodithioic Acid S-[(t-Butylthio)methyl] O,O-Diethyl Ester	A199	Industrial	131
Phosphorodithioic Acid, S-[(t-Butylthio)methyl] O,O-Diethyl Ester	A199	Industrial	131
Phosphorodithioic Acid S-[(tert-Butylthio)methyl] O,O-Diethyl Ester	A199	Industrial	131
Phosphorodithioic Acid, S-[(tert-Butylthio)methyl] O,O-Diethyl Ester	A199	Industrial	131
Phosphorodithioic Acid S-[(tertiary-Butylthio)methyl] O,O-Diethyl Ester	A199	Industrial	131
Phosphorodithioic Acid, S-[(tertiary-Butylthio)methyl] O,O-Diethyl Ester	A199	Industrial	131
Phosphorothioic Acid, O-(4-Bromo-2,5-dichlorophenyl) O,O-Diethyl Ester	A162	Industrial	152
Phosphorothioic Acid O-(3-Chloro-4-methyl-2-oxo-2H-1-benzopyran-7-yl) O,O-Diethyl Ester	A167	Industrial	152
Phosphorothioic Acid, O-(3-Chloro-4-methyl-2-oxo-2H-1-benzopyran-7-yl) O,O-Diethyl Ester	A167	Industrial	152

Agent	Agent Index #	Class Index #	NAERG
Phosphorothioic Acid, O-(3-Chloro-2-oxo-2H-1-benzopyran-7-yl) O,O-Diethyl Ester	A167	Industrial	152
Phosphorothioic Acid O-[2,5-Dichloro-4-(methylthio)phenyl] O,O-Diethyl Ester	A166	Industrial	152
Phosphorothioic Acid O-[4-[(Dimethylamino)sulfonyl]phenyl] O,O-Dimethyl Ester	A178	Industrial	152
Phosphorothioic Acid O,O-Diethyl O-[4-(Methylsulfinyl)phenyl] Ester	A181	Industrial	152
Phosphorothioic Acid, O,O-Diethyl O(and S)-(Ethylthio)ethyl Esters	A169	Industrial	152
Phosphorothioic Acid O,O-Diethyl O-(4-Nitrophenyl) Ester	A177	Industrial	152
Phosphorothioic Acid O,O-Dimethyl O-(4-Nitrophenyl) Ester	A189	Industrial	152
Phosphorothioic Acid S-[(5-Methoxy-4-oxo-4H-pyran-2-yl)methyl] O,O-Dimethyl Ester	A175	Industrial	152
Phosphorous Acid Dimethyl Ester	A225	Precursor	128
Phosphorous Acid, Diethyl Ester	A217	Precursor	128
Phosphorous Acid, Triethyl Ester	A267	Precursor	129
Phosphorous Acid, Trimethyl Ester	A268	Precursor	129
Phosphorous Chloride	A201	Industrial	137
Phosphorous Oxychloride	A247	Precursor	137
Phosphorous Pentachloride	A248	Precursor	137
Phosphorous Trichloride	A201	Industrial	137
Phosphorous (V) Chloride	A248	Precursor	137
Phosphorous (White)	—	C21	136
Phosphorous (Yellow)	—	C21	136
Phosphoropentachlorid	A248	Precursor	137
Phosphortrichlorid	A201	Industrial	137
Phosphorus	—	C21	136
Phosphorus Chloride	A248	Precursor	137
Phosphorus Chloride	A247	Precursor	137
Phosphorus Chloride Oxide	A247	Precursor	137
Phosphorus Oxide Chloride	A247	Precursor	137
Phosphorus Oxide Trichloride	A247	Precursor	137
Phosphorus Oxychloride	A247	Precursor	137
Phosphorus Oxytrichloride	A247	Precursor	137
Phosphorus Pentachloride	A248	Precursor	137
Phosphorus Pentasulphide	A249	Precursor	139
Phosphorus Perchloride	A248	Precursor	137
Phosphorus Sulfide	A249	Precursor	139
Phosphorus Trichloride	A201	Industrial	137
Phosphorus Trihydride	A143	Industrial	119
Phosphorus (V) Chloride	A248	Precursor	137
Phosphorus (V) Chloride Oxide	A247	Precursor	137
Phosphorus (V) Sulfide	A249	Precursor	139
Phosphorus (V) Trichloride Oxide	A247	Precursor	137
Phosphorus-31	—	C21	136
Phosphorwasserstoff	A143	Industrial	119
Phosphoryl Chloride	A247	Precursor	137
Phosphoryl Oxychloride	A247	Precursor	137

Agent	Agent Index #	Class Index #	NAERG
Phosphoryl Trichloride	A247	Precursor	137
Phostoxin	A133	Industrial	139
Phosvel	A185	Industrial	152
Phosvit	A137	Industrial	152
Phyban	A116	Industrial	151
Phyban H.C.	A116	Industrial	151
Phytar 560	A106	Industrial	151
Phytar 560G	A106	Industrial	151
<i>Phytophthora infestans</i>	—	C28	158
Pic-Clor	A041	C14	154
Picfume	A041	C14	154
Picride	A041	C14	154
Pieciochlorek Fosforu	A248	Precursor	137
Pigbel	A300	C24	158
Pimadin (free base)	A157	Industrial	153
Pinacolyl Alcohol	A250	Precursor	127
Pinacolyl Methanefluorophosphonate	A005	C01	153
Pinacolyl Methyl Phosphonofluoridate	A005	C01	153
Pinacolyl Methylfluorophosphonate	A005	C01	153
Pinacolylloxymethylphosphonyl Fluoride	A005	C01	153
Pinta Fever	A331	C25	158
Piombo Tetra-Etile	A204	Industrial	131
Piombo Tetra-Metile	A205	Industrial	131
<i>Piricularia oryzae</i>	—	C28	158
Pirofos	A198	Industrial	153
Plague	A324	C25	158
Plaguelike Disease of Rodents	A339	C25	158
Plant Dithio Aerosol	A198	Industrial	153
Plantfume 103 Smoke Generator	A198	Industrial	153
Plasticized White Phosphorous	—	C21	136
Plumbane, Tetraethyl-	A204	Industrial	131
Plumbane, Tetramethyl-	A205	Industrial	131
PMA	A156	Industrial	151
PMAC	A156	Industrial	151
PM Acetate	A156	Industrial	151
PMAL	A156	Industrial	151
<i>P. mallei</i>	A301	C27	158
PMAS	A156	Industrial	151
Pneumoencephalitis	A320	C27	158
Pneumonic Plague	A324	C25	158
Pneumorrickettsiosis	A327	C24	158
Point Two	A257	Industrial	154
Polsulkol Extra	A259	Precursor	133
Polychlorinated Isoprene	A263	Precursor	None
Polyoxymethylene	A102	Industrial	133
Polystyrene	A263	Precursor	None
Polyvinyl Chloride/Methyl Methacrylate Mixtures	A263	Precursor	None
Pomadex	—	C16	154
Pontaic Fever	A310	C24	158
Porcine Entero Type 9	—	C27	158
Posada's Disease	A294	C24	158

Agent	Agent Index #	Class Index #	NAERG
Potassium Acid Fluoride	A251	Precursor	154
Potassium Arsenite	A117	Industrial	151
Potassium Bifluoride	A251	Precursor	154
Potassium Cyanide	A252	Precursor	157
Potassium Fluoride	A251	Precursor	154
Potassium Fluoride	A253	Precursor	154
Potassium Fluoride, Anhydrous	A253	Precursor	154
Potassium Fluorure	A253	Precursor	154
Potassium Hydrogen Difluoride	A251	Precursor	154
Potassium Hydrogen Fluoride	A251	Precursor	154
Potassium Hydrogendifluoride	A251	Precursor	154
Potassium Monohydrogen Difluoride	A251	Precursor	154
Powassan Encephalitis	A325	C25	158
Powassan Virus Encephalitis	A325	C25	158
Powdery Mildew of Cereals	—	C28	158
P,P-Dichloromethylphosphine Sulfide	A246	Precursor	154
p,p'-Diphenylmethane Diisocyanate	A092	Industrial	156
p,p'-Methylenebis(phenyl Isocyanate)	A092	Industrial	156
<i>P. pseudomallei</i>	A317	C24	158
PRC 1237	A157	Industrial	153
Precipitated Sulfur	A259	Precursor	133
Predent	A257	Industrial	154
Prentox	A137	Industrial	152
Prezervit	A135	Industrial	171
Primin	A127	Industrial	151
PRO	A235	Precursor	129
Prodaluminol Double	A119	Industrial	151
Prodalumnol	A119	Industrial	151
Prodalumnol Double	A119	Industrial	151
Product G	A007	C01	153
Profume	A142	Industrial	123
Profume A	A041	C14	154
Prolixin	—	C16	154
Prolixin Deconoate	—	C16	154
Prolixin Enanthate	—	C16	154
Prolizin	—	C16	154
Propanal, 2-Amino-	A237	Precursor	132
Propan-2-amine	A237	Precursor	132
Propane, 1,2-Dibromo-3-chloro-	A132	Industrial	159
Propane, 1,2-Epoxy-	A144	Industrial	127P
Propane, 1-Chloro-2,3-Dibromo-	A132	Industrial	159
Propane, 2-Amino-	A237	Precursor	132
Propane, 2-Hydroxy-	A235	Precursor	129
Propane, Epoxy-	A144	Industrial	127P
Propanedinitrile,((2-Chlorophenyl)methylene)	A060	C17	159
Propan-2-ol	A235	Precursor	129
Prop-2-en-1-al	A056	C18	131P
Propenal	A056	C18	131P
Propene, 3-Chloro-2-methyl-	A134	Industrial	129P
Propene Oxide	A144	Industrial	127P
Propenenitrile	A081	Industrial	131P
Propen-1-ol-3	A082	Industrial	131

Agent	Agent Index #	Class Index #	NAERG
Propenol	A082	Industrial	131
Propenyl Alcohol	A082	Industrial	131
Propionaldehyde, 2-Methyl-2-(methylthio)-, O-(Methylcarbomoyl) Oxime	A120	Industrial	151
Propol	A235	Precursor	129
Propylamine Mono	A237	Precursor	132
Propylene Aldehyde	A091	Industrial	131P
Propylene Epoxide	A144	Industrial	127P
Propylene Oxide	A144	Industrial	127P
Propyleneoxide	A144	Industrial	127P
Prothoate	A196	Industrial	152
Prussic Acid	A030	C12	117
Prussite	A027	C12	119
PS	A041	C14	154
Pseudo-Fowl Pest	A320	C27	158
<i>Pseudomonas mallei</i>	A301	C27	158
<i>Pseudomonas pseudomallei</i>	A317	C24	158
Pseudoplague of Fowl	A320	C27	158
Pseudorabies	—	C27	158
Pseudotuberculosis Yersiniosis	A348	C26	158
Psilocibin	—	C16	154
Psilocybin	—	C16	154
Psittacosis	A326	C27	158
PSL	A185	Industrial	152
Psychedelic Agent 3	A055	C16	154
<i>P. tularensis</i>	A339	C25	158
<i>Puccinia graminis</i>	—	C28	158
<i>Puccinia graminis f. sp. tritici</i>	—	C28	158
<i>Puccinia striiformis</i>	—	C28	158
<i>Puccinia glumarum</i>	—	C28	158
Purasan-Sc-10	A156	Industrial	151
Puraturf 10	A156	Industrial	151
PWP	—	C21	136
<i>Pyricularia grisea</i>	—	C28	158
<i>Pyricularia oryzae</i>	—	C28	158
Pyridinamine	A157	Industrial	153
Pyridine, 4-Amino	A157	Industrial	153
Pyrol DMMP	A223	Precursor	128
Pyrophosphoric Acid, Octamethyltetraamide-	A197	Industrial	152
Pyrophosphoric Acid, Tetraethyldithio-	A198	Industrial	153
Pyrophosphoric Acid Tetraethyl Ester	A200	Industrial	152
Pyrophosphoric Acid, Tetraethyl Ester	A200	Industrial	152
Pyrophosphorodithioic Acid, O,O,O,O-Tetraethyl Ester	A198	Industrial	153
Pyrophosphorodithioic Acid, Tetraethyl Ester	A198	Industrial	153
Pyrophosphoryltetrakisdimethylamide	A197	Industrial	152

Q

Q	A025	C07	153
QD 10733	—	C16	154
Q Fever	A327	C24	158

Agent	Agent Index #	Class Index #	NAERG
QL	A227	C05	128
QNB	A055	C16	154
QS9625000	A158	Industrial	151
Query Fever	A327	C24	158
Quick-Phos	A133	Industrial	139
Quicksan	A156	Industrial	151
Quicksan 20	A156	Industrial	151
Quik-Fume	A133	Industrial	139
Quintan Fever	A338	C25	158
Quintana Fever	A338	C25	158
Quinuclidin-3-ol	A254	Precursor	154
Quinuclidine-3-ol	A254	Precursor	154
Quinuclidinol	A254	Precursor	154
Quinuclidinol-3	A254	Precursor	154

R

R-15	A073	C20	152
R-43	A014	C08	153
R-43A	A015	C08	153
R-74	A017	C07	153
R 717	A083	Industrial	125
R-1,158	—	C02	153
R 1303	A163	Industrial	152
R 1582	A160	Industrial	152
R 4263	—	C16	154
R5153	—	C02	153
R 30730	—	C16	154
R 34995	—	C16	154
Rabbit Fever	A339	C25	158
Rabies	A313	C24	158
Rad-E-Cate 25	A106	Industrial	151
Rafluor	A257	Industrial	154
Ragpicker Disease	A290	C24	158
Ram Epididymitis	A291	C24	158
Rampart	A193	Industrial	152
Ranikhet Disease	A320	C27	158
Rat Typhus	A341	C25	158
Ratbane 1080	A159	Industrial	151
Rationite	A012	C07	156
Rat-Nip	—	C21	136
<i>R. burnetti</i>	A327	C24	158
RCA	A282	C22	153
RCA1	A282	C22	153
RCA11	A282	C22	153
RCA60	A282	C22	153
RCA119	A282	C22	153
RCL (I + II)	A282	C22	153
RCL III	A282	C22	153
<i>R. conorii</i>	A316	C25	158
RC-Schwefel Extra	A259	Precursor	133
Reactive Phosphorus Pentasulfide	A249	Precursor	139

Agent	Agent Index #	Class Index #	NAERG
Recurrent Fever	A328	C25	158
Red Gas	A079	C20	152
Red No. 1	A079	C20	152
Red Star	A038	C14	124
Red Tide Toxins	A274	C22	153
Relapsing Fever	A328	C25	158
Rescue Squad	A257	Industrial	154
Resistox	A167	Industrial	152
Resitox	A167	Industrial	152
Resitox 794	A167	Industrial	152
Reston Virus	A299	C24	158
<i>Reticuleoendothelial cytomycosis</i>	A305	C24	158
Rhodia-6200	—	C02	153
Rhodialothan	—	C16	154
Rhodiatox	A177	Industrial	152
Rhodotoxin	A279	C22	153
Rice Blast	—	C28	158
Rice Stem Rust	—	C28	158
Ricin	A282	C22	153
Ricin D	A282	C22	153
Ricine	A282	C22	153
<i>Rickettsia burnetti</i>	A327	C24	158
<i>Rickettsia conorii</i>	A316	C25	158
<i>Rickettsia mooseri</i>	A341	C25	158
<i>Rickettsia prowazeki</i>	A342	C25	158
<i>Rickettsia quintana</i>	A338	C25	158
<i>Rickettsia rickettsii</i>	A331	C25	158
<i>Rickettsia tsutsugamushi</i>	A343	C25	158
<i>Rickettsia typhi</i>	A341	C25	158
Rift Valley Fever	A329	C25	158
Rift Valley Fever Virus	A329	C25	158
Rinderpest	—	C27	158
Rinderpest Virus	—	C27	158
Riogen	A156	Industrial	151
Riot Control Agent CA	A059	C17	159
Riot Control Agent CN	A064	C17	153
Riot Control Agent CNB	A067	C19	159
Riot Control Agent CNC	A066	C19	159
Riot Control Agent CR	A063	C18	159
Riot Control Agent CS	A060	C17	159
RK-7	—	C10	153
<i>R. mooseri</i>	A341	C25	158
RMSF	A331	C25	158
Ro 2-3308	A055	C16	154
Roach Salt	A257	Industrial	154
<i>Rochalimea quintana</i>	A338	C25	158
Rocio Encephalitis	A330	C25	158
Rocky Mountain Spotted Fever	A331	C25	158
Rodent Glanders	A317	C24	158
Roo-Pru	A145	Industrial	—
Rotate	A122	Industrial	131

Agent	Agent Index #	Class Index #	NAERG
Rotox	A142	Industrial	123
Rotz	A301	C27	158
Royal Blue	—	C16	154
RP2300000	A130	Industrial	151
<i>R. prowazeki</i>	A342	C25	158
<i>R. rickettsii</i>	A331	C25	158
RSSE	A332	C25	158
<i>R. tsutsugamushi</i>	A343	C25	158
<i>R. typhi</i>	A341	C25	158
Rubber Stamp Disease	A307	C24	158
Rubbing Alcohol	A235	Precursor	129
Ruphos	A173	Industrial	152
Rural Typhus	A343	C25	158
Russian and Central European Spring-Summer Encephalitis	A332	C25	158
Russian Spring-Summer Encephalitis	A332	C25	158
RVF	A329	C25	158
Ry Dichloro-1,2-ethane	A140	Industrial	129
Rye Stem Rust	—	C28	158

S

S	A020	C09	153
S1	A041	C14	154
S-27	—	C02	153
S-36	—	C02	153
S94	—	C16	154
S-4087	A168	Industrial	152
SA	A026	C13	119
Sabia Hemorrhagic Fever	A333	C24	158
Saeure Fluoride	A093	Industrial	124
<i>Salmonella typhi</i>	A340	C26	158
<i>Salmonella typhosa</i>	A340	C26	158
Salmonellosis	A340	C26	158
Salpetersaure	A100	Industrial	157
Salpeterzuuroplossingen	A100	Industrial	157
Salvo	A106	Industrial	151
San Joaquin Fever	A294	C24	158
San Joaquin Valley Fever	A294	C24	158
Sanhyuum	A139	Industrial	154
Sanitized Spg	A156	Industrial	151
Sao Paulo Fever	A331	C25	158
Saolan	A127	Industrial	151
Sapecron	A164	Industrial	152
Sarin	A004	C01	153
Sauerstoff Lost	A084	Industrial	152
Sauerstoffyperit	A084	Industrial	152
Saxitoxin	A283	C22	153
SC-110	A156	Industrial	151
Scheele's Green	A111	Industrial	151
Scheele's Mineral	A111	Industrial	151

Agent	Agent Index #	Class Index #	NAERG
S-(2-Chloro-1-(1,3-dihydro-1,3-dioxo-2H-isoindol-2-yl)ethyl) O,O-Diethyl Phosphorothioate	A170	Industrial	152
S-(Chloromethyl) O,O-Diethyl Phosphorodithioate	A165	Industrial	152
S-Chloromethylphosphorodithioic Acid O,O-Diethyl Ester	A165	Industrial	152
Schradan	A197	Industrial	152
Schwefeldioxyd	A202	Industrial	125
Schwefelkohlenstoff	A089	Industrial	131
Schwefellost	A017	C07	153
Schwefel-Lost	A017	C07	153
Schwefelsaeureloesungen	A203	Industrial	137
Schwefelwasserstoff	A032	C12	117
Schweinfurt Green	A110	Industrial	151
Scorpion Venoms/Toxins	A284	C22	153
Scotts Clout	A112	Industrial	151
Screening Smoke No. 1	—	C21	137
Screening Smoke No. 5	—	C21	137
Scrub Typhus	A343	C25	158
Scutl	A156	Industrial	151
SD 1750	A137	Industrial	152
SD 1897	A132	Industrial	159
SD 3562	A171	Industrial	152
SD 7859	A164	Industrial	152
SD 9129	A192	Industrial	152
s-Di(chloromethyl) Ether	A034	C14	153
S-2(2-(Diethylamino)ethyl) O,O-Diethyl Ester Phosphorothioic Acid	—	C02	153
S-(Diethylaminoethyl) O,O-Diethyl Phosphorothioate	—	C02	153
S-[2-(Diethylamino)ethyl]phosphorothioic Acid O,O-Diethyl Ester	—	C02	153
S-(3,4-Dihydro-4-oxo-1,2,3-benzotriazin-3-ylmethyl) O,O-Dimethyl Phosphorodithioate	A160	Industrial	152
S-(3,4-Dihydro-4-oxo-benzo(a)(1,2,3)triazin-3-ylmethyl) O,O-Dimethyl Phosphorodithioate	A160	Industrial	152
S-(3,4-Dihydro-4-oxobenzol[d]-[1,2,3]-triazin-3-ylmethyl)OO-dimethyl-phosphorodithioate	A160	Industrial	152
S-(3,4-Dihydro-4-oxobenzol[d][1,2,3]triazin-3-ylmethyl) O,O-Dimethyl Phosphorodithioate	A160	Industrial	152
S-2-Diisopropylaminoethyl O-Ethyl Methylphosphonothioate	A010	C02	153
S-(2-Diisopropylaminoethyl) O-Ethyl Methyl Phosphonothiolate	A010	C02	153
S-2((2-Diisopropylamino)ethyl) O-Ethyl Methylphosphonothiolate	A010	C02	153
S-(((1,1-Dimethylethyl)thio)methyl)-O,O-diethyl Phosphorodithioate	A199	Industrial	131
SEB	A286	C22	153
sec-Di(chloromethyl) Ether	A034	C14	153
secondary Propyl Alcohol	A235	Precursor	129

Agent	Agent Index #	Class Index #	NAERG
secondary-Di(chloromethyl) Ether	A034	C14	153
secondary-Propanol	A235	Precursor	129
secondary-Propyl Alcohol	A235	Precursor	129
secondary-Propylamine	A237	Precursor	132
sec-Propanol	A235	Precursor	129
sec-Propyl Alcohol	A235	Precursor	129
sec-Propylamine	A237	Precursor	132
Security	A113	Industrial	151
Security	A108	Industrial	151
Security Nutronex	A259	Precursor	133
Sedox	A122	Industrial	131
Sedresan	A155	Industrial	151
Seedox	A122	Industrial	131
Seedoxin	A122	Industrial	131
Seedtox	A156	Industrial	151
Sefril	A259	Precursor	133
Selenious Anhydride	A054	C15	154
Selenium Dioxide	A054	C15	154
Selenium Oxide	A054	C15	154
Selenium Oxide (fume)	A054	C15	154
Selenous Acid Anhydride	A054	C15	154
Senfgas	A017	C07	153
Serious Lymphocytic Meningitis	A312	C24	158
Sernyl	—	C16	154
Sernylan	—	C16	154
<i>Serratia marcescens</i>	—	C29	158
Sesquimustard	A025	C07	153
Sesqui-Mustard	A025	C07	153
Sevinol	—	C16	154
Sewer Gas	A032	C12	117
<i>S. dysenteriae</i>	A334	C26	158
SFA	A159	Industrial	151
Sheep Pox	—	C27	158
Shell Unkrauttod A	A082	Industrial	131
Shiga Bacillus	A334	C26	158
<i>Shigella dysenteriae</i>	A334	C26	158
Shigellosis	A334	C26	158
Shimmer-EX	A156	Industrial	151
Shin Bone Fever	A338	C25	158
Shipboard Fever	A342	C25	158
Shop Typhus	A341	C25	158
SI	A326	C27	158
Siarki Chlorek	A262	Precursor	137
Siarki Dwutlenek	A202	Industrial	125
Siarkowodor	A032	C12	117
Siberian Sore	A290	C24	158
Silvisar 550	A116	Industrial	151
Simpamina-D	—	C16	154
Sin Nombre	A335	C24	158
Siqualine	—	C16	154
Siqualon	—	C16	154
Sistan	A145	Industrial	—

Agent	Agent Index #	Class Index #	NAERG
SK	—	C17	—
SLE	A337	C25	158
S-Lost	A017	C07	153
Slug & Snail Bait	A128	Industrial	151
Slug-Geta	A128	Industrial	151
Slug'm	A128	Industrial	151
SM	—	C29	158
Smallpox	A336	C24	158
SMDC	A145	Industrial	—
S-Methyl 1-(Dimethylcarbamoyl)-N-[(methylcarbamoyl)oxy]thioformimidate	A130	Industrial	151
S-Methyl N-[(Methylcarbamoyl)oxy]thioacetimidate	A129	Industrial	151
S-Methyl N',N'-Dimethyl-N-(methylcarbamoyloxy)-1-thio-oxamimidate (I)	A130	Industrial	151
S Mustard	A017	C07	153
SN	—	C16	154
SNA	—	C16	154
S.N.P.	A177	Industrial	152
Snake Venoms/Toxins	A285	C22	153
Sneezing Gas	A076	C20	151
Snip	A125	Industrial	151
Snip Fly Bands	A125	Industrial	151
Sodanit	A119	Industrial	151
Sodar	A112	Industrial	151
Sodium Acid Methanearsonate	A116	Industrial	151
Sodium Arsenate	A118	Industrial	151
Sodium Arsenic Oxide	A119	Industrial	151
Sodium Arsenite	A119	Industrial	151
Sodium Bifluoride	A255	Precursor	154
Sodium Cyanide	A256	Precursor	157
Sodium Fluoacetate Acid	A159	Industrial	151
Sodium Fluoride	A257	Industrial	154
Sodium Fluoride Cyclic Dimer	A257	Industrial	154
Sodium Fluoroacetate	A159	Industrial	151
Sodium Fluorure	A257	Industrial	154
Sodium Hydrofluoride	A257	Industrial	154
Sodium Hydrogen Fluoride	A255	Precursor	154
Sodium Hydrogendifluoride	A255	Precursor	154
Sodium ISA	A266	Precursor	None
Sodium Metaarsenate	A118	Industrial	151
Sodium Metaarsenite	A119	Industrial	151
Sodium Methylcarbamodithioate	A145	Industrial	—
Sodium Methylidithiocarbamate	A145	Industrial	—
Sodium Monofluoride	A257	Industrial	154
Sodium Monofluoroacetate	A159	Industrial	151
Sodium Monomethylidithiocarbamate	A145	Industrial	—
Sodium Monosulfide	A258	Precursor	135
Sodium N-Methylaminodithioformate	A145	Industrial	—
Sodium N-Methylaminomethanethionothiolate	A145	Industrial	—
Sodium N-Methylidithiocarbamate	A145	Industrial	—
Sodium N-Methylidithiocarbamate	A145	Industrial	—

Agent	Agent Index #	Class Index #	NAERG
Sodium Ortho Arsenite	A119	Industrial	151
Sodium Orthoarsenate	A118	Industrial	151
Sodium Sulfide	A258	Precursor	135
Sodium Sulfide Anhydrous	A258	Precursor	135
Sodium Sulfide, beta	A258	Precursor	135
Sodium Sulfuret	A258	Precursor	135
Sodium Sulphide	A258	Precursor	135
So-Flo	A257	Industrial	154
Sofril	A259	Precursor	133
Soilbrom	A139	Industrial	154
Soilfume	A139	Industrial	154
Solasan 500	A145	Industrial	—
Solfuro di Carbonio	A089	Industrial	131
Solvirex	A174	Industrial	152
Soman	A005	C01	153
Sometam	A145	Industrial	—
Soprabel	A113	Industrial	151
South African Tick Typhus	A316	C25	158
S-[[para-Chlorophenyl]thio]methyl] O,O-Diethyl Phosphorodithioate	A163	Industrial	152
S-[[p-Chlorophenyl]thio]methyl] O,O-Diethyl Phosphorodithioate	A163	Industrial	152
Spectrar	A235	Precursor	129
Sperlox-S	A259	Precursor	133
Spersul	A259	Precursor	133
Spersul Thiovit	A259	Precursor	133
Spheridine	A289	C22	153
Spirit of Hartshorn	A083	Industrial	125
Spirits of Salt	A096	Industrial	125
Spor-Kil	A156	Industrial	151
Spotted Fever	A331	C25	158
Spra-Cal	A108	Industrial	151
s-Propanol	A235	Precursor	129
s-Propyl Alcohol	A235	Precursor	129
s-Propylamine	A237	Precursor	132
SQ 4918	—	C16	154
SQ 10733	—	C16	154
SQ 16144	—	C16	154
SRA 5172	A187	Industrial	152
SRA 12869	A184	Industrial	152
S,S'-1,4-Dioxane-2,3-diyl O,O,O',O'-Tetraethyl Phosphorodithioate	A173	Industrial	152
St 100	A199	Industrial	131
Staphylococcus Aureaus Toxins	A286	C22	153
Staphylococcus Enterotoxin B	A286	C22	153
Star Dust	—	C16	154
Stauffer N 521	A135	Industrial	171
Stay-Flo	A257	Industrial	154
S-t-Butylthiomethyl O,O-Diethyl Phosphorodithioate	A199	Industrial	131
S-[(t-Butylthio)methyl] O,O-Diethyl Phosphorodithioate	A199	Industrial	131

Agent	Agent Index #	Class Index #	NAERG
Steladone	A164	Industrial	152
Stem Rust of Cereals	—	C28	158
Sterisol Hand Disinfectant	A235	Precursor	129
Sternite	A023	C08	152
Sterolamide	A266	Precursor	None
S-[(tert-Butylthio)methyl] O,O-Diethyl Phosphorodithioate	A199	Industrial	131
S-tert-Butylthiomethyl O,O-Diethyl Phosphorodithioate	A199	Industrial	131
S-[(tertiary-Butylthio)methyl] O,O-Diethyl Phosphorodithioate	A199	Industrial	131
S-tertiary-Butylthiomethyl O,O-Diethyl Phosphorodithioate	A199	Industrial	131
Stickmonoxyd	A101	Industrial	124
Stickstofflost	A021	C09	153
Stickstofflost (EBEWE)	A020	C09	153
Stickstoffsensfgas	A021	C09	153
Sting-Kill	A266	Precursor	None
Stink Damp	A032	C12	117
St. Louis Encephalitis	A337	C25	158
St. Louis Encephalitis Virus	A337	C25	158
Stoff 100	A007	C01	153
Stoff 146	A004	C01	153
Stoff Oder	A007	C01	153
Studafluor	A257	Industrial	154
Sublimaze	—	C16	154
Sublimed Sulfur	A259	Precursor	133
Substance 33	—	C02	153
Substanz 83	A007	C01	153
Sufenta	—	C16	154
Sufentanil	—	C16	154
Sufran	A259	Precursor	133
Sufran D	A259	Precursor	133
Sul-Cide	A259	Precursor	133
Sulfate de Dimethyle	A012	C07	156
Sulfate de Methyle	A012	C07	156
Sulfate Dimethylique	A012	C07	156
Sulfatep	A198	Industrial	153
Sulfato de Dimetilo	A012	C07	156
Sulfex	A259	Precursor	133
Sulfidal	A259	Precursor	133
Sulfide, Bis(2-chloroethyl)	A017	C07	153
Sulfide, Bis(2-hydroxyethyl)	A264	Precursor	None
Sulfinyl Chloride	A265	Precursor	137
Sulfocarbonic Anhydride	A089	Industrial	131
Sulfonal	A017	C07	153
Sulfonic Acid Monochloride	A090	Industrial	137
Sulfonyl Fluoride	A146	Industrial	123
Sulforon	A259	Precursor	133
Sulfotep	A198	Industrial	153
Sulfotepp	A198	Industrial	153
Sulfur	A259	Precursor	133

Agent	Agent Index #	Class Index #	NAERG
Sulfur Atom	A259	Precursor	133
Sulfur Chloride	A261	Precursor	137
Sulfur Chloride	A262	Precursor	137
Sulfur Chloride (Di)	A261	Precursor	137
Sulfur Chloride (Mono)	A262	Precursor	137
Sulfur Chloride Oxide	A265	Precursor	137
Sulfur Dichloride	A261	Precursor	137
Sulfur Difluoride Dioxide	A146	Industrial	123
Sulfur Dioxide	A202	Industrial	125
Sulfur Dioxide (Anhydrous)	A202	Industrial	125
Sulfur Dioxide Difluoride	A146	Industrial	123
Sulfur, Flowers	A259	Precursor	133
Sulfur Fluoride Oxide	A146	Industrial	123
Sulfur Hydride	A032	C12	117
Sulfur (I) Chloride	A262	Precursor	137
Sulfur (II) Chloride	A261	Precursor	137
Sulfur Monochloride	A262	Precursor	137
Sulfur Mustard	A017	C07	153
Sulfur Mustard Gas	A017	C07	153
Sulfur Mustard/Lewisite (Vesicant)	—	C10	153
Sulfur Mustard (Vesicant)	A022	C07	153
Sulfur Oxide	A202	Industrial	125
Sulfur Oxychloride	A265	Precursor	137
Sulfur Phosphide	A249	Precursor	139
Sulfur, Precipitated	A259	Precursor	133
Sulfur Soap	A259	Precursor	133
Sulfur Subchloride	A262	Precursor	137
Sulfurated Hydrogen	A032	C12	117
Sulfuretted Hydrogen	A032	C12	117
Sulfuric Acid	A203	Industrial	137
Sulfuric Acid, Dimethyl Ester	A012	C07	156
Sulfuric Chlorohydrin	A090	Industrial	137
Sulfuric Oxyfluoride	A146	Industrial	123
Sulfur-Mustard/Sesqui-Mustard (Vesicant)	—	C07	153
Sulfur-Mustard T Mixture	—	C07	153
Sulfur-Mustard (Vesicant)	—	C07	153
Sulfurous Acid Anhydride	A202	Industrial	125
Sulfurous Anhydride	A202	Industrial	125
Sulfurous Chloride	A265	Precursor	137
Sulfurous Dichloride	A265	Precursor	137
Sulfurous Oxide	A202	Industrial	125
Sulfurous Oxychloride	A265	Precursor	137
Sulfuryl Fluoride	A146	Industrial	123
Sulfuryl Fluoride Fumigant	A146	Industrial	123
Sulikol	A259	Precursor	133
Sulkol	A259	Precursor	133
Sulphocarbonic Anhydride	A089	Industrial	131
Sulphur Dioxide	A202	Industrial	125
Sulphur Mustard	A017	C07	153
Sulphur Mustard Gas	A017	C07	153
Sulphuret of Carbon	A089	Industrial	131
Sulphuric Acid	A203	Industrial	137

Agent	Agent Index #	Class Index #	NAERG
Sulphuryl Fluoride	A146	Industrial	123
Sulsol	A259	Precursor	133
Sultaf	A259	Precursor	133
Sulvinite	—	C17	—
Suntol	A167	Industrial	152
Super Colloid	A259	Precursor	133
Super Cosan	A259	Precursor	133
Super Crab-E-Rad-Calar	A107	Industrial	151
Super Dal-E-Rad	A107	Industrial	151
Super Six	A259	Precursor	133
Super-Dent	A257	Industrial	154
Superior Methyl Bromide-2	A142	Industrial	123
Super-K	—	C16	154
Superlysoform	A094	Industrial	132
Supona	A164	Industrial	152
Supracide	A188	Industrial	152
Surecide	A168	Industrial	152
Surpalite	A044	C14	125
Svovl	A259	Precursor	133
SW	A240	Precursor	135
Swat	A161	Industrial	152
Sweeney's Ant-Go	A118	Industrial	151
Swine Fever	—	C27	158
Swine Vesicular Disease	—	C27	158
SWS	A246	Precursor	154
sym-Dibromoethane	A139	Industrial	154
sym-Dichloro-Dimethyl Ether	A034	C14	153
sym-Dichloroethane	A140	Industrial	129
sym-Dichloroethyl Ether	A084	Industrial	152
sym-Di(chloromethyl) Ether	A034	C14	153
sym-Dichloromethyl Ether	A034	C14	153
Sympamin	—	C16	154
S-Yperite	A017	C07	153
System	A197	Industrial	152
Systemox	A169	Industrial	152
Systophos	A197	Industrial	152
Systox	A169	Industrial	152
Sytam	A197	Industrial	152
SZ7710000	A225	Precursor	128
SZ9120000	A223	Precursor	128
Szklarniak	A137	Industrial	152

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T	A084	Industrial	152
T	A022	C07	153
T-2	A287	C23	153
T-9	A021	C09	153
T-34	A274	C22	153
T-35	A266	Precursor	None
T-46	A004	C01	153
T-47	A274	C22	153

Agent	Agent Index #	Class Index #	NAERG
T-83	A007	C01	153
T-114	A004	C01	153
T-144	A004	C01	153
T-150	A028	C12	125
T-155	A030	C12	117
T-300	—	C13	139
T-773	A021	C09	153
T-1035	—	C01	153
T-1036	—	C01	153
T-1703	—	C01	153
T-1835	—	C01	153
TA1770000	A232	Precursor	154
Tabun	A007	C01	153
Tabun A	—	C01	153
Tabun B	—	C01	153
Tafasan	A155	Industrial	151
Tafasan 6W	A155	Industrial	151
Tag	A156	Industrial	151
Tag 331	A156	Industrial	151
Tag HL-331	A156	Industrial	151
Takineocol	A235	Precursor	129
Talbot	A113	Industrial	151
Tamaron	A187	Industrial	152
TAP 9VP	A137	Industrial	152
Target MSMA	A116	Industrial	151
Tarichatoxin	A289	C22	153
TASK	A137	Industrial	152
TASK Tabs	A137	Industrial	152
Tattoo	A122	Industrial	131
TB1720000	A185	Industrial	152
TB2100000	A246	Precursor	154
TB6125000	A248	Precursor	137
TBA	A021	C09	153
t-Butyl Methyl Carbinol	A250	Precursor	127
t-Butyl Methylcarbinol	A250	Precursor	127
TC0350000	A137	Industrial	152
TD7200000	A199	Industrial	131
TDI	A206	Industrial	156
TE1925000	A160	Industrial	152
TE3350000	A173	Industrial	152
TEA	A266	Precursor	None
Tear Agent 2	A064	C17	153
Tear Agent O	A060	C17	159
Tear Gas	A064	C17	153
Tear Gas No. 1	A064	C17	153
Tear Gas No. 2	A066	C19	159
Tear Gas No. 3	A067	C19	159
Tear Gas No. 4	A065	C19	159
Tedegyl	A264	Precursor	None
TEDP	A198	Industrial	153
TEDTP	A198	Industrial	153
TEL	A204	Industrial	131

Agent	Agent Index #	Class Index #	NAERG
Telefos	A196	Industrial	152
Temik	A120	Industrial	151
Temik 10 G	A120	Industrial	151
Temik G10	A120	Industrial	151
Tenac	A137	Industrial	152
Tenox BHT	A137	Industrial	152
Tensofin	—	C16	154
TeNT	A288	C22	153
TEP	A200	Industrial	152
TEPP	A200	Industrial	152
Terabol	A142	Industrial	123
Terbufos	A199	Industrial	131
Terracur P	A181	Industrial	152
Terrastam	A172	Industrial	152
Terra-sytam	A172	Industrial	152
Terro Ant Killer	A118	Industrial	151
Terr-O-Gas	A142	Industrial	123
tert-Butyl Methyl Carbinol	A250	Precursor	127
tert-Butyl Methylcarbinol	A250	Precursor	127
tertiary-Butyl Methyl Carbinol	A250	Precursor	127
tertiary-Butyl Methylcarbinol	A250	Precursor	127
Teschen Disease	—	C27	158
Tesuloid	A259	Precursor	133
Tetanus	A288	C22	153
Tetanus Toxin	A288	C22	153
Tetracarbonyl Nickel	A046	C14	131
Tetraethyl Diphosphate	A200	Industrial	152
Tetraethyldithiodifosfat	A198	Industrial	153
Tetraethyl Dithionopyrophosphate	A198	Industrial	153
Tetraethyl Dithiopyrophosphate	A198	Industrial	153
Tetraethyl Ester Diphosphonic Acid	A200	Industrial	152
Tetraethyl Lead	A204	Industrial	131
Tetraethyllead	A204	Industrial	131
Tetraethylplumbane	A204	Industrial	131
Tetraethyl Pyrophosphate	A200	Industrial	152
Tetraethyl Pyrophosphorodithionate	A198	Industrial	153
Tetraethyl Thiodiphosphate	A198	Industrial	153
Tetrafosfor	—	C21	136
Tetrahydro-2H-3,5-dimethyl-1,3,5-thiadiazine-2-thione	A135	Industrial	171
Tetrahydro-3,5-dimethyl-1,3,5-thiadiazine-2-thione	A135	Industrial	171
Tetrahydro-3,5-dimethyl-2H-1,3,5-thiadiazine-2-thione	A135	Industrial	171
Tetrahydro-6,6,9-trimethyl-3-pentyl-6H-dibenzo[b,d]pyran-1-ol	—	C16	154
Tetrahydrocannabinol	—	C16	154
Tetrahydrocannabinol C-9 (1,2-Dimethyl Heptyl) homolog	—	C16	154
Tetrakisdimethylaminophosphonous Anhydride	A197	Industrial	152
Tetram	—	C02	153
Tetramethyl Lead	A205	Industrial	131

Agent	Agent Index #	Class Index #	NAERG
Tetramethyldiamidophosphoric Fluoride	A172	Industrial	152
Tetramethyllead	A205	Industrial	131
Tetramethylphosphorodiamidic Fluoride	A172	Industrial	152
Tetramethylplumbane	A205	Industrial	131
Tetraphosphor	—	C21	136
Tetrastigmine	A200	Industrial	152
Tetravos	A137	Industrial	152
Tetrodotoxin	A289	C22	153
Tetrodotoxin	A289	C22	153
Tetrodotoxine	A289	C22	153
Tetron	A200	Industrial	152
Tetron-100	A200	Industrial	152
TF0525000	—	C02	153
TF3150000	A169	Industrial	152
T-Fluoride	A257	Industrial	154
TG7875000	A217	Precursor	128
TGD	A006	C01	153
T-Granate	—	C17	—
T-Granate, Grun	—	C17	—
T-Granate, Grun'	—	C17	—
TH1130000	A267	Precursor	129
TH1400000	A268	Precursor	129
TH3500000	—	C21	136
TH4375000	A249	Precursor	139
TH4897000	A247	Precursor	137
That F	A259	Precursor	133
That which bends up	A292	C25	158
THC	—	C16	154
THD	A018	C07	153
Thera-Flur	A257	Industrial	154
Thera-Flur-N	A257	Industrial	154
Thiazone	A135	Industrial	171
Thickened GD	A006	C01	153
Thickened HD	A018	C07	153
Thickened Lewisite	A015	C08	153
Thickened Mustard	A018	C07	153
Thickened Soman	A006	C01	153
Thickener, K125	A263	Precursor	—
Thimet	A193	Industrial	152
Thiocarbonylchloride	A071	C17	157
Thiodemeton	A174	Industrial	152
Thiodiethanol	A264	Precursor	None
Thiodiethylene Glycol	A264	Precursor	None
Thiodiglycol	A264	Precursor	None
Thiodiphosphoric Acid Tetraethyl Ester	A198	Industrial	153
Thiofaco T-35	A266	Precursor	None
Thiolux	A259	Precursor	133
Thiomethanol	A099	Industrial	117
Thiomethyl Alcohol	A099	Industrial	117
Thion	A259	Precursor	133
Thion 80	A259	Precursor	133
Thion 95	A259	Precursor	133

Agent	Agent Index #	Class Index #	NAERG
Thionyl Chloride	A265	Precursor	137
Thionyl Dichloride	A265	Precursor	137
Thiophos	A177	Industrial	152
Thiophosgene	A071	C17	157
Thiophosphate de O,O-Diethyle et de O-(3-Chloro-4-methyl-7-coumarinyle)	A167	Industrial	152
Thiopyrophosphoric Acid, Tetraethyl Ester	A198	Industrial	153
Thiorit	A259	Precursor	133
Thiosulfurous Dichloride	A262	Precursor	137
Thiotep	A198	Industrial	153
Thio-tepp	A198	Industrial	153
Thiovit	A259	Precursor	133
Thioxamyl	A130	Industrial	151
<i>Thrips palmi</i>	—	C28	—
Tiazon	A135	Industrial	171
Tick Fever	A328	C25	158
Tick Fever	A339	C25	158
Tick Fever	A331	C25	158
Tick Typhus	A331	C25	158
Tick-borne Encephalitis Complex	—	C25	158
Tick-borne Group B Virus Encephalitis	A332	C25	158
Tickborne Typhus Fever	A331	C25	158
Tifus Exantematico, Tabardillo	A342	C25	158
Titanium Tetrachloride	—	C21	137
TL 69	A023	C08	152
TL 146	A020	C09	153
TL 214	A013	C08	151
TL 249	A016	C08	152
TL 329	A019	C09	153
TL 373	A230	Precursor	135
TL 1149	A019	C09	153
TL 1450	A098	Industrial	155
TML	A205	Industrial	131
TMP	A268	Precursor	129
T-2 Mycotoxin	A287	C23	153
(T-4)-Nickel Tetracarbonyl	A046	C14	131
TO	A021	C09	153
Tobacco Mosaic Virus	—	C28	158
Toluen-Diisocyanat	A206	Industrial	156
Toluen-Disocianato	A206	Industrial	156
Toluene, alpha-Bromo-	—	C17	156
Toluene, alpha-Chloro-	A058	C17	156
Toluene, $\alpha$ -Bromo-	—	C17	156
Toluene, $\alpha$ -Chloro-	A058	C17	156
Toluene Diisocyanate	A206	Industrial	156
Toluene, 2,4-Diisocyanato-	A206	Industrial	156
Toluene-2,4-diisocyanate	A206	Industrial	156
Toluienodwuzicyjanian	A206	Industrial	156
Toluylene-2,4-diisocyanate	A206	Industrial	156
Tolyene 2,4-Diisocyanate	A206	Industrial	156
Tolyene-2,4-diisocyanate	A206	Industrial	156
Tolyl Chloride	A058	C17	156

Agent	Agent Index #	Class Index #	NAERG
Tolylene Diisocyanate	A206	Industrial	156
Tolylene-2,4-diisocyanate	A206	Industrial	156
Tonite	—	C17	—
Topanol	A137	Industrial	152
Torak	A170	Industrial	152
Toxalbumin	A269	C22	153
<i>T. palmi</i>	—	C28	—
TR-1	A290	C24	158
TR-2	A290	C24	158
Trancin	—	C16	154
Trans-Vert	A116	Industrial	151
Trench Fever	A338	C25	158
Triethanolamin-NG	A266	Precursor	None
Tri-Brom	A142	Industrial	123
Tribromoborane	A085	Industrial	157
Trichloornitromethaan	A041	C14	154
Trichloronitromethan	A041	C14	154
Trichloroacetonitrile	A147	Industrial	131
Trichloroarsine	A033	C14	157
Trichloroborane	A086	Industrial	125
Trichloroboron	A086	Industrial	125
Tri(2-chloroethyl)amine	A021	C09	153
Trichloromethanesulfenyl Chloride	A047	C14	157
Trichloromethyl Chloroformate	A044	C14	125
Trichloronate	A180	Industrial	152
Trichloronitromethane	A041	C14	154
Trichlorophosphine	A201	Industrial	137
Trichlorophosphine Oxide	A247	Precursor	137
Trichlorophosphorus Oxide	A247	Precursor	137
Trichothecene	A287	C23	153
Trichothecene Mycotoxin	A287	C23	153
Tri-Clor	A041	C14	154
Tricloro-nitro-metano	A041	C14	154
Triethanolamin	A266	Precursor	None
Triethanolamine	A266	Precursor	None
Triethanolamine Hydrochloride	A266	Precursor	None
Triethanolamin-NG	A266	Precursor	None
Triethoxyphosphine	A267	Precursor	129
Triethylamine, 2,2'-Dichloro-	A019	C09	153
Triethylamine, 2,2',2''-Trichloro-	A021	C09	153
Triethylamine, 2,2',2''-Trihydroxy-	A266	Precursor	None
Triethyl Phosphite	A267	Precursor	129
Triethylamine	A266	Precursor	None
Trifluoro Boron	A087	Industrial	125
Trifluoroborane	A087	Industrial	125
Trifluoroboron	A087	Industrial	125
Triformol	A102	Industrial	133
Trigosan	A156	Industrial	151
Tri(hydroxyethyl)amine	A266	Precursor	None
Trihydroxytriethylamine	A266	Precursor	None
Trilon	A005	C01	153
Trilon 46	A004	C01	153

Agent	Agent Index #	Class Index #	NAERG
Trilon 83	A007	C01	153
Trilon 113	—	C01	153
Trilon 144	A004	C01	153
Trilon 300	A026	C13	119
Trimaton	A145	Industrial	—
Trimethoate	A196	Industrial	152
Trimethoxyfosfin	A268	Precursor	129
Trimethoxyphosphine	A268	Precursor	129
Trimethylfosfit	A268	Precursor	129
Trimethyl Phosphite	A268	Precursor	129
Tri-normal-propyl Lead Methanesulphonamide	—	C20	—
Tri-n-propyl Lead Methanesulphonamide	—	C20	—
Tris(beta-chloroethyl)amine	A021	C09	153
Tris(beta-hydroxyethyl)amine	A266	Precursor	None
Tris(beta-chloroethyl)amine	A021	C09	153
Tris(2-chloroethyl)amine	A021	C09	153
Tris(2-chlorovinyl)arsine	—	C08	153
Tris(beta-hydroxyethyl)amine	A266	Precursor	None
Tris(2-hydroxyethyl)amine	A266	Precursor	None
Tris(hydroxyethyl)amine	A266	Precursor	None
Trismus	A288	C22	153
Trisodium Trifluoride	A257	Industrial	154
Trithion	A163	Industrial	152
Trojchlorek Fosforu	A201	Industrial	137
Trolamine	A266	Precursor	None
Trona	A085	Industrial	157
Tropical Typhus	A343	C25	158
Troysan 142	A135	Industrial	171
TS160	A021	C09	153
TS6650000	A251	Precursor	154
TS8750000	A252	Precursor	157
T-Stoff	—	C17	—
Tsutsugamushi Disease	A343	C25	158
TT0700000	A253	Precursor	154
TTX	A289	C22	153
Tularemia	A339	C25	158
Tuluylendiisocyanat	A206	Industrial	156
Tungsten Hexafluoride	A207	Industrial	125
Turcam	A122	Industrial	131
Turkey "X" Disease	A270	C22	153
Two Green Rings	A043	C14	—
TX60	A010	C02	153
Tydex	—	C16	154
Type C Lethargic Encephalitis	A337	C25	158
Typhoid Fever	A340	C26	158
Typhus Abdominalis	A340	C26	158
Typhus, Endemic	A341	C25	158
Typhus, Epidemic	A342	C25	158
Typhus Exanthematicus	A342	C25	158
Typhus Exanthematique	A342	C25	158
Typhus, Scrub	A343	C25	158

Agent	Agent Index #	Class Index #	NAERG
<i>U</i>			
UC 1149	A120	Industrial	151
UC 21149	A120	Industrial	151
UCC 974	A135	Industrial	171
UDVF	A137	Industrial	152
UE2275000	A120	Industrial	151
UL	A339	C25	158
Ultracide	A188	Industrial	152
Ultra Sulfur	A259	Precursor	133
Umbelliferone, 3-Chloro-4-methyl-, O,O-Diethyl Phosphorothioate	A167	Industrial	152
Umbethion	A167	Industrial	152
UN 1005	A083	Industrial	125
UN 1008	A087	Industrial	125
UN 1017	A038	C14	124
UN 1026	A027	C12	119
UN 1032	A221	Precursor	118
UN 1040	A141	Industrial	119
UN 1045	A093	Industrial	124
UN 1048	A095	Industrial	125
UN 1050	A096	Industrial	125
UN 1051	A030	C12	117
UN 1052	A097	Industrial	125
UN 1053	A032	C12	117
UN 1062	A142	Industrial	123
UN 1064	A099	Industrial	117
UN 1076	A044	C14	125
UN 1076	A048	C14	125
UN 1079	A202	Industrial	125
UN 1092	A056	C18	131P
UN 1093	A081	Industrial	131P
UN 1098	A082	Industrial	131
UN 1131	A089	Industrial	131
UN 1135	A211	Precursor	131
UN 1143	A091	Industrial	131P
UN 1158	A218	Precursor	132
UN 1184	A140	Industrial	129
UN 1190	A138	Industrial	129
UN 1198	A094	Industrial	132
UN 1219	A235	Precursor	129
UN 1221	A237	Precursor	132
UN 1259	A046	C14	131
UN 1280	A144	Industrial	127P
UN 1340	A249	Precursor	139
UN 1350	A259	Precursor	133
UN 1380	A103	Industrial	135
UN 1381	—	C21	136
UN 1385	A258	Precursor	135
UN 1397	A133	Industrial	139

<b>Agent</b>	<b>Agent Index #</b>	<b>Class Index #</b>	<b>NAERG</b>
UN 1554	A104	Industrial	154
UN 1556	A023	C08	152
UN 1560	A033	C14	157
UN 1561	A105	Industrial	151
UN 1569	—	C17	131
UN 1572	A106	Industrial	151
UN 1573	A108	Industrial	151
UN 1574	A109	Industrial	151
UN 1580	A041	C14	154
UN 1585	A110	Industrial	151
UN 1586	A111	Industrial	151
UN 1589	A028	C12	125
UN 1595	A012	C07	156
UN 1603	—	C17	155
UN 1605	A139	Industrial	154
UN 1616	A113	Industrial	151
UN 1658	A158	Industrial	151
UN 1660	A101	Industrial	124
UN 1670	A047	C14	157
UN 1672	—	C14	151
UN 1674	A156	Industrial	151
UN 1678	A117	Industrial	151
UN 1680	A252	Precursor	157
UN 1685	A118	Industrial	151
UN 1689	A256	Precursor	157
UN 1690	A257	Industrial	154
UN 1694	A059	C17	159
UN 1695	—	C17	131
UN 1697	A064	C17	153
UN 1698	A073	C20	152
UN 1701	—	C17	152
UN 1704	A198	Industrial	153
UN 1727	A208	Precursor	154
UN 1737	—	C17	156
UN 1738	A058	C17	156
UN 1741	A086	Industrial	125
UN 1744	A036	C14	154
UN 1746	A088	Industrial	144
UN 1749	A040	C14	124
UN 1769	A076	C20	151
UN 1806	A248	Precursor	137
UN 1809	A201	Industrial	137
UN 1810	A247	Precursor	137
UN 1811	A251	Precursor	154
UN 1812	A253	Precursor	154
UN 1830	A203	Industrial	137
UN 1836	A265	Precursor	137
UN 1838	—	C21	137
UN 1889	—	C12	157
UN 1892	A013	C08	151
UN 1916	A084	Industrial	152
UN 2032	A100	Industrial	157

Agent	Agent Index #	Class Index #	NAERG
UN 2078	A206	Industrial	156
UN 2188	A026	C13	119
UN 2191	A146	Industrial	123
UN 2196	A207	Industrial	125
UN 2199	A143	Industrial	119
UN 2213	A102	Industrial	133
UN 2249	A034	C14	153
UN 2323	A267	Precursor	129
UN 2329	A268	Precursor	129
UN 2417	—	C14	125
UN 2439	A255	Precursor	154
UN 2474	A071	C17	157
UN 2480	A098	Industrial	155
UN 2489	A092	Industrial	156
UN 2554	A134	Industrial	129P
UN 2629	A159	Industrial	151
UN 2650	A131	Industrial	153
UN 2653	—	C17	156
UN 2664	A136	Industrial	160
UN 2686	A213	Precursor	132
UN 2692	A085	Industrial	157
UN 2745	—	C17	157
UN 9206	A243	Precursor	137
Undistilled Pentasulfide	A249	Precursor	139
Undulant Fever	A291	C24	158
Unifos	A137	Industrial	152
Unifos 50 EC	A137	Industrial	152
Unifos (Pesticide)	A137	Industrial	152
Unifume	A139	Industrial	154
Union Carbide 21149	A120	Industrial	151
Union Carbide UC-21149	A120	Industrial	151
Union Carbide UCA 21149	A120	Industrial	151
Unisan	A156	Industrial	151
UP	A021	C09	153
Urban Typhus	A341	C25	158
Urban Yellow Fever	A347	C25	158
URF	A347	C25	158
US	A291	C24	158
US1750000	A157	Industrial	153
USAF A-16784	A219	Precursor	132
USAF DO-52	A239	Precursor	None
USAF KF-11	A060	C17	159
UX6825000	A200	Industrial	152

V

V1	A073	C20	152
Valamina	—	C16	154
Valley Fever	A294	C24	158
Vapam	A145	Industrial	—
Vapona	A137	Industrial	152
Vapona Insecticide	A137	Industrial	152

Agent	Agent Index #	Class Index #	NAERG
Vaponite	A137	Industrial	152
Vapora II	A137	Industrial	152
Vaporole	A083	Industrial	125
Vaporooter	A145	Industrial	—
Vapotone	A200	Industrial	152
Variola	A336	C24	158
Variola Major	A336	C24	158
Variola Virus	A336	C24	158
<i>V. cholerae</i>	A293	C26	158
VCN	A081	Industrial	131P
VCS	A185	Industrial	152
VCS 506	A185	Industrial	152
VD6191700	A254	Precursor	154
VE	—	C02	153
VEE	A344	C25	158
Velsicol 506	A185	Industrial	152
Velsicol VCS 506	A185	Industrial	152
Venezuelan Equine Encephalitis	A344	C25	158
Venezuelan Equine Encephalomyelitis Virus Disease	A344	C25	158
Venezuelan Equine Fever	A344	C25	158
Venezuelan Hemorrhagic Fever	A302	C24	158
Verdican	A137	Industrial	152
Verdipor	A137	Industrial	152
Verdisol	A137	Industrial	152
Verotoxin producing <i>E. coli</i>	A304	C26	158
Versar DSMA-LQ	A112	Industrial	151
Vertac MSMA 400	A116	Industrial	151
Vertac MSMA 660	A116	Industrial	151
Very Fast Death Factor	A271	C22	153
Vesicular Stomatitis Fever	A345	C25	158
Vesicular Stomatitis Virus Disease	A345	C25	158
Vespazine	—	C16	154
Vetalar	—	C16	154
VDFD	A271	C22	153
VG	—	C02	153
V-gas	A008	C02	153
V Gas	—	C02	153
V Gas (Russian)	—	C02	153
<i>Vibrio cholerae</i>	A293	C26	158
<i>Vibrio Comma</i>	A293	C26	158
Vikane	A146	Industrial	123
Vikane Fumigant	A146	Industrial	123
Villantite	—	C07	156
Villiumite	A257	Industrial	154
Vincennite	A031	C12	—
Vinyl Alcohol, 2,2-Dichloro-, Dimethyl Phosphate	A137	Industrial	152
Vinyl Carbinol	A082	Industrial	131
Vinyl Cyanide	A081	Industrial	131P
Vinylcarbinol	A082	Industrial	131
Vinylofos	A137	Industrial	152
Vinylophos	A137	Industrial	152

Agent	Agent Index #	Class Index #	NAERG
VIR	A018	C07	153
Visco 1152	A235	Precursor	129
Viscol 1152	A235	Precursor	129
Vitriol Brown Oil	A203	Industrial	137
Vitriol, Oil of	A203	Industrial	137
Vitrite	A029	C12	—
VM	A009	C02	153
VMI 10-3	A157	Industrial	153
VN	A031	C12	—
Vomiting Gas	A041	C14	154
Vomiting Gas No. 1	A073	C20	152
Vomiting Gas No. 2	A076	C20	157
VPM	A145	Industrial	—
VR-2	—	C02	153
VR-55	—	C01	153
VS	—	C02	153
V-sub-x	A008	C02	153
VSV	A345	C25	158
VTEC	A304	C26	158
Vx	A008	C02	153
VX	A010	C02	153
VX2	—	C05	153
Vydate	A130	Industrial	151
Vydate L	A130	Industrial	151
Vydate L Insecticide/nematicide	A130	Industrial	151
Vydate L Oxamyl Insecticide/nematocide	A130	Industrial	151
VZ7525000	A256	Precursor	157

W

W	A282	C22	153
Warbex	A178	Industrial	152
War Fever	A342	C25	158
Wart Hog Disease	—	C27	158
Water Repellant CS	A061	C17	159
WB0350000	A257	Industrial	154
WB0350010	A255	Precursor	154
Weakening of the joints	A322	C25	158
Wedding Bells	—	C16	154
WEE	A346	C25	158
Weed 108	A116	Industrial	151
Weed Drench	A082	Industrial	131
Weed-E-Rad	A112	Industrial	151
Weed-E-Rad	A116	Industrial	151
Weed-E-Rad 360	A112	Industrial	151
Weed-E-Rad DMA Powder	A112	Industrial	151
Weed-Hoe	A116	Industrial	151
Weed-Hoe	A112	Industrial	151
Weedone Crabgrass Killer	A112	Industrial	151
Weed-S-Rad	A116	Industrial	151
Weeviltox	A089	Industrial	131
Wegla Dwusiarczek	A089	Industrial	131

Agent	Agent Index #	Class Index #	NAERG
Weibring	A064	C17	153
Weiss Phosphor	—	C21	136
Western Equine Encephalitis	A346	C25	158
Western Equine Encephalitis Virus	A346	C25	158
Wheat Cover Smut	—	C28	158
Wheat Stem Rust	—	C28	158
White Arsenic	A105	Industrial	151
White No. 1	A033	C14	157
White Phosphorous	—	C21	136
White Star	A049	C14	—
Whitmore Disease	A317	C24	158
Wild Typhus	A342	C25	158
Willy Pete	—	C21	136
Winter Mustard	—	C07	153
Winterlost	—	C10	153
Winterlost OA	—	C10	156
Winter-Lost OA	—	C10	156
Winterlost OB	—	C07	153
Winter-Lost OB	—	C07	153
Winterlost OKM	—	C07	153
Winter-Lost OKM	—	C07	153
Winterlost OR	—	C07	153
Winter-Lost OR	—	C07	153
Winylophos	A137	Industrial	152
Wolhynian Fever	A338	C25	158
Woodfume Vapam	A145	Industrial	—
Woolsorter's Disease	A290	C24	158
WP	—	C21	136
WS4250000	A259	Precursor	133
WS5600000	A203	Industrial	137
WT5075000	A146	Industrial	123

X

X	A273	C22	153
<i>Xanthomonas albilineans</i>	—	C28	158
<i>Xanthomonas campestris pv. citri</i>	—	C28	158
<i>Xanthomonas campestris pv. oryzae</i>	—	C28	158
Xaridium	A257	Industrial	154
XLP 30	A137	Industrial	152
XM5150000	A265	Precursor	137
XN4375000	A198	Industrial	153
XTC	—	C16	154
<i>Xylella fastidiosa</i>	—	C28	158
Xylyl Bromide	—	C17	152
Xylylene Bromide	—	C17	—

Y

Y	A017	C07	153
Y 3	—	C07	153

Agent	Agent Index #	Class Index #	NAERG
Y 5	—	C07	153
Y 5A	—	C07	153
Yasoknock	A159	Industrial	151
Yellow Cross Gas	A017	C07	153
Yellow Cross Liquid	A017	C07	153
Yellow Fever	A347	C25	158
Yellow Fever Virus	A347	C25	158
Yellow Jack	A347	C25	158
Yellow No. 1	A017	C07	153
Yellow No. 2	A014	C08	153
Yellow Phosphorous	—	C21	136
Yellow Star	A039	C14	—
<i>Yersinia pestis</i>	A324	C25	158
<i>Yersinia pseudotuberculosis</i>	A348	C26	158
Yersiniosis	A348	C26	158
YM2800000	—	C16	154
Yperite	A017	C07	153
<i>Y. pestis</i>	A324	C25	158
Y-PhDA	—	C10	153
<i>Y. pseudotuberculosis</i>	A348	C26	158
Yc	A017	C07	153
Yt	A017	C07	153

Z

Z	A045	C14	154
Zacondiscoids	A030	C12	117
Zahlost	A018	C07	153
Zahyperit	A018	C07	153
Zamitam Plateau	—	C16	154
Zarin	A004	C01	153
Z-Chloroethanol	A211	Precursor	131
Ziarnik	A156	Industrial	151
Zinga	A329	C25	158
ZL	A018	C07	153
ZO	A018	C07	153
ZOA	A018	C07	153
Zolvis	A259	Precursor	133
Zoman	A005	C01	153
ZOR	A018	C07	153
Zostrix	A070	C18	159
Zusatz	A048	C14	125
Zwavelwaterstof	A032	C12	117
Zwavelzuuroplossingen	A203	Industrial	137
Zyklon	A030	C12	117
Zyklon A	—	C12	—
Zyklon B	A030	C12	117
Zymafluor	A257	Industrial	154
Zytox	A142	Industrial	123

# **Section II**

# **Agent Index**

# 2

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## *Agent Index*

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The Agent Index contains technical information about individual agents. There is a section within the Index for each major class of agent. These classes are nerve agents, vesicants (blister agents), blood agents, choking agents, incapacitating agents, tear agents, vomiting agents, industrial “agents,” precursors and dual-threat chemicals, toxins, and pathogens. Individual agents within each section are listed alphabetically to facilitate rapid screening of the member of that particular class of agents. An index number is assigned to each entry and is used to assist in the cross-referencing of agents with the Alphabetical Index, Section I. Information contained in the individual agent entries includes:

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### Name

This section contains information on the nomenclature and identification of the individual agents.

The **Agent Index #** cross-references synonyms in the Alphabetical Index to entries in the Agent Index.

The **Class Index #** cross references entries in the Agent Index to the appropriate Class Index.

The **agent name** (in bold face) is a common synonym of the designated agent. Agents within each Agent Index are arranged alphabetically by these names. For biological agents, a common synonym for the disease produced by the agent may be substituted for the pathogen name.

The **agent symbol** appears immediately below the agent name and is the United States military identification code for the agent. Although identification codes for other countries may be available, they are not included under this heading. A listing of “No U.S. Military Designation” indicates that the agent is not within the U.S. arsenal. A numeric listing beginning with the letters

“EA” indicates that the agent is an experimental agent and is not actually within the U.S. arsenal. It may, however, be an active agent in the arsenal of another country.

The **biological name** provides the name of the pathogen responsible for production of the indexed disease.

The **CAS #** is the Chemical Abstracts Service registry number. It is unique for each chemical and allows for efficient searching of computerized databases.

**Type** indicates the general classification of pathogen producing the indexed disease.

The **NAERG #** is the 1996 North American Emergency Response Guide number for the material.<sup>133</sup> As in the Guidebook, the letter “P” following the guide number indicates that the material has a significant risk of violent polymerization if not properly stabilized. A notation of “None” indicates that the material is not regulated as a hazardous material in North America.

If available, the **chemical structure/formula** is listed.

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## Physical Description

This section identifies the normal physical state of the agent and general appearance of the material at 68°F. If available, the color and odor of the pure agent are also listed. Common commercial and dual uses (i.e., agents produced) for precursors are included in this section.

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## Symptoms

This section provides a general description of the most prevalent symptoms presented by either the specific pathogen or toxin.

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## Exposure Hazards

This section identifies exposure hazards of the various agents. Unless otherwise indicated, effects are based on a 10-minute exposure for a “standard

man" (i.e., a person weighting 70 kg/154 lbs.) who has a respiratory tidal volume of 15 liters/minute (i.e., is involved in light activity such as administrative tasks). Concentrations are expressed in parts per million (ppm) for vapors and mg/m<sup>3</sup> for dusts and aerosols. For any given parameters, an indication of "—" means that the value is unavailable because it has not been determined or has not been published.

It is important to realize that, other than industrial standards (i.e., TWAs and IDLHs), the doses listed in this handbook were developed for military operations and are not appropriate for use in determining acceptable exposure of civilians. In fact, the current levels are actually *offensive concentrations* that must be established in an aggressive action in order to facilitate the desired impacts rather than *defensive concentrations* used to protect allied soldiers. The U.S. Army is currently developing defensive exposure limits for most of the common nerve agents and for sulfur mustard gas. Proposals for these exposure limits are included in the Agent Index. They are located below the current lethal levels and are identified by placing brackets around the proposed [**defensive exposure limits**].<sup>118</sup>

Specifically identified hazardous impacts include:

**Eye:** indicates the concentration of vapor, dust, or aerosol that will cause a localized impact on the eyes.

**Skin:** indicates the concentration of vapor, dust, or aerosol that will cause a localized impact on exposed skin.

**Additional symptoms:** (e.g., nasal irritation, vomiting) indicate the concentration of vapor, dust, or aerosol that will cause the specified effect.

**Ceiling:** is an industrial exposure limit that specifies the concentration of vapor, dust, or aerosol that should not be exceeded at any time during the workday.

**TWA:** *Time-Weighted Average* is the average concentration of a chemical that a normal worker can be continuously exposed to during a normal 8-hour work day and a 40-hour week without showing any adverse effects.

**IDLH:** *Immediately Dangerous to Life or Health* levels indicate that exposure to the listed concentrations of airborne contaminants is likely to cause death, immediate or delayed permanent adverse health effects, or prevent escape from the contaminated environment. IDLH levels are established to ensure that the worker can escape from the contaminated environment in the event of a failure of respiratory protection. An indication of "10% LEL" indicates that, for safety considerations, the IDLH was based on an atmospheric concentration of ten percent of the lower explosive limit even though toxicological impacts might not appear until higher concentrations are reached.

**IC<sub>50</sub>**: indicates the concentration in air necessary to incapacitate or disable 50% of exposed and unprotected individuals through inhalation of the agent.

**LC<sub>50</sub>**: indicates the agent concentration in air necessary to kill 50% of exposed and unprotected individuals through inhalation of the agent.

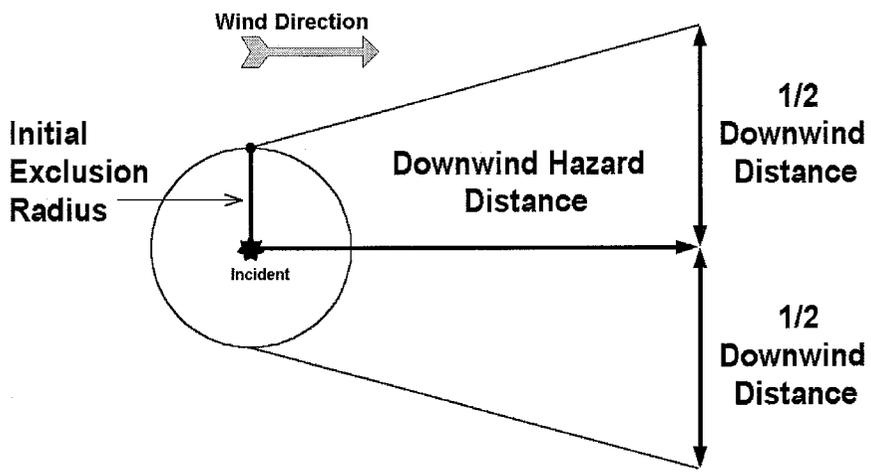
**LD<sub>50</sub>**: is the amount of liquid or solid material required to kill 50% of exposed and unprotected individuals. The agent enters the body through skin absorption unless indicated as ingestion.

Possible **routes** of exposure to chemical agents and toxins include inhalation, skin absorption of agent (solid, liquid, or gas), ingestion, local skin and/or eye impacts. Possible routes of exposure to pathogens include inhalation, ingestion, abraded skin (e.g., scrapes or cuts), mucous membranes (e.g., eyes, nose), and vectors (both aggressive and mechanical).

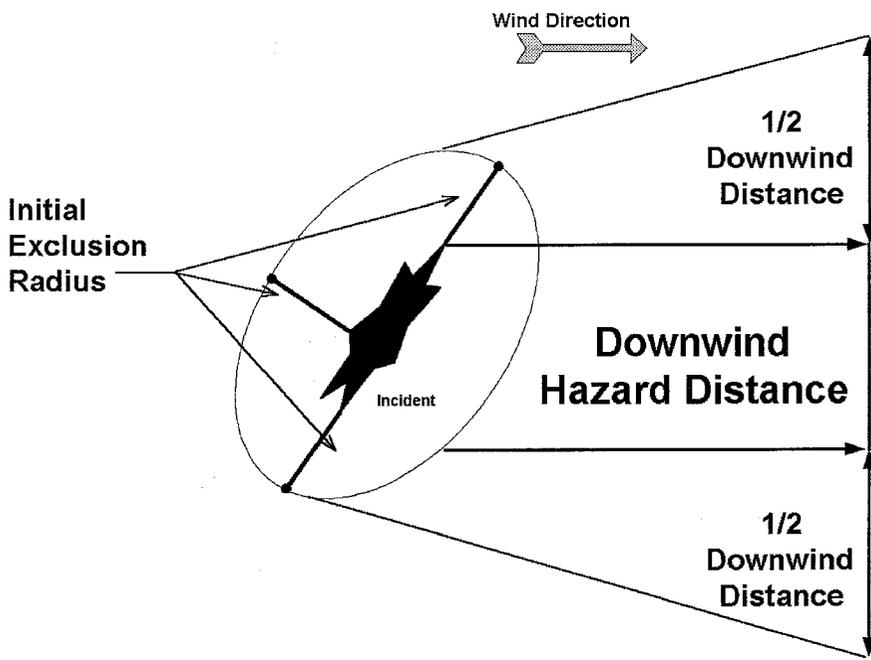
**Evacuation Distances** include the **Initial** isolation distance (**Initial**) and downwind evacuation distances for both day (**DW Day**) and night (**DW Night**) from the 1996 North American Emergency Response Guidebook (NAERG). All distances listed are for a “small spill” as defined by the NAERG (i.e., the amount of material released does not exceed 55 gallons). For information on response to larger releases refer to the NAERG. These distances indicate areas that would most likely be affected during the first 30 minutes after a release. Because of environmental conditions (e.g., weather, terrain) or the characteristics of the release, the impacted areas could increase with time.<sup>133</sup>

A simplified downwind hazard assessment can be developed by plotting these protective action distances in the form of a map overlay. The **Initial** distance is the radius of a circle immediately surrounding the point of release where people may potentially be exposed to dangerous or life threatening concentrations of vapor. The downwind distance (**DW Day** or **DW Night**) indicates the area of potential threat posed by vapors carried by the wind. The downwind threat may change depending on the time of the release. Distances for either day or night releases are indicated in the table. The potential distance of horizontal diffusion of agent vapor is determined by adding one-half of the downwind distance to either side of a line drawn from the middle of the release. [Figure 1](#) illustrates a simplified downwind hazard assessment.

Distances recommended in the NAERG were developed to assist responders at the scene of traditional hazardous materials incidents. It is important to realize that these distances were not developed to account for additional dispersal from an explosive device or from a spray release. In these cases, the **Initial** isolation and downwind evacuation distances should begin at the edge of any liquid contamination caused by the dispersal device. [Figure 2](#) illustrates an irregular release downwind hazard assessment.



**FIGURE 1**  
Standard NAERG downwind hazard diagram.



**FIGURE 2**  
Irregular release downwind hazard diagram.

**Secondary hazards** to pathogens identifies potential indirect dangers associated with contact with infected or contaminated individuals, animals, plants, or materials. These hazards include residual bacterial/fungal spores, contact with bodily fluids from infected individuals/animals, contact with fecal material from infected individuals/animals, contaminated fomites, as well as the vector cycle for pathogens that can be transmitted naturally via insects.

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## Toxicology

This section provides a general overview of the nature of the toxin agent (i.e., neurotoxin or cytotoxin) as well as any known specific physiological effects.

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## Properties

Chemical/Physical properties that vary with the ambient temperature are listed for “room temperature” (68°F or 20°C) unless otherwise indicated. Listed properties include:

**MW:** *Molecular Weight* or formula weight of the agent.

**MP:** *Melting Point* of the pure material.

**BP:** *Boiling Point* of the pure material at standard pressure (1 atmosphere). A designation of “decomposes” indicates that the agent will thermally decompose before it reaches its boiling point.

**VP:** *Vapor Pressure* of the pure material. Vapor pressure is the force exerted by a vapor when a state of equilibrium exists between the vapor phase and the solid/liquid phase. The higher the vapor pressure, the more rapidly the material will evaporate. When the vapor pressure equals 760 mm Hg (1 atmosphere), the material will boil.

**Vlt:** *Volatility* of the agent. Volatility is a measure of how much agent will evaporate under a given set of environmental conditions. The volatility of an agent can be compared to a hazardous exposure level to determine the potential risks. For example, the volatility of sarin is 2,800 ppm; the LC<sub>50</sub> for a 10-minute exposure is 1.2 ppm. The concentration produced by evaporating sarin is over 1,000 times this lethal level.

Volatility is sometimes used to estimate the persistency of an agent. While volatility does indicate the amount of material that will fill a volume of air above an agent, it does not account for the migration (diffusion) of that vapor out of the area to allow more agent to evaporate. Heavier agents will migrate out of an area more slowly than lighter agents will. For a more appropriate estimate of persistency, see the listing of relative persistency (RPr).

**SG:** *Specific Gravity* is a comparison of the liquid density of the agent to the density of water. The reference density of water is set at 1 gram per milliliter.

**RVD:** *Relative Vapor Density* is analogous to the specific gravity of liquids and is a comparison of the mass per unit volume of vapor of the agent to the mass per unit volume of air. Because of the properties of gases, the relative vapor density of one gas as compared to another gas can be calculated by establishing the ratio of their molecular (formula) weights. The reference formula weight of air, based on the normal distribution of oxygen, nitrogen and other gases, is set at 29.

**RPr:** *Relative Persistency* is a mathematical comparison of the evaporation and diffusion rates of water at 68°F (20°C) to the evaporation and diffusion rates of the agent. The value represents an estimate of the ratio of the time required for a liquid or solid agent to dissipate as compared to the amount of time required for an equal amount of liquid water to dissipate. The greater the value, the greater the amount of time required for the agent to evaporate. Other than evaporation and diffusing, this calculation does not account for additional factors that could impact the stability and persistence of a given agent (e.g., decomposition due to reaction with water).

**Sol:** *Solubility* of the agent in water. Solubilities are generally given in percentages indicating the weight of agent that will dissolve in the complementary amount of water. When quantitative solubility data is not available, qualitative terms (e.g., negligible, slight) are used to provide an intuitive evaluation of agent solubility. A designation of “miscible” indicates that the agent is soluble in water in all proportions. A designation of “insoluble” indicates that no appreciable amount of the agent will dissolve in water. A designation of “reacts” indicates that the agent is chemically incompatible with water and will decompose into other materials which may or may not be hazardous.

**Fl.P.:** *Flashpoint* of the material. The flashpoint is the temperature at which the liquid phase gives off enough vapor to flash when exposed to an ignition source.

**IP:** *Ionization Potential* is the amount of energy needed to remove an electron from a molecule of chemical vapor. The resultant ion is a charged particle that is detectable by certain instrumentation (i.e., photo ionization or flame ionization detectors). If the ionization potential of the agent is greater than the energy produced by the detection device, the agent vapor will not be detected.

For toxins, this section identifies where the toxin can be obtained from as well as the appearance of the pure material, its solubility in water, and its overall stability in the environment.

The **incubation period** is the amount of time between the exposure to a pathogen and the appearance of disease symptoms.

The **mortality rate** is the percentage of non-treated infected individuals that can be expected to die from the specific disease.

The **reservoir** is the animal, plant, or substance in which a pathogen normally lives. If this reservoir exists in the area of the release, then there is the possibility that an extended outbreak can result.

The **potential for direct person-to-person transmission** of pathogens is designated as possible, rare, or does not occur.

## NERVE AGENTS

Name	Physical Description	Exposure Hazards	Properties
Agent Index # A001 Class Index # C01	Colorless clear liquid with no odor.	<b>TWA:</b> 0.00001 ppm <b>IDLH:</b> 0.03 ppm <b>LC<sub>50</sub>:</b> — [0.5 ppm] <b>LD<sub>50</sub>:</b> — [0.35 gm/person]	<b>MW:</b> 180.2 <b>MP:</b> 10°F <b>BP:</b> 462°F <b>VP:</b> 0.07 mmHg (77°F) <b>Vl:</b> 59 ppm <b>SG:</b> 1.13 <b>RVD:</b> 6.2 <b>RPr:</b> 80 (77°F) <b>Sol:</b> 3.7% <b>Fl.P:</b> 201°F <b>IP:</b> ≤ 10.6 eV
<b>Cyclosarin</b> Agent GF CAS # 329-99-7 NAERG # 153		<b>Routes:</b> Inhalation Skin Absorption (liq, vpr) Ingestion	
$\text{CH}_3\text{P}(\text{O})(\text{F})\text{OC}_6\text{H}_{11}$			
<b>Evacuation Distances</b>			
<b>Initial:</b> 700 feet			
<b>DW Day:</b> 1.2 miles			
<b>DW Night:</b> 5.5 miles			
Agent Index # A002 Class Index # C03	Colorless liquid to white semi-solid depending on purity. Salts are white solids.	Human toxicity values have not been established. However, this agent is a powerful cholinesterase inhibitor.	<b>MW:</b> 198.2 <b>MP:</b> -166°F <b>BP:</b> 439°F <b>VP:</b> 0.049 mmHg (77°F) <b>Vl:</b> 65 ppm (77°F) <b>SG:</b> 1.11 (77°F) <b>RVD:</b> 6.8 <b>RPr:</b> 100 (77°F) <b>Sol:</b> — <b>Fl.P:</b> — <b>IP:</b> —
<b>DMAEDMAFP</b> Agent GP CAS # — NAERG # 153		<b>Routes:</b> Inhalation Skin Absorption (liq, vpr) Ingestion	
$(\text{CH}_3)_2\text{NP}(\text{O})(\text{F})\text{OCH}_2$ $\text{CH}_2\text{N}(\text{CH}_3)_2$			
<b>Evacuation Distances</b>			
<b>Initial:</b> 700 feet			
<b>DW Day:</b> 1.2 miles			
<b>DW Night:</b> 5.5 miles			
Agent Index # A003 Class Index # C03	Liquid.	Human toxicity values have not been established. However, this agent is a powerful cholinesterase inhibitor.	<b>MW:</b> 212.2 <b>MP:</b> -116°F <b>BP:</b> 435°F <b>VP:</b> 0.014 mmHg (77°F) <b>Vl:</b> 18 ppm (77°F) <b>SG:</b> 1.04
<b>DMAPDMAFP</b> Agent EA 5414 CAS # —			

**NERVE AGENTS (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
NAERG # 153 $(\text{CH}_3)_2\text{NP}(\text{O})(\text{F})\text{OCH}_2\text{CH}_2\text{CH}_2\text{N}(\text{CH}_3)_2$		<b>Routes:</b> Inhalation Skin Absorption (liq, vpr) Ingestion	<b>RVD:</b> 7.3 <b>RPr:</b> 100 (77°F) <b>Sol:</b> — <b>FLP:</b> — <b>IP:</b> —
		<b>Evacuation Distances</b> <b>Initial:</b> 700 feet <b>DW Day:</b> 1.2 miles <b>DW Night:</b> 5.5 miles	
Agent Index # A004 Class Index # C01 <b>Sarin</b> Agent GB CAS # 107-44-8 NAERG # 153 $\text{CH}_3\text{P}(\text{O})(\text{F})\text{OCH}(\text{CH}_3)_2$	Colorless, odorless liquid.	<b>TWA:</b> 0.00002 ppm <b>IDLH:</b> 0.03 ppm <b>LC<sub>50</sub>:</b> 1.2 ppm [0.6 ppm] <b>LD<sub>50</sub>:</b> 1.7 gm/person	<b>MW:</b> 140.1 <b>MP:</b> -69°F <b>BP:</b> 316°F <b>VP:</b> 2.1 mmHg <b>Vlt:</b> 2,800 ppm <b>SG:</b> 1.10 <b>RVD:</b> 4.9 <b>RPr:</b> 3 <b>Sol:</b> Miscible <b>FLP:</b> None <b>IP:</b> ~10.6 eV
		<b>Routes:</b> Inhalation Skin Absorption (liq, vpr) Ingestion	
		<b>Evacuation Distances</b> <b>Initial:</b> 700 feet <b>DW Day:</b> 1.2 miles <b>DW Night:</b> 5.5 miles	
Agent Index # A005 Class Index # C01 <b>Soman</b> Agent GD CAS # 96-64-0 NAERG # 153 $\text{CH}_3\text{P}(\text{O})(\text{F})\text{OCH}(\text{CH}_3)\text{C}(\text{CH}_3)_3$	Colorless to brown liquid with a fruity odor. Impurities may give GD the odor of oil of camphor. Thickened agent has viscosity similar to honey. Color and/or odor may vary from unthickened agent.	<b>TWA:</b> 0.000004 ppm <b>IDLH:</b> 0.008 ppm <b>LC<sub>50</sub>:</b> 0.9 ppm [0.5 ppm] <b>LD<sub>50</sub>:</b> 0.35 gm/person	<b>MW:</b> 182.2 <b>MP:</b> -44°F <b>BP:</b> 388°F <b>VP:</b> 0.40 mmHg (77°F) <b>Vlt:</b> 520 ppm (77°F) <b>SG:</b> 1.02 (77°F) <b>RVD:</b> 6.3 <b>RPr:</b> 10 (77°F) <b>Sol:</b> 2.1% <b>FLP:</b> 250°F <b>IP:</b> <10.6 eV
		<b>Routes:</b> Inhalation Skin Absorption (liq, vpr) Ingestion	

**NERVE AGENTS (CONTINUED)**

Name	Physical Description	Exposure Hazards	Properties
Agent Index # A006 Thickened		<b>Evacuation Distances</b> <b>Initial:</b> 700 feet <b>DW Day:</b> 1.2 miles <b>DW Night:</b> 5.5 miles	Properties of thickened agent vary according to thickeners used and proportions of agents to thickeners.
Agent Index # A007 Class Index # C01  <b>Tabun</b> Agent GA CAS # 77-81-6 NAERG # 153	Colorless to brown liquid with no odor when pure. Impurities may give GA a faintly fruity odor or the odor of bitter almonds.	<b>TWA:</b> 0.00002 ppm <b>IDLH:</b> 0.03 ppm <b>LC<sub>50</sub>:</b> 2 ppm [1 ppm] <b>LD<sub>50</sub>:</b> 1 gm/person  <b>Routes:</b> Inhalation Skin Absorption (liq, vpr) Ingestion	<b>MW:</b> 162.1 <b>MP:</b> -58°F <b>BP:</b> 428°F <b>VP:</b> 0.037 mmHg <b>Vl:</b> 49 ppm <b>SG:</b> 1.07 (77°F) <b>RVD:</b> 5.6 <b>RPr:</b> 200 <b>Sol:</b> 7.2% <b>FLP:</b> 172°F <b>IP:</b> <10.6 eV
C <sub>2</sub> H <sub>5</sub> OP(O)(CN)N (CH <sub>3</sub> ) <sub>2</sub>		<b>Evacuation Distances</b> <b>Initial:</b> 700 feet <b>DW Day:</b> 1.2 miles <b>DW Night:</b> 5.5 miles	
Agent Index # A008 Class Index # C02  <b>V-Gas</b> Agent Vx CAS # 20820-80-8 NAERG # 153	Amber colored oily liquid with no odor.	Human toxicity values have not been established. However, this agent should have toxicities very similar to agent VX.	<b>MW:</b> 211.2 <b>MP:</b> — <b>BP:</b> near 490°F <b>VP:</b> 0.004 mmHg <b>Vl:</b> 5.6 ppm <b>SG:</b> 1.06 (77°F) <b>RVD:</b> 7.3 <b>RPr:</b> 1,000 <b>Sol:</b> "Slight" (77°F) 100% at colder temperatures <b>FLP:</b> — <b>IP:</b> < 10.6 eV
CH <sub>3</sub> P(O)(OCH <sub>2</sub> CH <sub>3</sub> ) SCH <sub>2</sub> CH <sub>2</sub> N(CH <sub>3</sub> ) <sub>2</sub>		<b>Routes:</b> Inhalation Skin Absorption (liq, vpr) Ingestion  <b>Evacuation Distances</b> <b>Initial:</b> 700 feet <b>DW Day:</b> 1.2 miles <b>DW Night:</b> 5.5 miles	

**NERVE AGENTS (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A009 Class Index # C02  <b>VM</b> Agent VM CAS # 21770-86-5 NAERG # 153	Colorless to dark-yellow colored oily liquid with no odor.	<b>TWA:</b> 0.000001 ppm <b>IDLH:</b> 0.002 ppm <b>LC<sub>50</sub>:</b> 0.5 ppm <b>LD<sub>50</sub>:</b> —	<b>MW:</b> 239.3 <b>MP:</b> -58°F <b>BP:</b> near 560°F <b>VP:</b> 0.002 mmHg (77°F)
CH <sub>3</sub> P(O)(OCH <sub>2</sub> CH <sub>3</sub> )SCH <sub>2</sub> CH <sub>2</sub> N-(CH <sub>2</sub> CH <sub>3</sub> ) <sub>2</sub>		<b>Routes:</b> Inhalation Skin Absorption (liq, vpr) Ingestion	<b>VIt:</b> 2.8 ppm (77°F) <b>SG:</b> 1.03 (77°F) <b>RVD:</b> 8.3 <b>RPr:</b> 2,000 (77°F) <b>Sol:</b> Miscible
		<b>Evacuation Distances</b> <b>Initial:</b> 700 feet <b>DW Day:</b> 1.2 miles <b>DW Night:</b> 5.5 miles	<b>Fl.P:</b> 505°F <b>IP:</b> < 10.6 eV
Agent Index # A010 Class Index # C02  <b>VX</b> Agent VX CAS # 50782-69-9 NAERG # 153	Colorless to amber colored oily liquid, similar in appearance to motor oil, with no odor.	<b>TWA:</b> 0.0000009 ppm <b>IDLH:</b> 0.002 ppm <b>LC<sub>50</sub>:</b> 0.3 ppm [0.2 ppm] <b>LC<sub>50</sub>:</b> 0.01 gm/person [0.005 gm/person]	<b>MW:</b> 267.4 <b>MP:</b> ≤ -60°F <b>BP:</b> 568°F <b>VP:</b> 0.0007 mmHg <b>VIt:</b> 0.96 ppm <b>SG:</b> 1.01 <b>RVD:</b> 9.2 <b>RPr:</b> 6,000
CH <sub>3</sub> P(O)(OCH <sub>2</sub> CH <sub>3</sub> )SCH <sub>2</sub> CH <sub>2</sub> N-[CH(CH <sub>3</sub> ) <sub>2</sub> ] <sub>2</sub>	Thickened agent has viscosity similar to honey.	<b>Routes:</b> Inhalation Skin Absorption (liq, vpr) Ingestion	<b>Sol:</b> 3% (77°F) <b>Miscible</b> (≤ 49°F) <b>Fl.P:</b> 318°F <b>IP:</b> < 10.6 eV
Agent Index # A011 Thickened	Color and/or odor may vary from unthickened agent.	<b>Evacuation Distances</b> <b>Initial:</b> 700 feet <b>DW Day:</b> 1.2 miles <b>DW Night:</b> 5.5 miles	Properties of thickened agent vary according to thickeners used and proportions of agents to thickeners.

## VESICANTS

Name	Physical Description	Exposure Hazards	Properties
Agent Index # A012 Class Index # C07	Colorless, oily liquid with a faint onion-like odor.	<b>Eye:</b> — <b>Skin:</b> — <b>TWA:</b> 1 ppm <b>IDLH:</b> 7 ppm <b>LC<sub>50</sub>:</b> — <b>LD<sub>50</sub>:</b> —	<b>MW:</b> 126.1 <b>MP:</b> -25°F <b>BP:</b> Decomposes <b>VP:</b> 0.1 mmHg <b>Vlt:</b> 130 ppm <b>SG:</b> 1.33 <b>RVD:</b> 4.3
<b>Dimethylsulfate</b> No U.S. Military Designation CAS # 77-78-1 NAERG # 156		<b>Routes:</b> Inhalation Skin Absorption (liq) Ingestion Local Skin/Eye Impacts	<b>RPr:</b> 70 <b>Sol:</b> 3% (64°F) Reacts (> 64°F) <b>Fl.P:</b> 182°F <b>IP:</b> —
(CH <sub>3</sub> O) <sub>2</sub> SO <sub>2</sub>			
<b>Evacuation Distances</b>			
<b>Initial:</b> 400 feet			
<b>DW Day:</b> 0.4 miles			
<b>DW Night:</b> 1.7 miles			
Agent Index # A013 Class Index # C08	Colorless to yellowish liquid with fruity but biting and irritating odor.	<b>Eye:</b> — <b>Skin:</b> — <b>Nasal Irritation:</b> 0.07 ppm <b>TWA:</b> — <b>IDLH:</b> — <b>LC<sub>50</sub>:</b> 42 ppm <b>LD<sub>50</sub>:</b> —	<b>MW:</b> 174.9 <b>MP:</b> < -85°F <b>BP:</b> 313°F <b>VP:</b> 2.1 mmHg <b>Vlt:</b> 2,795 ppm <b>SG:</b> 1.74 <b>RVD:</b> 6.0
<b>Ethylchloroarsine</b> Agent ED CAS # 598-14-1 NAERG # 151	Vapor is irritating to both eyes and skin.	<b>Routes:</b> Inhalation Skin Absorption (liq, vpr) Ingestion Local Skin/Eye Impacts	<b>RPr:</b> 3 <b>Sol:</b> Reacts <b>Fl.P:</b> "High" <b>IP:</b> —
CH <sub>3</sub> CH <sub>2</sub> AsCl <sub>2</sub>			
<b>Evacuation Distances</b>			
<b>Initial:</b> 300 feet			
<b>DW Day:</b> 0.3 miles			
<b>DW Night:</b> 1.0 miles			
Agent Index # A014 Class Index # C08	Colorless to brownish liquid with geranium-like odor. No odor when pure.	<b>Eye:</b> < 3.5 ppm <b>Skin:</b> 18 ppm <b>Ceiling:</b> 0.0004 ppm <b>IDLH:</b> — <b>LC<sub>50</sub>:</b> 17 ppm	<b>MW:</b> 207.4 <b>MP:</b> 32°– 64°F <b>BP:</b> 374°F <b>VP:</b> 0.39 mmHg <b>Vlt:</b> 530 ppm

**VESICANTS (CONTINUED)**

Name	Physical Description	Exposure Hazards	Properties
<b>Lewisite</b> Agent L CAS # 541-25-3 NAERG # 153	Hydrolysis product, chlorovinyl arsenous oxide is also a vesicant.	<b>LD<sub>50</sub>:</b> 2.1 gm/person	<b>SG:</b> 1.89 <b>RVD:</b> 7.1 <b>RPr:</b> 10 <b>Sol:</b> Insoluble <b>FLP:</b> None <b>IP:</b> —
$\text{ClCH=CHAsCl}_2$  Agent Index # A015 Thickened	Thickened agent has viscosity similar to honey. Color and/or odor may vary from unthickened agent.	<b>Routes:</b> Inhalation Skin Absorption (liq, vpr) Ingestion Local Skin/Eye Impacts  <b>Evacuation Distances</b> <b>Initial:</b> 400 feet <b>DW Day:</b> 0.5 miles <b>DW Night:</b> 2.1 miles	Properties of thickened agent vary according to thickeners used and proportions of agents to thickeners.
Agent Index # A016 Class Index # C08	Liquid with no odor.	<b>Eye:</b> — <b>Skin:</b> — <b>Nasal Irritation:</b> 0.4 ppm <b>TWA:</b> — <b>IDLH:</b> — <b>LC<sub>50</sub>:</b> 46 ppm <b>LD<sub>50</sub>:</b> —	<b>MW:</b> 160.9 <b>MP:</b> -67°F <b>BP:</b> 271°F <b>VP:</b> 7.8 mmHg <b>Vlt:</b> 11,000 ppm <b>SG:</b> 1.84 <b>RVD:</b> 5.5 <b>RPr:</b> 0.8 <b>Sol:</b> Reacts <b>FLP:</b> "High" <b>IP:</b> 10.4 eV
<b>Methyldichloroarsine</b> Agent MD CAS # 593-89-5 NAERG # 152		<b>Routes:</b> Inhalation Skin Absorption (liq, vpr) Ingestion Local Skin/Eye Impacts	
$\text{CH}_3\text{AsCl}_2$		<b>Evacuation Distances</b> <b>Initial:</b> 200 feet <b>DW Day:</b> 0.2 miles <b>DW Night:</b> 0.6 miles	
Agent Index # A017 Class Index # C07	Oily, colorless to amber liquid with garlic-like or horseradish odor.	<b>Eye:</b> 1.5 ppm <b>Skin:</b> ≤ 31 ppm <b>TWA:</b> 0.0005 ppm <b>IDLH:</b> — <b>LC<sub>50</sub>:</b> 23 ppm [14 ppm]	<b>MW:</b> 159.1 <b>MP:</b> 58°F <b>BP:</b> Decomposes <b>VP:</b> 0.072 mmHg <b>Vlt:</b> 94 ppm <b>SG:</b> 1.27

**VESICANTS (CONTINUED)**

Name	Physical Description	Exposure Hazards	Properties
<b>Mustard</b> Agent H or HD CAS # 505-60-2 NAERG # 153  $(\text{ClCH}_2\text{CH}_2)_2\text{S}$	Thickened agent has viscosity similar to honey. Color and/or odor may vary from unthickened agent.	<b>LD<sub>50</sub>:</b> 7 gm/person [1.4 gm/person]  <b>Routes:</b> Inhalation Skin Absorption (liq, vpr) Ingestion Local Skin/Eye Impacts  <b>Evacuation Distances</b> <b>Initial:</b> 400 feet <b>DW Day:</b> 0.5 miles <b>DW Night:</b> 2.1 miles	<b>RVD:</b> 5.4 <b>RPr:</b> 80 <b>Sol:</b> < 1% <b>Fl.P:</b> 221°F <b>IP:</b> < 9 eV  Properties of thickened agent vary according to thickeners used and proportions of agents to thickeners.
Agent Index # A018 Thickened			
Agent Index # A019 Class Index # C09	Oily colorless to pale yellow liquid with faint fishy or musty odor. Salts are solids.	<b>Eye:</b> 2.9 ppm <b>Skin:</b> 130 ppm <b>TWA:</b> 0.0004 ppm <b>IDLH:</b> — <b>LC<sub>50</sub>:</b> 22 ppm <b>LD<sub>50</sub>:</b> —  <b>Routes:</b> Inhalation Skin Absorption (liq, vpr) Ingestion Local Skin/Eye Impacts	<b>MW:</b> 170.1 <b>MP:</b> -29°F <b>BP:</b> Decompose <b>VP:</b> 0.24 mmHg (77°F) <b>Vlt:</b> 220 ppm <b>SG:</b> 1.09 (77°F) <b>RVD:</b> 5.9 <b>RPr:</b> 20 (77°F) <b>Sol:</b> "Sparingly" <b>Fl.P:</b> "High" <b>IP:</b> —
<b>Nitrogen Mustard-1</b> Agent HN-1 CAS # 538-07-8 NAERG # 153  $\text{CH}_3\text{CH}_2\text{N}(\text{CH}_2\text{CH}_2\text{Cl})_2$	Slowly polymerizes during storage.	<b>Evacuation Distances</b> <b>Initial:</b> 400 feet <b>DW Day:</b> 0.5 miles <b>DW Night:</b> 2.1 miles	
Agent Index # A020 Class Index # C09	Dark liquid with fruity odor in high concentrations. Low concentrations have an odor similar to "soft-soap". Salts are solids.	<b>Eye:</b> 1.6 ppm <b>Skin:</b> 150 ppm <b>TWA:</b> — <b>IDLH:</b> — <b>LC<sub>50</sub>:</b> 47 ppm <b>LD<sub>50</sub>:</b> —	<b>MW:</b> 156.1 <b>MP:</b> -85°F <b>BP:</b> Decomposes <b>VP:</b> 0.29 mmHg <b>Vlt:</b> 560 ppm (77°F) <b>SG:</b> 1.15 <b>RVD:</b> 5.4

**VESICANTS (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
<b>Nitrogen Mustard-2</b> Agent HN-2 CAS # 51-75-2 NAERG # 153  $\text{CH}_3\text{N}(\text{CH}_2\text{CH}_2\text{Cl})_2$	Slowly polymerizes during storage. Not stable over extended periods.	<b>Routes:</b> Inhalation Skin Absorption (liq, vpr) Ingestion Local Skin/Eye Impacts	<b>RPr:</b> 20 <b>Sol:</b> "Sparingly" <b>Fl.P:</b> "High" <b>IP:</b> —
<b>Evacuation Distances</b> <b>Initial:</b> 400 feet <b>DW Day:</b> 0.5 miles <b>DW Night:</b> 2.1 miles			
Agent Index # A021 Class Index # C09  <b>Nitrogen Mustard-3</b> Agent HN-3 CAS # 555-77-1 NAERG # 153  $(\text{ClCH}_2\text{CH}_2)_3\text{N}$	Oily liquid with no odor. Salts are solids. Agent darkens during extended storage.	<b>Eye:</b> 2.4 ppm <b>Skin:</b> 30 ppm <b>TWA:</b> — <b>IDLH:</b> — <b>LC<sub>50</sub>:</b> 18 ppm <b>LD<sub>50</sub>:</b> 0.7 gm/person  <b>Routes:</b> Inhalation Skin Absorption (liq, vpr) Ingestion Local Skin/Eye Impacts	<b>MW:</b> 204.5 <b>MP:</b> 25°F <b>BP:</b> Decomposes <b>VP:</b> 0.011 mmHg (77°F) <b>Vlt:</b> 14 ppm (77°F) <b>SG:</b> 1.24 <b>RVD:</b> 7.1 <b>RPr:</b> 500 <b>Sol:</b> Insoluble <b>Fl.P:</b> "High" <b>IP:</b> —
<b>Evacuation Distances</b> <b>Initial:</b> 400 feet <b>DW Day:</b> 0.5 miles <b>DW Night:</b> 2.1 miles			
Agent Index # A022 Class Index # C07  <b>O-Mustard</b> Agent T CAS # 63918-89-8 NAERG # 153  $(\text{ClCH}_2\text{CH}_2\text{SCH}_2\text{CH}_2)_2\text{O}$	Yellow liquid with a garlic-like odor.	Human toxicity values have not been established. However, T is a powerful vesicant and is highly toxic by inhalation.  <b>Routes:</b> Inhalation Skin Absorption (liq, vpr) Ingestion Local Skin/Eye Impacts	<b>MW:</b> 263.3 <b>MP:</b> 49°F <b>BP:</b> Decomposes <b>VP:</b> 0.00003 mmHg (77°F) <b>Vlt:</b> 0.039 ppm (77°F) <b>SG:</b> 1.24 (77°F) <b>RVD:</b> 9.1 <b>RPr:</b> 100,000 <b>Sol:</b> Insoluble <b>Fl.P:</b> — <b>IP:</b> —

**VESICANTS (CONTINUED)**

Name	Physical Description	Exposure Hazards	Properties
<b>Evacuation Distances</b>			
Initial: 400 feet			
DW Day: 0.5 miles			
DW Night: 2.1 miles			
Agent Index # A023 Class Index # C08	Odorless liquid.	Eye: 6.9 ppm Skin: 24 ppm (approx.) Vomiting: 0.2 ppm	MW: 222.9 MP: -4°F BP: 486°F
<b>Phenyldichloroarsine</b> Agent PD CAS # 696-28-6 NAERG # 152		TWA: — IDLH: — LC <sub>50</sub> : 29 ppm LD <sub>50</sub> : —	VP: 0.033 mmHg (77°F) Vlt: 43 ppm (77°F) SG: 1.65 (77°F)
C <sub>6</sub> H <sub>5</sub> AsCl <sub>2</sub>		<b>Routes:</b> Inhalation Skin Absorption (liq, vpr) Ingestion Local Skin/Eye Impacts	RVD: 7.7 RPr: 200 Sol: Reacts Fl.P: "High" IP: —
<b>Evacuation Distances</b>			
None established			
Agent Index # A024 Class Index # C11	Colorless solid or liquid with intense, penetrating, disagreeable and violently irritating odor.	Eye: 0.2 ppm (10 second exposure) Skin: 0.6 ppm (1 minute exposure) TWA: — IDLH: — LC <sub>50</sub> : 69 ppm LD <sub>50</sub> : —	MW: 113.9 MP: 95°F BP: Decomposes VP: 11.2 mmHg Vlt: 390 ppm SG: —
<b>Phosgene Oxime</b> Agent CX CAS # 1794-86-1 NAERG # 154	Extremely unstable in contact with various metals. May decompose explosively in contact with iron chloride.	<b>Routes:</b> Inhalation Ingestion Local Skin/Eye Impacts	RVD: 3.9 RPr: 0.6 Sol: 100% Fl.P: — IP: —
Cl <sub>2</sub> C=NOH			
<b>Evacuation Distances</b>			
Initial: 400 feet			
DW Day: 0.5 miles			
DW Night: 2.1 miles			

## VESICANTS (CONTINUED)

Name	Physical Description	Exposure Hazards	Properties
Agent Index # A025 Class Index # C07	Liquid/solid with a garlic-like odor.	Human toxicity values have not been established. However, Q is the most powerful vesicant known and is highly toxic by inhalation.	<b>MW:</b> 219.2 <b>MP:</b> 133°F <b>BP:</b> Decomposes <b>VP:</b> 0.000035 mmHg (77°F) <b>Vlt:</b> 0.046 ppm (77°F) <b>SG:</b> 1.27 (77°F) <b>RVD:</b> 7.6 <b>RPr:</b> 140,000 <b>Sol:</b> Insoluble <b>Fl.P:</b> — <b>IP:</b> —
<b>Sesqui-Mustard</b> Agent Q CAS # 3563-36-8 NAERG # 153		<b>Routes:</b> Inhalation Skin Absorption (liq, vpr) Ingestion Local Skin/Eye Impacts	
<chem>ClCH2CH2SCH2CH2SCH2CH2Cl</chem>		<b>Evacuation Distances</b> <b>Initial:</b> 400 feet <b>DW Day:</b> 0.5 miles <b>DW Night:</b> 2.1 miles	

## BLOOD AGENTS

Name	Physical Description	Exposure Hazards	Properties
Agent Index A026 Class Index # C13	Colorless gas with a mild garlic-like odor.	<b>TWA:</b> 0.05 ppm <b>IDLH:</b> 3 ppm <b>LC<sub>50</sub>:</b> 160 ppm	<b>MW:</b> 77.9 <b>MP:</b> -177°F <b>BP:</b> -81°F <b>VP:</b> 11,100 mmHg
<b>Arsine</b> Agent SA CAS # 7784-42-1 NAERG # 119	Decomposed by light, heat, and contact with various metals.	<b>Routes:</b> Inhalation	<b>Vlt:</b> Gas <b>SG:</b> Gas <b>RVD:</b> 2.7 <b>RPr:</b> Gas
AsH <sub>3</sub>		<b>Evacuation Distances</b> <b>Initial:</b> 400 feet <b>DW Day:</b> 0.4 miles <b>DW Night:</b> 1.5 miles	<b>Sol:</b> 20% <b>Fl.P:</b> Gas <b>IP:</b> 9.89 eV

## BLOOD AGENTS (CONTINUED)

Name	Physical Description	Exposure Hazards	Properties
Agent Index # A027 Class Index # C12	Colorless gas with pungent, almond-like odor. Odor may not be detectable except at high concentrations.	<b>TWA:</b> 10 ppm <b>IDLH:</b> — <b>LC<sub>50</sub>:</b> —	<b>MW:</b> 52.0 <b>MP:</b> -18°F <b>BP:</b> -6°F <b>VP:</b> 3,876 mmHg
<b>Cyanogen</b> No U.S. Military Designation CAS # 460-19-5 NAERG # 119	Odor is not detectable by all individuals.	<b>Routes:</b> Inhalation Local Skin/Eye Impacts	<b>VI:</b> Gas <b>SG:</b> Gas <b>RVD:</b> 1.8 <b>RPr:</b> Gas
(CN) <sub>2</sub>		<b>Evacuation Distances</b> <b>Initial:</b> 200 feet <b>DW Day:</b> 0.2 miles <b>DW Night:</b> 0.6 miles	<b>Sol:</b> 1% <b>FLP:</b> Gas <b>IP:</b> 13.6 eV
Agent Index # A028 Class Index # C12	Colorless liquid or gas with a pungent, biting odor. Odor can go unnoticed because of discomfort.	<b>Eyes:</b> 4.8 ppm <b>Ceiling:</b> 0.3 ppm <b>IDLH:</b> — <b>LC<sub>50</sub>:</b> 430 ppm	<b>MW:</b> 61.5 <b>MP:</b> 20°F <b>BP:</b> 55°F <b>VP:</b> 1,010 mmHg
<b>Cyanogen Chloride</b> Agent CK CAS # 506-77-4 NAERG # 125	Will polymerize during extended storage.	<b>Routes:</b> Inhalation Skin Absorption (liq) Ingestion Local Skin/Eye Impacts	<b>VI:</b> Gas <b>SG:</b> 1.22 <b>RVD:</b> 2.2 <b>RPr:</b> Gas <b>Sol:</b> 7% <b>FLP:</b> None
CNCl	Polymerization may be explosive.		<b>IP:</b> 12.49 eV
Agent Index # A029 Mixed with Arsenic Trichloride (A033)	Cyanogen chloride is also used as an Industrial Fumigant.	<b>Evacuation Distances</b> <b>Initial:</b> 300 feet <b>DW Day:</b> 0.3 miles <b>DW Night:</b> 1.3 miles	
Agent Index # A030 Class Index # C12	Colorless gas or liquid with a bitter almond-like odor. Odor is not detectable by all individuals.	<b>TWA:</b> 10 ppm <b>IDLH:</b> 50 ppm <b>LC<sub>50</sub>:</b> 180 ppm <b>LD<sub>50</sub>:</b> 7 gm/person	<b>MW:</b> 27.0 <b>MP:</b> 8°F <b>BP:</b> 78°F <b>VP:</b> 612 mmHg
<b>Hydrogen Cyanide</b> Agent AC CAS # 74-90-8 NAERG # 117	Hydrogen cyanide is also used as an Industrial Fumigant.	<b>Routes:</b> Inhalation Skin Absorption (liq, vpr) Ingestion	<b>VI:</b> 980,000 ppm <b>SG:</b> 0.69 <b>RVD:</b> 0.99 <b>RPr:</b> 0.02 <b>Sol:</b> Miscible
HCN			<b>FLP:</b> 0°F
Agent Index # A031  Mixed with Arsenic Trichloride (A033)		<b>Evacuation Distances</b> <b>Initial:</b> 200 feet <b>DW Day:</b> 0.1 miles <b>DW Night:</b> 0.5 miles	<b>IP:</b> 13.60 eV

## BLOOD AGENTS (CONTINUED)

Name	Physical Description	Exposure Hazards	Properties
Agent Index # A032 Class Index # C12	Colorless gas with a strong odor of rotten eggs. Sense of smell rapidly fatigued and not reliable.	<b>Ceiling:</b> 20 ppm	<b>MW:</b> 34.1
<b>Hydrogen Sulfide</b>		<b>IDLH:</b> 100 ppm	<b>MP:</b> -122°F
No U.S. Military Designation	This chemical is also a precursor used in the synthesis of various arsenical Vesicant and Vomiting agents.	<b>LC<sub>50</sub>:</b> 700 ppm (30 minute exposure)	<b>BP:</b> -77°F
CAS # 7783-06-4		<b>Routes:</b> Inhalation	<b>VP:</b> 13,376 mmHg
NAERG # 117		<b>Evacuation Distances</b>	<b>RVD:</b> 1.2
H <sub>2</sub> S		<b>Initial:</b> 200 feet	<b>RPr:</b> Gas
		<b>DW Day:</b> 0.1 miles	<b>Sol:</b> 0.4%
		<b>DW Night:</b> 0.3 miles	<b>FLP:</b> Gas
			<b>IP:</b> 10.5 eV

## CHOKING AGENTS

Name	Physical Description	Exposure Hazards	Properties
Agent Index # A033 Class Index # C14	Clear, colorless to pale-yellow oily liquid sensitive to both light and moisture.	<b>TWA:</b> 0.07 ppm (as As)	<b>MW:</b> 181.3
<b>Arsenic Trichloride</b>		<b>IDLH:</b> —	<b>MP:</b> 17°F
No U.S. Military Designation	This chemical is also a precursor used in the synthesis of various arsenical Vesicant and Vomiting agents.	<b>LC<sub>50</sub>:</b> —	<b>BP:</b> 266°F
CAS # 7784-34-1		<b>LD<sub>50</sub>:</b> —	<b>VP:</b> 10 mmHg
NAERG # 157		<b>Routes:</b> Inhalation Skin Absorption (liq, gas) Ingestion	<b>Vlt:</b> 13,000 ppm
AsCl <sub>3</sub>		Local Skin/Eye Impacts	<b>SG:</b> 2.16
		<b>Evacuation Distances</b>	<b>RVD:</b> 6.3
		<b>Initial:</b> 300 feet	<b>RPr:</b> 0.6
		<b>DW Day:</b> 0.2 miles	<b>Sol:</b> Reacts
		<b>DW Night:</b> 0.8 miles	<b>FLP:</b> None
			<b>IP:</b> 10.9 eV

Agent Index # A034 Class Index # C14	Colorless liquid with a suffocating odor.	<b>TWA:</b> —	<b>MW:</b> 115.0
<b>Bis(chloromethyl) Ether</b>		<b>IDLH:</b> —	<b>MP:</b> -43°F
No US Military Designation	This chemical is also a precursor used in the synthesis of various arsenical Vesicant and Vomiting agents.	<b>LC<sub>50</sub>:</b> —	<b>BP:</b> 223°F
CAS # 542-88-1		<b>LD<sub>50</sub>:</b> —	<b>VP:</b> 30 mmHg (72°F)
NAERG # 153		<b>Routes:</b> Inhalation Skin Absorption (liq)	<b>Vlt:</b> 39,000 ppm (72°F)
			<b>SG:</b> 1.32
			<b>RVD:</b> 3.9

## CHOKING AGENTS (CONTINUED)

Name	Physical Description	Exposure Hazards	Properties
(ClCH <sub>2</sub> ) <sub>2</sub> O Agent Index # A035 Mixed with Ethyl Dichloroarsine (A013)		Ingestion Local Skin/Eye Impacts  <b>Evacuation Distances</b> None established	RPr: 0.2 Sol: Reacts Fl.P: <66°F IP: —
Agent Index # A036 Class Index # C14 <b>Bromine</b> No U.S. Military Designation CAS # 7726-95-6 NAERG # 154  Br <sub>2</sub>	Dark, reddish-brown liquid with suffocating, irritating fumes.	TWA: 0.1 ppm IDLH: 3 ppm LC <sub>50</sub> : — LD <sub>50</sub> : —  <b>Routes:</b> Inhalation Ingestion Local Skin/Eye Impacts  <b>Evacuation Distances</b> Initial: 200 feet DW Day: 0.2 miles DW Night: 0.6 miles	MW: 159.8 MP: 19°F BP: 139°F VP: 172 mmHg Vlt: 226,000 ppm SG: 3.12 RVD: 5.5 RPr: 0.03 Sol: 4% Fl.P: None IP: 10.6 eV
Agent Index # A037 Class Index # C15 <b>Cadmium Oxide (Fume)</b> No U.S. Military Designation CAS # 1306-19-0 NAERG # 154  CdO	Odorless, yellow- brown to colorless aerosol.	TWA: 0.005 mg/m <sup>3</sup> IDLH: 9 mg/m <sup>3</sup> LC <sub>50</sub> : —  <b>Routes:</b> Inhalation  <b>Evacuation Distances</b> None established	MW: 128.4 MP: 2,599°F BP: Decomposes VP: None Vlt: None SG: 8.15 RVD: Aerosol RPr: Aerosol Sol: Insoluble Fl.P: None IP: —
Agent Index # A038 Class Index # C14 <b>Chlorine</b> Agent Cl CAS # 7782-50-5 NAERG # 124  Cl <sub>2</sub>	Greenish-yellow gas with pungent, bleach- like odor.	Eye: 6 ppm Ceiling: 1 ppm IDLH: 10 ppm LC <sub>50</sub> : 655 ppm LD <sub>50</sub> : —  <b>Routes:</b> Inhalation Local Skin/Eye Impacts	MW: 70.9 MP: -150°F BP: -29°F VP: 4,992 mmHg Vlt: Gas SG: Gas RVD: 2.4 RPr: Gas Sol: 0.7% Fl.P: None

## CHOKING AGENTS (CONTINUED)

Name	Physical Description	Exposure Hazards	Properties
Agent Index # A039 Mixed with Chloropicrin (A041)		<b>Evacuation Distances</b> <b>Initial:</b> 200 feet <b>DW Day:</b> 0.2 miles <b>DW Night:</b> 0.5 miles	<b>IP:</b> 11.5 eV
Agent Index # A040 Class Index # C14 <b>Chlorine Trifluoride</b> No U.S. Military Designation CAS # 7790-91-2 NAERG # 124  ClF <sub>3</sub>	Colorless gas or a greenish-yellow liquid with a somewhat sweet, suffocating odor.  High concentrations of agent vapor will cause organic materials to spontaneously combust.	<b>Ceiling:</b> 0.1 ppm <b>IDLH:</b> 20 ppm <b>LC<sub>50</sub>:</b> — <b>LD<sub>50</sub>:</b> —  <b>Routes:</b> Inhalation Skin Absorption (liq) Ingestion Local Skin/Eye Impacts	<b>MW:</b> 92.5 <b>MP:</b> -105°F <b>BP:</b> 53°F <b>VP:</b> 1,064 mmHg <b>Vlt:</b> Gas <b>SG:</b> 1.77 <b>RVD:</b> 3.2 <b>RPr:</b> Gas <b>Sol:</b> Reacts <b>FLP:</b> None <b>IP:</b> 13.0 eV
		<b>Evacuation Distances</b> <b>Initial:</b> 300 feet <b>DW Day:</b> 0.2 miles <b>DW Night:</b> 0.8 miles	
Agent Index # A041 Class Index # C14 <b>Chloropicrin</b> Agent PS CAS # 76-06-2 NAERG # 154  CCl <sub>3</sub> NO <sub>2</sub>	Colorless oily liquid with a stinging, pungent odor.  This agent is currently identified by the U.S. as a tear agent because of its warning properties.  However, it was originally classified as a Choking Agent in WWI. It causes pulmonary edema, vomiting, and the liquid will produce blisters.	<b>Eye:</b> 0.1 ppm <b>TWA:</b> 0.1 ppm <b>IDLH:</b> 2 ppm <b>LC<sub>50</sub>:</b> 29.7 ppm <b>LD<sub>50</sub>:</b> —  <b>Routes:</b> Inhalation Ingestion Local Skin/Eye Impacts	<b>MW:</b> 164.4 <b>MP:</b> -93°F <b>BP:</b> 234°F <b>VP:</b> 18.3 mmHg <b>Vlt:</b> 25,000 ppm <b>SG:</b> 1.66 <b>RVD:</b> 5.7 <b>RPr:</b> 0.3 <b>Sol:</b> 0.2% <b>FLP:</b> None <b>IP:</b> —
Agent Index # A042 Mixed with Hydrogen Sulfide (A032)		<b>Evacuation Distances</b> <b>Initial:</b> 300 feet <b>DW Day:</b> 0.3 miles <b>DW Night:</b> 1.3 miles	
Agent Index # A043 Mixed with Stannic Chloride	Chloropicrin is also used as an Industrial Fumigant.		

## CHOKING AGENTS (CONTINUED)

Name	Physical Description	Exposure Hazards	Properties
Agent Index # A044 Class Index # C14  <b>Diphosgene</b> Agent DP CAS # 503-38-8 NAERG # 125  ClC(O)OCCL <sub>3</sub>	Colorless oily liquid with odor of new mown hay, grass, or green corn.  Converts to phosgene (CG) during extended storage.	<b>TWA:</b> — <b>IDLH:</b> — <b>LC<sub>50</sub>:</b> 37 ppm  <b>Routes:</b> Inhalation  <b>Evacuation Distances</b> <b>Initial:</b> 400 feet <b>DW Day:</b> 0.4 miles <b>DW Night:</b> 1.7 miles	<b>MW:</b> 197.9 <b>MP:</b> -71°F <b>BP:</b> 261°F <b>VP:</b> 4.2 mmHg <b>Vlt:</b> 5,600 ppm <b>SG:</b> 1.65 <b>RVD:</b> 6.8 <b>RPr:</b> 1 <b>Sol:</b> Slight <b>Fl.P:</b> None <b>IP:</b> —
Agent Index # A045 Class Index # C14  <b>Disulfur Decafluoride</b> No U.S. Military Designation CAS # 5714-22-7  S <sub>2</sub> F <sub>10</sub>	Colorless liquid or gas with an odor of sulfur dioxide.	<b>TWA:</b> 0.025 ppm <b>IDLH:</b> 1 ppm <b>LC<sub>50</sub>:</b> — <b>LD<sub>50</sub>:</b> —  <b>Routes:</b> Inhalation Skin Absorption (liq) Local Skin/Eye Impacts  <b>Evacuation Distances</b> None established	<b>MW:</b> 254.1 <b>MP:</b> -134°F <b>BP:</b> 84°F <b>VP:</b> 561 mmHg <b>Vlt:</b> 740,000 ppm <b>SG:</b> 2.08 <b>RVD:</b> 8.8 <b>RPr:</b> 0.008 <b>Sol:</b> Insoluble <b>Fl.P:</b> None <b>IP:</b> —
Agent Index # A046 Class Index # C14  <b>Nickel Carbonyl</b> No U.S. Military Designation CAS # 13463-39-3 NAERG # 131  Ni(CO) <sub>4</sub>	Colorless to yellow liquid with a musty or sooty odor.	<b>TWA:</b> 0.001 ppm <b>IDLH:</b> 2 ppm <b>LC<sub>50</sub>:</b> — <b>LD<sub>50</sub>:</b> —  <b>Routes:</b> Inhalation Skin Absorption (liq) Ingestion Local Skin/Eye Impacts  <b>Evacuation Distances</b> <b>Initial:</b> 400 feet <b>DW Day:</b> 0.3 miles <b>DW Night:</b> 1.5 miles	<b>MW:</b> 170.7 <b>MP:</b> -13°F <b>BP:</b> 110°F <b>VP:</b> 315 mmHg <b>Vlt:</b> 410,000 ppm <b>SG:</b> 1.32 <b>RVD:</b> 5.9 <b>RPr:</b> 0.02 <b>Sol:</b> 0.05% <b>Fl.P:</b> <-4° <b>IP:</b> 8.3 eV

## CHOKING AGENTS (CONTINUED)

Name	Physical Description	Exposure Hazards	Properties
Agent Index # A047 Class Index # C14	Pale-yellow, oily liquid with an unbearable, acrid odor.	<b>TWA:</b> 0.1 ppm <b>IDLH:</b> 10 ppm <b>LC<sub>50</sub>:</b> — <b>LD<sub>50</sub>:</b> —	<b>MW:</b> 185.9 <b>MP:</b> — <b>BP:</b> Decomposes <b>VP:</b> 3 mmHg <b>Vlt:</b> 3,900 ppm <b>SG:</b> 1.69 <b>RVD:</b> 6.4 <b>RPr:</b> 2 <b>Sol:</b> Insoluble <b>Fl.P:</b> None <b>IP:</b> —
<b>Perchloromethyl Mercaptan</b> No U.S. Military Designation CAS # 594-42-3 NAERG # 157		<b>Routes:</b> Inhalation Skin Absorption (liq) Ingestion Local Skin/Eye Impacts	
Cl <sub>3</sub> CSCl		<b>Evacuation Distances</b> <b>Initial:</b> 300 feet <b>DW Day:</b> 0.2 miles <b>DW Night:</b> 0.8 miles	
Agent Index # A048 Class Index # C14	Colorless gas with an odor of new-mown hay, grass, or green corn.	<b>TWA:</b> 0.1 ppm <b>IDLH:</b> 2 ppm <b>LC<sub>50</sub>:</b> 79 ppm	<b>MW:</b> 98.9 <b>MP:</b> -198°F <b>BP:</b> 46°F <b>VP:</b> 1,173 mmHg <b>Vlt:</b> Gas <b>SG:</b> 1.37 <b>RVD:</b> 3.4 <b>RPr:</b> Gas <b>Sol:</b> "Slight" <b>Fl.P:</b> None <b>IP:</b> 11.55 eV
<b>Phosgene</b> Agent CG CAS # 75-44-5 NAERG # 125		<b>Routes:</b> Inhalation	
COCl <sub>2</sub>		<b>Evacuation Distances</b> <b>Initial:</b> 400 feet <b>DW Day:</b> 0.4 miles <b>DW Night:</b> 1.7 miles	
Agent Index # A049 Mixed with Chlorine (A038)			
Agent Index # A050 Mixed with Di-phosgene (A044)			
Agent Index # A051 Mixed with Chloropicrin (A041)			
Agent Index # A052 Mixed with Arsenic Trichloride (A033)			

## CHOKING AGENTS (CONTINUED)

Name	Physical Description	Exposure Hazards	Properties
Agent Index # A053 Mixed with Stannic Chloride			
Agent Index # A054 Class Index # C15 <b>Selenium Oxide (Fume)</b> No U.S. Military Designation CAS # 7446-08-4 NAERG # 154	Yellow to off-white aerosol, which may be either odorless or have a pungent sour smell.	<b>TWA:</b> 0.28 mg/m <sup>3</sup> <b>IDLH:</b> 1.4 mg/m <sup>3</sup> <b>LC<sub>50</sub>:</b> — <b>Routes:</b> Inhalation Ingestion Local Skin/Eye Impacts	<b>MW:</b> 112.0 <b>MP:</b> 644°F <b>BP:</b> Sublimes <b>VP:</b> 12.5 mmHg (158°F) <b>Vit:</b> — <b>SG:</b> 3.95 <b>RVD:</b> Aerosol <b>RPr:</b> Aerosol <b>Sol:</b> 38.4% (57°F)
SeO <sub>2</sub>		<b>Evacuation Distances</b> None established	<b>Fl.P:</b> None <b>IP:</b> —

## INCAPACITATING AGENTS

Name	Physical Description	Exposure Hazards	Properties
Agent Index # A055 Class Index # C16 <b>Buzz</b> Agent BZ CAS # 13004-56-3 NAERG # 154	White crystalline solid with no odor.	<b>TWA:</b> 0.004 mg/m <sup>3</sup> <b>IDLH:</b> — <b>IC<sub>50</sub>:</b> 11.2 mg/m <sup>3</sup> <b>LC<sub>50</sub>:</b> 20,000 mg/m <sup>3</sup> <b>Routes:</b> Inhalation Skin Absorption (sld) Ingestion	<b>MW:</b> 337.4 <b>MP:</b> 327°F <b>BP:</b> 608°F <b>VP:</b> Negligible <b>Vit:</b> Negligible <b>SG:</b> 0.51 (powder) <b>RVD:</b> 11 <b>RPr:</b> "High" <b>Sol:</b> "Slight" <b>Fl.P:</b> 475°F <b>IP:</b> —
(C <sub>6</sub> H <sub>5</sub> ) <sub>2</sub> C(OH)CO <sub>2</sub> C <sub>7</sub> H <sub>12</sub> N·HCl		<b>Evacuation Distances</b> None established	

## TEAR AGENTS

Name	Physical Description	Exposure Hazards	Properties
Agent Index # A056 Class Index # C18	Colorless to yellow liquid with a piercing, disagreeable odor.	<b>Eye:</b> 0.5 ppm <b>TWA:</b> 0.1 ppm <b>IDLH:</b> 2 ppm <b>LC<sub>50</sub>:</b> —	<b>MW:</b> 56.1 <b>MP:</b> -126°F <b>BP:</b> 127°F <b>VP:</b> 210 mmHg <b>Vlt:</b> 280,000 ppm
<b>Acrolein</b> No U.S. Military Designation CAS # 107-02-8 NAERG # 131P	Acrolein is also used as an Industrial Fumigant.	<b>Routes:</b> Inhalation Ingestion Local Skin/Eye Impacts	<b>SG:</b> 0.84 <b>RVD:</b> 1.9 <b>RPr:</b> 0.05 <b>Sol:</b> 40% <b>FLP:</b> -15°F <b>IP:</b> 10.1 eV
CH <sub>2</sub> =CHCHO		<b>Evacuation Distances</b> <b>Initial:</b> 400 feet <b>DW Day:</b> 0.3 miles <b>DW Night:</b> 1.4 miles	
Agent Index # A057 Mixed with Stannic Chloride			
Agent Index # A058 Class Index # C17	Colorless to slightly yellow liquid with a pungent, aromatic odor.	<b>Eye:</b> 8 ppm <b>TWA:</b> 1 ppm <b>IDLH:</b> 10 ppm <b>LC<sub>50</sub>:</b> —	<b>MW:</b> 126.6 <b>MP:</b> -38°F <b>BP:</b> 354°F <b>VP:</b> 1 mmHg <b>Vlt:</b> 1,300 ppm
<b>Benzyl Chloride</b> No U.S. Military Designation CAS # 100-44-7 NAERG # 156		<b>Routes:</b> Inhalation Ingestion Local Skin/Eye Impacts	<b>SG:</b> 1.10 <b>RVD:</b> 4.4 <b>RPr:</b> 7 <b>Sol:</b> 0.05% <b>FLP:</b> 153°F <b>IP:</b> —
C <sub>6</sub> H <sub>5</sub> CH <sub>2</sub> Cl		<b>Evacuation Distances</b> None established	
Agent Index # A059 Class Index # C17	Yellow liquid or solid with the odor of soured or rotting fruit.	<b>Eye:</b> 0.04 ppm <b>TWA:</b> — <b>IDLH:</b> — <b>LC<sub>50</sub>:</b> 99.8 ppm	<b>MW:</b> 196.0 <b>MP:</b> 78°F <b>BP:</b> Decomposes <b>VP:</b> 0.011 mmHg <b>Vlt:</b> 14 ppm
<b>Bromobenzylcyanide</b> Agent CA CAS # 16532-79-9 NAERG # 159		<b>Routes:</b> Inhalation Local Skin/Eye Impacts	<b>SG:</b> 1.52 (solid) <b>RVD:</b> 6.7 <b>RPr:</b> 500 <b>Sol:</b> Insoluble <b>FLP:</b> None <b>IP:</b> —
C <sub>6</sub> H <sub>5</sub> CHBrCN		<b>Evacuation Distances</b> None established	

## TEAR AGENTS (CONTINUED)

Name	Physical Description	Exposure Hazards	Properties
Agent Index # A060 Class Index # C17  <b>o-Chlorobenzyl-malononitrile</b> Agent CS CAS # 2698-41-1 NAERG # 159	White crystalline solid with a pungent pepper-like odor. May also appear as a 1% solution in trioctylphosphite.	<b>Eye:</b> 1 mg/m <sup>3</sup> <b>TWA:</b> 0.4 mg/m <sup>3</sup> <b>IDLH:</b> 2 mg/m <sup>3</sup> <b>LC<sub>50</sub>:</b> 6,100 mg/m <sup>3</sup>  <b>Routes:</b> Inhalation Ingestion Local Skin/Eye Impacts	<b>MW:</b> 188.6 <b>MP:</b> 199°F <b>BP:</b> 590°F <b>VP:</b> 0.00034 mmHg <b>VI:</b> 0.09 ppm <b>SG:</b> 0.26 (powder) <b>RVD:</b> 6.5 <b>RPr:</b> 20,000 <b>Sol:</b> 0.02% <b>FLP:</b> 386°F <b>IP:</b> —
C <sub>10</sub> H <sub>9</sub> CH=C(CN) <sub>2</sub>		<b>Evacuation Distances</b> None established	
Agent Index # A061 Mixed with Silica Aerogel			
Agent Index # A062 Mixed with Trioctylphosphite			
Agent Index # A063 Class Index # C18  <b>Dibenz-(b,f)-1,4-oxazepine</b> Agent CR CAS # 257-07-8 NAERG # 159	Yellow needles or brown solid, sugary in appearance, with peppery odor.	<b>Eye:</b> 0.15 mg/m <sup>3</sup> <b>Ceiling:</b> 0.005 mg/m <sup>3</sup> <b>IDLH:</b> 0.25 mg/m <sup>3</sup> <b>LC<sub>50</sub>:</b> —  <b>Routes:</b> Inhalation Ingestion Local Skin/Eye Impacts	<b>MW:</b> 195.2 <b>MP:</b> 162°F <b>BP:</b> 635°F <b>VP:</b> 0.000059 mmHg <b>VI:</b> 0.08 ppm (77°F) <b>SG:</b> 1.56 <b>RVD:</b> 6.7 <b>RPr:</b> 90,000 <b>Sol:</b> 0.008% <b>FLP:</b> 370°F <b>IP:</b> —
C <sub>6</sub> H <sub>4</sub> (O)(N=CH)C <sub>6</sub> H <sub>4</sub>		<b>Evacuation Distances</b> None established	
Agent Index # A064 Class Index # C17  <b>Mace</b> Agent CN CAS # 532-27-4 NAERG # 153	Colorless to gray crystalline solid with a sharp irritating odor similar to apple blossoms.	<b>Eye:</b> 8 mg/m <sup>3</sup> <b>TWA:</b> 0.3 mg/m <sup>3</sup> <b>IDLH:</b> 15 mg/m <sup>3</sup> <b>LC<sub>50</sub>:</b> 1,400 mg/m <sup>3</sup>  <b>Routes:</b> Inhalation Local Skin/Eye Impacts	<b>MW:</b> 154.6 <b>MP:</b> 134°F <b>BP:</b> 472°F <b>VP:</b> 0.005 mmHg <b>VI:</b> 5.4 ppm <b>SG:</b> 1.32 <b>RVD:</b> 5.3 <b>RPr:</b> 1,000 <b>Sol:</b> Insoluble <b>FLP:</b> 244°F <b>IP:</b> 9.44 eV
C <sub>6</sub> H <sub>5</sub> C(O)CH <sub>2</sub> Cl		<b>Evacuation Distances</b> None established	
Agent Index # A065 Mixed with Chloropicrin (A041)			

## TEAR AGENTS (CONTINUED)

Name	Physical Description	Exposure Hazards	Properties
Agent Index # A066 Mixed with Chloroform			
Agent Index # A067 Mixed with Benzene and Carbon Tetrachloride			
Agent Index # A068 Class Index # C18  <b>1-Methoxy-1,3,5-cycloheptatriene</b> Agent CH CAS # — NAERG # 159	Colorless to brown liquid with a "sweetish" odor.	Human toxicity values have not been established. However, this agent is a powerful lacrimator with effects reported to be more severe than from Agent CS.	<b>MW:</b> 122.0 <b>MP:</b> -153°F <b>BP:</b> 345°F <b>VP:</b> 1.3 mmHg (77°F) <b>Vlt:</b> 1,700 ppm <b>SG:</b> 0.97 (77°F) <b>RVD:</b> 4.2 <b>RP:</b> 5 <b>Sol:</b> 0.07% <b>FLP:</b> 133°F <b>IP:</b> —
-[CH <sub>2</sub> C(OCH <sub>3</sub> )=CH CH=CHCH=CH]-		<b>Routes:</b> Inhalation Skin Absorption (liq) Ingestion Local Skin/Eye Impacts	
		<b>Evacuation Distances</b> None established	
Agent Index # A069 Class Index # C19  <b>Pepper Spray</b> Agent OC CAS # Mixture NAERG # 159	Varies depending on manufacturer. Typically amber to light red appearance with a slight ethereal odor due to the propellant. Mixture may include dye.	<b>Eye:</b> — <b>TWA:</b> — <b>IDLH:</b> — <b>LC<sub>50</sub>:</b> —  <b>Routes:</b> Inhalation Local Skin/Eye Impacts	<b>MW:</b> Mixture <b>MP:</b> Varies <b>BP:</b> Varies <b>VP:</b> Varies <b>Vlt:</b> Varies <b>SG:</b> Varies <b>RVD:</b> Varies <b>RP:</b> Varies <b>Sol:</b> Varies <b>FLP:</b> Varies <b>IP:</b> —
Agent Index # A070 Capsaicin	For Capsaicin: orange red liquid or dark red solid.	<b>Evacuation Distances</b> None established	

### TEAR AGENTS (CONTINUED)

Name	Physical Description	Exposure Hazards	Properties
Agent Index # A071 Class Index # C17	Reddish liquid.	Eye: — TWA: — IDLH: — LC <sub>50</sub> : — LD <sub>50</sub> : —	MW: 115.0 MP: — BP: 163°F VP: — Vlt: — SG: 1.51 RVD: 4.0 RPr: — Sol: Reacts FLP: None IP: 9.7 eV
<b>Thiophosgene</b> No U.S. Military Designation CAS # 463-71-8 NAERG # 157		<b>Routes:</b> Inhalation Skin Absorption (liq) Ingestion Local Skin/Eye Impacts	
CSCI <sub>2</sub>			
Agent Index # A072 Mixed with Stannic Chloride		<b>Evacuation Distances</b> Initial: 300 feet DW Day: 0.2 miles DW Night: 0.7 miles	

### VOMITING AGENTS

Name	Physical Description	Exposure Hazards	Properties
Agent Index # A073 Class Index # C20	Light yellow to green crystals with no pronounced odor. Vapors are irritating.	TWA: — IDLH: — Vomiting: 2.2 mg/m <sup>3</sup> LC <sub>50</sub> : 1,100 mg/m <sup>3</sup>	MW: 277.6 MP: 383°F BP: 770°F VP: Negligible Vlt: Negligible SG: 1.65 (solid) RVD: Aerosol RPr: Aerosol Sol: Insoluble FLP: None IP: —
<b>Adamsite</b> Agent DM CAS # 578-94-9 NAERG # 152		<b>Routes:</b> Inhalation Ingestion Local Skin/Eye Impacts	
C <sub>6</sub> H <sub>4</sub> (NH)(AsCl)C <sub>6</sub> H <sub>4</sub>			
Agent Index # A074 Mixed with Diphenylchloroarsine (A076)		<b>Evacuation Distances</b> None established	
Agent Index # A075 Mixed with Cellulose Nitrate and Urea			

## VOMITING AGENTS (CONTINUED)

Name	Physical Description	Exposure Hazards	Properties
Agent Index # A076 Class Index # C20	Colorless crystals with no pronounced odor.	<b>TWA:</b> — <b>IDLH:</b> — <b>Vomiting:</b> 1.2 mg/m <sup>3</sup> <b>LC<sub>50</sub>:</b> 1,500 mg/m <sup>3</sup>	<b>MW:</b> 264.5 <b>MP:</b> 106°F <b>BP:</b> Decomposes <b>VP:</b> 0.0036 mmHg (113°F)
<b>Diphenylchloroarsine</b> Agent DA CAS # 712-48-1 NAERG # 151  (C <sub>6</sub> H <sub>5</sub> ) <sub>2</sub> AsCl		<b>Routes:</b> Inhalation Ingestion Local Skin/Eye Impacts	<b>VI:</b> 5 ppm (113°F) <b>SG:</b> 1.39 (122°F) <b>RVD:</b> 9.1 <b>RPr:</b> 1,000 (113°F) <b>Sol:</b> Insoluble <b>FLP:</b> 662°F <b>IP:</b> <9 eV
Agent Index # A077 Mixed with Ethylcarbazole		<b>Evacuation Distances</b> None established	
Agent Index # A078 Mixed with Phenylchloroarsine (A023)			
Agent Index # A079 Class Index # C20	Solid with odor similar to garlic and bitter almonds.	<b>TWA:</b> — <b>IDLH:</b> — <b>Vomiting:</b> 0.2 ppm <b>LC<sub>50</sub>:</b> 95.9 ppm	<b>MW:</b> 255.0 <b>MP:</b> 89°F <b>BP:</b> Decomposes <b>VP:</b> 0.0002 mmHg
<b>Diphenylcyanoarsine</b> Agent DC CAS # 23525-22-6 NAERG # 152  (C <sub>6</sub> H <sub>5</sub> ) <sub>2</sub> AsCN		<b>Routes:</b> Inhalation Ingestion Local Skin/Eye Impacts	<b>VI:</b> 0.3 ppm <b>SG:</b> 1.33 <b>RVD:</b> 8.8 <b>RPr:</b> 20,000 <b>Sol:</b> Insoluble <b>FLP:</b> "Low" <b>IP:</b> <9 eV
Agent Index # A080 Mixed with Phenylchloroarsine (A023)		<b>Evacuation Distances</b> None established	

## INDUSTRIAL "AGENTS"

Name	Physical Description	Exposure Hazards	Properties
Agent Index # A081 <b>Acrylonitrile</b> CAS # 107-13-1 NAERG # 131P	Colorless to pale-yellow liquid with an unpleasant odor. Odor is only detectable above the TWA.  Acrylonitrile is also used as an Industrial Fumigant.	<b>TWA:</b> 2 ppm <b>IDLH:</b> 85 ppm  <b>Routes:</b> Inhalation Skin Absorption (liq) Ingestion Local Skin/Eye Impacts	<b>MW:</b> 53.1 <b>MP:</b> -116°F <b>BP:</b> 171°F <b>VP:</b> 83 mmHg <b>Vl:</b> 110,000 ppm <b>SG:</b> 0.81 <b>RVD:</b> 1.8 <b>RPr:</b> 0.1 <b>Sol:</b> 7% <b>FLP:</b> 30°F <b>IP:</b> 10.9 eV
		<b>Evacuation Distances</b> None established	
Agent Index # A082 <b>Allyl Alcohol</b> CAS # 107-18-6 NAERG # 131	Colorless liquid with a pungent, mustard-like odor.	<b>TWA:</b> 2 ppm <b>IDLH:</b> 20 ppm  <b>Routes:</b> Inhalation Skin Absorption (liq) Ingestion Local Skin/Eye Impacts	<b>MW:</b> 58.1 <b>MP:</b> -200°F <b>BP:</b> 205°F <b>VP:</b> 17 mmHg <b>Vl:</b> 22,000 ppm <b>SG:</b> 0.85 <b>RVD:</b> 2.0 <b>RPr:</b> 0.5 <b>Sol:</b> Miscible <b>FLP:</b> 70°F <b>IP:</b> 9.6 eV
		<b>Evacuation Distances</b> <b>Initial:</b> 200 feet <b>DW Day:</b> 0.1 miles <b>DW Night:</b> 0.3 miles	
Agent Index # A083 <b>Ammonia</b> CAS # 7664-41-7 NAERG # 125	Colorless gas with a pungent, suffocating odor.	<b>TWA:</b> 25 ppm <b>IDLH:</b> 300 ppm  <b>Routes:</b> Inhalation Local Skin/Eye Impacts	<b>MW:</b> 17.0 <b>MP:</b> -108°F <b>BP:</b> -28°F <b>VP:</b> 6,460 mmHg <b>Vl:</b> Gas <b>SG:</b> Gas <b>RVD:</b> 0.6 <b>RPr:</b> Gas <b>Sol:</b> 34% <b>FLP:</b> Gas <b>IP:</b> 10.2 eV
		<b>Evacuation Distances</b> <b>Initial:</b> 100 feet <b>DW Day:</b> 0.1 miles <b>DW Night:</b> 0.2 miles	

**INDUSTRIAL "AGENTS" (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A084	Colorless liquid with chlorinated solvent-like odor.	<b>TWA:</b> 5 ppm <b>IDLH:</b> 100 ppm	<b>MW:</b> 143 <b>MP:</b> -58°F <b>BP:</b> 352°F <b>VP:</b> 0.7 mmHg <b>VI:</b> 920 ppm <b>SG:</b> 1.22 <b>RVD:</b> 4.9 <b>RPr:</b> 9 <b>Sol:</b> 1.1% <b>FLP:</b> 131°F <b>IP:</b> —
<b>Bis(2-chloroethyl) Ether</b> CAS # 111-44-4 NAERG # 152  (ClCH <sub>2</sub> CH <sub>2</sub> ) <sub>2</sub> O	Bis(2-chloroethyl) Ether is also used as an Industrial Fumigant.	<b>Routes:</b> Inhalation Skin Absorption (liq) Ingestion Local Skin/Eye Impacts	
		<b>Evacuation Distances</b> None established	
Agent Index # A085	Colorless liquid with a sharp, irritating odor.	<b>Ceiling:</b> 1 ppm <b>IDLH:</b> —	<b>MW:</b> 250.5 <b>MP:</b> -51°F <b>BP:</b> 194°F <b>VP:</b> 40 mmHg (57°F) <b>VI:</b> 53,000 ppm (57°F) <b>SG:</b> 2.64 <b>RVD:</b> 8.6 <b>RPr:</b> 0.1 (57°F) <b>Sol:</b> Reacts <b>FLP:</b> None <b>IP:</b> 9.7 eV
<b>Boron Tribromide</b> CAS # 10294-33-4 NAERG # 157  BBr <sub>3</sub>		<b>Routes:</b> Inhalation Ingestion Local Skin/Eye Impacts	
		<b>Evacuation Distances</b> <b>Initial:</b> 200 feet <b>DW Day:</b> 0.1 miles <b>DW Night:</b> 0.5 miles	
Agent Index # A086	Colorless fuming liquid or gas with a pungent, choking odor.	<b>TWA:</b> — <b>IDLH:</b> —	<b>MW:</b> 117.2 <b>MP:</b> -161°F <b>BP:</b> 54°F <b>VP:</b> 760 mmHg (55°F) <b>VI:</b> Gas <b>SG:</b> 1.35 (52°F) <b>RVD:</b> 4.0 <b>RPr:</b> 0.009 <b>Sol:</b> Reacts <b>FLP:</b> None <b>IP:</b> —
<b>Boron Trichloride</b> CAS # 10294-34-5 NAERG # 125  BCl <sub>3</sub>		<b>Routes:</b> Inhalation Ingestion Local Skin/Eye Impacts	
		<b>Evacuation Distances</b> <b>Initial:</b> 200 feet <b>DW Day:</b> 0.1 miles <b>DW Night:</b> 0.3 miles	

**INDUSTRIAL "AGENTS" (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A087 <b>Boron Trifluoride</b> CAS # 7637-07-2 NAERG # 125  BF <sub>3</sub>	Colorless gas with a pungent suffocating odor. Forms dense, white smoke in moist air.	<b>Ceiling:</b> 1 ppm <b>IDLH:</b> 25 ppm  <b>Routes:</b> Inhalation Local Skin/Eye Impacts  <b>Evacuation Distances</b> <b>Initial:</b> 200 feet <b>DW Day:</b> 0.1 miles <b>DW Night:</b> 0.4 miles	<b>MW:</b> 67.8 <b>MP:</b> -196°F <b>BP:</b> -148°F <b>VP:</b> >38,000 mmHg <b>Vl:</b> Gas <b>SG:</b> Gas <b>RVD:</b> 2.4 <b>RPr:</b> Gas <b>Sol:</b> 106% (cold water) <b>FLP:</b> Gas <b>IP:</b> 15.5 eV
Agent Index # A088 <b>Bromine Trifluoride</b> CAS # 7787-71-5 NAERG # 144  BrF <sub>3</sub>	Colorless to pale-yellow fuming liquid.	<b>TWA:</b> — <b>IDLH:</b> —  <b>Routes:</b> Inhalation Skin Absorption (liq) Ingestion Local Skin/Eye Impacts  <b>Evacuation Distances</b> <b>Initial:</b> 300 feet <b>DW Day:</b> 0.2 miles <b>DW Night:</b> 0.9 miles	<b>MW:</b> 136.9 <b>MP:</b> 48°F <b>BP:</b> 259°F <b>VP:</b> 7.8 mmHg <b>SG:</b> 2.80 <b>RVD:</b> 5.0 <b>Sol:</b> Reacts <b>FLP:</b> None <b>IP:</b> 12.2 eV
Agent Index # A089 <b>Carbon Disulfide</b> CAS # 75-15-0 NAERG # 131  CS <sub>2</sub>	Colorless to faint-yellow liquid with a sweet ether-like odor. Impurities may give it a foul odor.  Carbon Disulfide is also used as an Industrial Fumigant.	<b>TWA:</b> 20 ppm <b>IDLH:</b> 500 ppm  <b>Routes:</b> Inhalation Skin Absorption (liq) Ingestion Local Skin/Eye Impacts  <b>Evacuation Distances</b> None established	<b>MW:</b> 76.1 <b>MP:</b> -169°F <b>BP:</b> 116°F <b>VP:</b> 297 mmHg <b>Vl:</b> 390,000 ppm <b>SG:</b> 1.26 <b>RVD:</b> 2.6 <b>Sol:</b> 0.3% <b>FLP:</b> -22°F <b>IP:</b> 10.1 eV

**INDUSTRIAL "AGENTS" (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A090 <b>Chlorosulfonic Acid</b> CAS # 7790-94-5 NAERG # 137  ClSO <sub>3</sub> H	Colorless to light yellow fuming liquid that is clear to slightly cloudy and with a pungent odor.	<b>TWA:</b> — <b>IDLH:</b> —  <b>Routes:</b> Inhalation Skin Absorption (liq) Ingestion Local Skin/Eye Impacts  <b>Evacuation Distances</b> <b>Initial:</b> 200 feet <b>DW Day:</b> 0.1 miles <b>DW Night:</b> 0.5 miles	<b>MW:</b> 116.5 <b>MP:</b> -112°F <b>BP:</b> 306°F <b>VP:</b> 1 mmHg <b>VI:</b> 1,300 ppm <b>SG:</b> 1.75 <b>RVD:</b> 4.0 <b>Sol:</b> Reacts <b>FLP:</b> None <b>IP:</b> —
Agent Index # A091 <b>Crotonaldehyde</b> CAS # 4170-30-3 NAERG # 131P  CH <sub>3</sub> CH=CHCHO	Water-white liquid with a suffocating odor. Turns pale yellow when exposed to air.	<b>TWA:</b> 2 ppm <b>IDLH:</b> 50 ppm  <b>Routes:</b> Inhalation Ingestion Local Skin/Eye Impacts  <b>Evacuation Distances</b> <b>Initial:</b> 200 feet <b>DW Day:</b> 0.1 miles <b>DW Night:</b> 0.3 miles	<b>MW:</b> 70.1 <b>MP:</b> -101°F <b>BP:</b> 219°F <b>VP:</b> 19 mmHg <b>VI:</b> 25,000 ppm <b>SG:</b> 0.87 <b>RVD:</b> 2.4 <b>Sol:</b> 18% <b>FLP:</b> 45°F <b>IP:</b> 9.7 eV
Agent Index # A092 <b>Diphenylmethane-4-diisocyanate</b> CAS # 101-68-8 NAERG # 156  CH <sub>2</sub> (C <sub>6</sub> H <sub>4</sub> NCO) <sub>2</sub>	White to light-yellow odorless solid.	<b>Ceiling:</b> 0.2 ppm <b>IDLH:</b> 75 ppm  <b>Routes:</b> Inhalation Ingestion Local Skin/Eye Impacts  <b>Evacuation Distances</b> None established	<b>MW:</b> 250.3 <b>MP:</b> 99°F <b>BP:</b> 597°F <b>VP:</b> 0.000005 mmHg (77°F) <b>VI:</b> 0.007 ppm <b>SG:</b> 1.23 (solid, 77°F) <b>RVD:</b> 8.6 <b>Sol:</b> 0.2% <b>FLP:</b> 390°F <b>IP:</b> —

**INDUSTRIAL "AGENTS" (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A093 <b>Fluorine</b> CAS # 7782-41-4 NAERG # 124	Pale-yellow to greenish gas with a pungent, irritating odor.	<b>TWA:</b> 0.1 ppm <b>IDLH:</b> 25 ppm  <b>Routes:</b> Inhalation Local Skin/Eye Impacts	<b>MW:</b> 38.0 <b>MP:</b> -363°F <b>BP:</b> -307°F <b>VP:</b> >760 mmHg <b>Vl:</b> Gas <b>SG:</b> Gas <b>RVD:</b> 1.3 <b>Sol:</b> Reacts <b>FLP:</b> None <b>IP:</b> 15.7 eV
F <sub>2</sub>		<b>Evacuation Distances</b> <b>Initial:</b> 200 feet <b>DW Day:</b> 0.1 miles <b>DW Night:</b> 0.5 miles	
Agent Index # A094 <b>Formaldehyde</b> CAS # 50-00-0 NAERG # 132	Nearly colorless gas with a pungent, suffocating odor.  Formaldehyde is also used as an Industrial Fumigant.	<b>TWA:</b> 0.75 ppm <b>IDLH:</b> 20 ppm  <b>Routes:</b> Inhalation Local Skin/Eye Impacts	<b>MW:</b> 30.0 <b>MP:</b> -134°F <b>BP:</b> -6°F <b>VP:</b> >760 mmHg <b>Vl:</b> Gas <b>SG:</b> Gas <b>RVD:</b> 1.0 <b>Sol:</b> Miscible <b>FLP:</b> Gas <b>IP:</b> 10.9 eV
CH <sub>2</sub> O		<b>Evacuation Distances</b> None established	
Agent Index # A095 <b>Hydrogen Bromide</b> CAS # 10035-10-6 NAERG # 125	Colorless gas with a sharp, irritating odor.	<b>TWA:</b> 3 ppm <b>IDLH:</b> 30 ppm  <b>Routes:</b> Inhalation Local Skin/Eye Impacts	<b>MW:</b> 80.9 <b>MP:</b> -124°F <b>BP:</b> -88°F  <b>VP:</b> 15,200 mmHg <b>Vl:</b> Gas <b>SG:</b> Gas <b>RVD:</b> 2.8 <b>Sol:</b> 49% <b>FLP:</b> Gas <b>IP:</b> 11.6 eV
HBr		<b>Evacuation Distances</b> <b>Initial:</b> 200 feet <b>DW Day:</b> 0.1 miles <b>p[DW Night:</b> 0.2 miles	
Agent Index # A096 <b>Hydrogen Chloride</b> CAS # 7647-01-0 NAERG # 125	Colorless to slightly yellow gas with a pungent, irritating odor.	<b>Ceiling:</b> 5 ppm <b>IDLH:</b> 50 ppm  <b>Routes:</b> Inhalation Local Skin/Eye Impacts	<b>MW:</b> 36.5 <b>MP:</b> -174°F <b>BP:</b> -121°F <b>VP:</b> 30,780 mmHg <b>Vl:</b> Gas <b>SG:</b> Gas <b>RVD:</b> 1.3

**INDUSTRIAL "AGENTS" (CONTINUED)**

Name	Physical Description	Exposure Hazards	Properties
HCl		<b>Evacuation Distances</b> <b>Initial:</b> 200 feet <b>DW Day:</b> 0.1 miles <b>DW Night:</b> 0.3 miles	<b>Sol:</b> 67% (86°F) <b>Fl.P:</b> Gas <b>IP:</b> 12.7 eV
Agent Index # A097  <b>Hydrogen Fluoride</b> CAS # 7664-39-3 NAERG # 125	Colorless gas or fuming liquid with a strong, irritating odor.  This chemical is also a Dual-Threat Precursor used in the synthesis of various "G" series Nerve Agents.	<b>TWA:</b> 3 ppm <b>IDLH:</b> 30 ppm  <b>Routes:</b> Inhalation Skin Absorption (liq) Ingestion Local Skin/Eye Impacts	<b>MW:</b> 20.0 <b>MP:</b> -118°F <b>BP:</b> 67°F <b>VP:</b> 783 mmHg <b>Vl:</b> Gas <b>SG:</b> 1.00 (67°F) <b>RVD:</b> 1.9 <b>Sol:</b> 100% <b>Fl.P:</b> None <b>IP:</b> 16.0 eV
HF		<b>Evacuation Distances</b> <b>Initial:</b> 200 feet <b>DW Day:</b> 0.1 miles <b>DW Night:</b> 0.4 miles	
Agent Index # A098  <b>Methyl Isocyanate</b> CAS # 624-83-9 NAERG # 155	Colorless liquid with a sharp, pungent odor.	<b>TWA:</b> 0.02 ppm <b>IDLH:</b> 3 ppm  <b>Routes:</b> Inhalation Skin Absorption (liq, gas) Ingestion Local Skin/Eye Impacts	<b>MW:</b> 57.1 <b>MP:</b> -49°F <b>BP:</b> 139°F <b>VP:</b> 348 mmHg <b>Vl:</b> 460,000 ppm <b>SG:</b> 0.96 <b>RVD:</b> 2.0 <b>Sol:</b> 10% (59°F) <b>Fl.P:</b> 19°F <b>IP:</b> 10.7 eV
CH <sub>3</sub> NCO		<b>Evacuation Distances</b> <b>Initial:</b> 400 feet <b>DW Day:</b> 0.3 miles <b>DW Night:</b> 1.4 miles	
Agent Index # A099  <b>Methyl Mercaptan</b> CAS # 74-93-1 NAERG # 117	Colorless gas with a disagreeable garlic or rotten cabbage odor.	<b>TWA:</b> 0.5 ppm <b>IDLH:</b> 150 ppm  <b>Routes:</b> Inhalation	<b>MW:</b> 48.1 <b>MP:</b> -168°F <b>BP:</b> 43°F <b>VP:</b> 1,292 mmHg <b>Vl:</b> Gas

**INDUSTRIAL "AGENTS" (CONTINUED)**

Name	Physical Description	Exposure Hazards	Properties
CH <sub>3</sub> SH		<b>Evacuation Distances</b> <b>Initial:</b> 200 feet <b>DW Day:</b> 0.1 miles <b>DW Night:</b> 0.3 miles	<b>SG:</b> 0.90 (32°F) <b>RVD:</b> 1.7 <b>Sol:</b> 2% <b>FLP:</b> 0°F <b>IP:</b> 9.4 eV
Agent Index # A100  <b>Nitric Acid, Fuming</b> CAS # 7697-37-2 NAERG # 157	Colorless, yellow, or red fuming liquid with an acrid, suffocating odor.	<b>TWA:</b> 2 ppm <b>IDLH:</b> 25 ppm  <b>Routes:</b> Inhalation Ingestion Local Skin/Eye Impacts	<b>MW:</b> 63.0 <b>MP:</b> -44°F <b>BP:</b> 181°F <b>VP:</b> 48 mmHg <b>Vl:</b> 63,000 ppm <b>SG:</b> 1.50 (77°F) <b>RVD:</b> 2.2 <b>Sol:</b> Miscible <b>FLP:</b> None <b>IP:</b> 12.0 eV
HNO <sub>3</sub> /NO <sub>2</sub>		<b>Evacuation Distances</b> <b>Initial:</b> 200 feet <b>DW Day:</b> 0.1 miles <b>DW Night:</b> 0.3 miles	
Agent Index # A101  <b>Nitric Oxide</b> CAS # 10102-43-9 NAERG # 124	Colorless gas.	<b>TWA:</b> 25 ppm <b>IDLH:</b> 100 ppm  <b>Routes:</b> Inhalation	<b>MW:</b> 30.0 <b>MP:</b> -263°F <b>BP:</b> -241°F <b>VP:</b> 25,992 mmHg <b>Vl:</b> Gas <b>SG:</b> Gas
NO		<b>Evacuation Distances</b> <b>Initial:</b> 200 feet <b>DW Day:</b> 0.1 miles <b>DW Night:</b> 0.5 miles	<b>RVD:</b> 1.0 <b>Sol:</b> 5% <b>FLP:</b> Gas <b>IP:</b> 9.3 eV
Agent Index # A102  <b>Paraformaldehyde</b> CAS # 30525-89-4 NAERG # 133	White solid with a strong, pungent, and irritating odor of formaldehyde.	<b>TWA:</b> — <b>IDLH:</b> —  <b>Routes:</b> Inhalation Ingestion Local Skin/Eye Impacts	<b>MW:</b> Polymer <b>MP:</b> 248°F <b>BP:</b> Sublimes <b>VP:</b> 1.2 mmHg <b>Vl:</b> 1,600 ppm <b>SG:</b> 1.40 <b>RVD:</b> 1.0 <b>Sol:</b> Varies <b>FLP:</b> 158°F <b>IP:</b> —
[CH <sub>2</sub> O]	Paraformaldehyde is also used as an Industrial Fumigant.	<b>Evacuation Distances</b> None established	

## INDUSTRIAL "AGENTS" (CONTINUED)

Name	Physical Description	Exposure Hazards	Properties
Agent Index # A103 <b>Pentaborane</b> CAS # 19624-22-7 NAERG # 135	Colorless liquid with a pungent odor like sour milk.	<b>TWA:</b> 0.005 ppm <b>IDLH:</b> 1 ppm  <b>Routes:</b> Inhalation Skin Absorption (liq) Ingestion Local Skin/Eye Impacts	<b>MW:</b> 63.1 <b>MP:</b> -52°F <b>BP:</b> 140°F <b>VP:</b> 171 mmHg <b>VI:</b> 220,000 ppm <b>SG:</b> 0.62 <b>RVD:</b> 2.2 <b>SoI:</b> Reacts <b>FLP:</b> 86°F <b>IP:</b> 9.9 eV
B <sub>3</sub> H <sub>9</sub>			
<b>Evacuation Distances</b>			
<b>Initial:</b> 500 feet			
<b>DW Day:</b> 0.6 miles			
<b>DW Night:</b> 2.9 miles			

### Pesticides - Arsenic

Agent Index # A104  
Arsenic Acid; CAS # 1327-52-2

Agent Index # A105  
Arsenic Trioxide; CAS # 1327-53-3

Agent Index # A106  
Cacodylic Acid; CAS # 75-60-5

Agent Index # A107  
Calcium Acid Methane Arsonate;  
CAS # 5902-95-4

Agent Index # A108  
Calcium Arsenate; CAS # 7778-44-1

Agent Index # A109  
Calcium Arsenite; CAS # 52740-16-6

Agent Index # A110  
Copper Acetoarsenite; CAS # 12002-03-8

Agent Index # A111  
Copper Arsenite; CAS # 10290-12-7

Agent Index # A112  
Disodium Methyl Arsonate; CAS # 144-21-8

Agent Index # A113  
Lead Arsenate; CAS # 102-48-4

Agent Index # A114  
Methane Arsonic Acid; CAS # 124-58-3

Agent Index # A115  
Monoammonium Methane Arsonate;  
CAS # 2321-53-1

Agent Index # A116  
Monosodium Methane Arsonate;  
CAS # 2163-80-6

Agent Index # A117  
Potassium Arsenite; CAS # 10124-50-2

Arsenic based pesticides can be either organic or inorganic based. They can be either solids or liquids with varying colors and odors. These pesticides are also found as solutions.

Toxicities for these compounds vary over a wide range.

**TWA:** 0.01 mg/m<sup>3</sup> (as As for inorganic compounds)  
**IDLH:** 5 mg/m<sup>3</sup> (as As for inorganic compounds)  
**TWA:** 0.5 mg/m<sup>3</sup> (as As for organic compounds)  
**IDLH:** — (as As for organic compounds)

Some arsenic based pesticides are carcinogenic.

**Routes:**  
Inhalation  
Skin Absorption  
Ingestion  
Local Skin/Eye Impacts

**Evacuation Distances**  
In general, none have been established. See individual compounds in the North American Emergency Response Guidebook.

## INDUSTRIAL "AGENTS" (CONTINUED)

Name	Physical Description	Exposure Hazards	Properties
Agent Index # A118 Sodium Arsenate; CAS # 7631-89-2			
Agent Index # A119 Sodium Arsenite; CAS # 7784-46-5			
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<b>Pesticides - Carbamates</b>		Carbamate pesticides can be either solids or liquids with varying colors and odors. These pesticides are also found as solutions.	
Agent Index # A120 Aldicarb; CAS # 116-06-3			
Agent Index # A121 Aminocarb; CAS # 2032-59-9		These pesticides inhibit acetylcholine esterase and produce effects similar to, but much milder and more transient than, nerve agents. In some cases, inhalation exposure may also lead to pulmonary edema.	
Agent Index # A122 Bendiocarb; CAS # 22781-23-3			
Agent Index # A123 Carbofuran; CAS # 1563-66-2			
Agent Index # A124 Cloethocarb; CAS # 51487-69-5		<b>Routes:</b> Inhalation Skin Absorption Ingestion	
Agent Index # A125 Dimetilan; CAS # 644-64-4			
Agent Index # A126 Formetanate; CAS # 23422-53-9		<b>Evacuation Distances</b> In general, none have been established. See individual compounds in the North American Emergency Response Guidebook.	
Agent Index # A127 Isolan; CAS # 119-38-0			
Agent Index # A128 Methiocarb; CAS # 2032-65-7			
Agent Index # A129 Methomyl; CAS # 16752-77-5			
Agent Index # A130 Oxamyl; CAS # 23135-22-0			
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<b>Pesticides - Fumigants</b>		Fumigants can be either organic or inorganic based. They can be gases or volatile liquids or solids with varying colors and odors. Fumigants may or may not have significant warning properties, which may be confused with other urban pollutants. These pesticides are also found mixed or as solutions with other materials. Some fumigants react with water to produce toxic gases. Vapors from fumigants rapidly diffuse throughout an exposed area.	
Agent Index # A131 1,1-Dichloro-1-nitroethane; CAS # 594-72-9			
Agent Index # A132 1,2-Dibromo-3-chloropropane; CAS # 96-12-8			
Agent Index # A133 Aluminum Phosphide; CAS # 20859-73-8			
Agent Index # A134 beta Methallyl Chloride; CAS # 563-47-3			
Agent Index # A135 Dazomet; CAS # 533-74-4			

## INDUSTRIAL "AGENTS" (CONTINUED)

Name	Physical Description	Exposure Hazards	Properties
Agent Index # A136	Dibromomethane; CAS # 74-95-3	<p>Fumigants may produce eye and/or skin irritation even to the extent of severe burns. Some fumigants are readily absorbed across the skin and can produce systemic effects. Inhalation of some fumigants cause damage to the respiratory system leading to pulmonary edema. Some fumigants can cause nausea and/or vomiting. Many fumigants also produce a narcotic effect when inhaled.</p> <p><b>Routes:</b></p> <ul style="list-style-type: none"> <li>Inhalation</li> <li>Skin Absorption</li> <li>Ingestion</li> <li>Local Skin/Eye Impacts</li> </ul> <p><b>Evacuation Distances</b></p> <p>In general, none have been established. See individual compounds in the North American Emergency Response Guidebook.</p>	
Agent Index # A137	Dichlorvos; CAS # 62-73-7		
Agent Index # A138	Ethyl Formate; CAS # 109-94-4		
Agent Index # A139	Ethylene Dibromide; CAS # 106-93-4		
Agent Index # A140	Ethylene Dichloride; CAS # 107-06-2		
Agent Index # A141	Ethylene Oxide; CAS # 75-21-8		
Agent Index # A142	Methyl Bromide; CAS # 74-83-9		
Agent Index # A143	Phosphine; CAS # 7803-51-2		
Agent Index # A144	Propylene Oxide; CAS # 75-56-9		
Agent Index # A145	Sodium N-Methyldithiocarbamate; CAS # 137-42-8		
Agent Index # A146	Sulfuryl Fluoride; CAS # 2699-79-8		
Agent Index # A147	Trichloroacetonitrile; CAS # 545-06-2		

### Pesticides - Mercury

Agent Index # A148	Methyl Mercury Hydroxide; CAS # 1184-57-2	<p>Mercury based pesticides can be either organic or inorganic based. They can be either solids or liquids with varying colors and odors. These pesticides are also found as solutions.</p> <p>Toxicities for these compounds vary over a wide range. Mercury based pesticides may produce eye and/or skin irritation. Some mercury compounds are readily absorbed across the skin and can produce systemic effects. Inhalation of some mercury based pesticides can cause damage to the respiratory system leading to pulmonary edema. Some can cause nausea and/or vomiting. Many impact the nervous system.</p> <p><b>TWA:</b> 0.1 mg/m<sup>3</sup> (as Hg for inorganic compounds)</p>	
Agent Index # A149	Methyl Mercury Nitrile; CAS # 2597-97-9		
Agent Index # A150	Methyl Mercury Benzoate; CAS # 3626-13-9		
Agent Index # A151	Methyl Mercury Acetate; CAS # 108-07-6		
Agent Index # A152	Methyl Mercury Propionate; CAS # 5903-10-6		
Agent Index # A153	Methyl Mercury Quinolinolate; CAS # 86-85-1		
Agent Index # A154	Methoxyethyl Mercury Acetate; CAS # 151-38-2		

## INDUSTRIAL "AGENTS" (CONTINUED)

Name	Physical Description	Exposure Hazards	Properties
Agent Index # A155 Methoxyethyl Mercury Chloride; CAS # 123-88-6		IDLH: 10 mg/m <sup>3</sup> (as Hg for inorganic compounds) TWA: 0.01 mg/m <sup>3</sup> (as Hg for organic compounds)	
Agent Index # A156 Phenyl Mercury Acetate; CAS # 62-38-4		IDLH: 2 mg/m <sup>3</sup> (as Hg for organic compounds)	
		<b>Routes:</b> Inhalation Skin Absorption Ingestion Local Skin/Eye Impacts	
		<b>Evacuation Distances</b> In general, none have been established. See individual compounds in the North American Emergency Response Guidebook.	
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<b>Pesticides - Miscellaneous</b>		These materials can be either solids or liquids with varying colors and odors. They are also found as solutions.	
Agent Index # A157 4-Aminopyridine; CAS # 504-24-5		Toxicities for these compounds vary over a wide range.	
Agent Index # A158 Nicotine Sulfate; CAS # 65-30-5			
Agent Index # A159 Sodium Fluoroacetate; CAS # 62-74-8		<b>Routes:</b> Inhalation Skin Absorption (Limited except for nicotine base) Ingestion Local Skin/Eye Impacts	
		<b>Evacuation Distances</b> In general, none have been established. See individual compounds in the North American Emergency Response Guidebook.	
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<b>Pesticides - Organophosphorous</b>		Organophosphorous pesticides can be either solids or liquids with varying colors and odors. These pesticides are also found as solutions.	
Agent Index # A160 Azinphos-Methyl; CAS # 86-50-0			

## INDUSTRIAL "AGENTS" (CONTINUED)

Name	Physical Description	Exposure Hazards	Properties
Agent Index # A161 Bomyl; CAS # 122-10-1		<p>These pesticides inhibit acetylcholine esterase and produce effects similar to, but much milder than, nerve agents. Some of these pesticides exhibit significant delayed neurotoxic effects. Some are readily stored in body fat, which may increase the period between exposure and manifestation of symptoms as well as prolong the time required for the body to excrete the toxins.</p> <p><b>Routes:</b>                      Inhalation                      Skin Absorption                      Ingestion</p> <p><b>Evacuation Distances</b>                      In general, none have been established. See individual compounds in the North American Emergency Response Guidebook.</p>	
Agent Index # A162 Bromophos-ethyl; CAS # 4824-78-6			
Agent Index # A163 Carbophenothion; CAS # 786-19-6			
Agent Index # A164 Chlorfenvinphos; CAS # 470-90-6			
Agent Index # A165 Chlormephos; CAS # 24934-91-6			
Agent Index # A166 Chlorthiophos; CAS # 21923-23-9			
Agent Index # A167 Coumaphos; CAS # 56-72-4			
Agent Index # A168 Cyanofenphos; CAS # 13067-93-1			
Agent Index # A169 Demeton; CAS # 8065-48-3			
Agent Index # A170 Dialifor; CAS # 10311-84-9			
Agent Index # A171 Dicrotophos; CAS # 141-66-2			
Agent Index # A172 Dimefox; CAS # 115-26-4			
Agent Index # A173 Dioxathion; CAS # 78-34-2			
Agent Index # A174 Disulfoton; CAS # 298-04-4			
Agent Index # A175 Endothion; CAS # 2778-04-3			
Agent Index # A176 EPN; CAS # 2104-64-5			
Agent Index # A177 Ethyl Parathion; CAS # 56-38-2			
Agent Index # A178 Famphur; CAS # 52-85-7			
Agent Index # A179 Fenamiphos; CAS # 22224-92-6			
Agent Index # A180 Fenophosphon; CAS # 327-98-0			
Agent Index # A181 Fensulfothion; CAS # 115-90-2			
Agent Index # A182 Fonofos; CAS # 944-22-9			
Agent Index # A183 Fosthietan; CAS # 21548-32-3			
Agent Index # A184 Isofenphos; CAS # 25311-71-1			
Agent Index # A185 Leptophos; CAS # 21609-90-5			

**INDUSTRIAL "AGENTS" (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A186 Mephosfolan; CAS # 950-10-7			
Agent Index # A187 Methamidophos; CAS # 10265-92-6			
Agent Index # A188 Methidathion; CAS # 950-37-8			
Agent Index # A189 Methyl Parathion; CAS # 298-00-0			
Agent Index # A190 Mevinphos; CAS # 7786-34-7			
Agent Index # A191 Mipafox; CAS # 371-86-8			
Agent Index # A192 Monocrotophos; CAS # 6923-22-4			
Agent Index # A193 Phorate; CAS # 298-02-2			
Agent Index # A194 Phosfolan; CAS # 947-02-4			
Agent Index # A195 Phosphamidon; CAS # 13171-21-6			
Agent Index # A196 Prothoate; CAS # 2275-18-5			
Agent Index # A197 Schradan; CAS # 152-16-9			
Agent Index # A198 Sulfotepp; CAS # 3689-24-5			
Agent Index # A199 Terbufos; CAS # 13071-79-9			
Agent Index # A200 Tetraethyl Pyrophosphate; CAS # 107-49-3			
Agent Index # A201 <b>Phosphorous Trichloride</b> CAS # 7719-12-2 NAERG # 137	Colorless to yellow fuming liquid with an odor like hydrochloric acid (pungent and irritating).  This chemical is also a Dual-Threat Precursor used in the synthesis of various Nerve Agents.	<b>TWA:</b> 0.5 ppm <b>IDLH:</b> 25 ppm  <b>Routes:</b> Inhalation Ingestion Local Skin/Eye Impacts  <b>Evacuation Distances</b> <b>Initial:</b> 200 feet <b>DW Day:</b> 0.1 miles <b>DW Night:</b> 0.5 miles	<b>MW:</b> 137.4 <b>MP:</b> -170°F <b>BP:</b> 169°F <b>VP:</b> 100 mmHg <b>Vlt:</b> 130,000 ppm <b>SG:</b> 1.58 <b>RVD:</b> 4.7 <b>Sol:</b> Reacts <b>FLP:</b> None <b>IP:</b> 9.9 eV
PCl <sub>3</sub>			

**INDUSTRIAL "AGENTS" (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A202 <b>Sulfur Dioxide</b> CAS # 7446-09-5 NAERG # 125	Colorless gas with a characteristic, irritating, pungent odor.  Sulfur Dioxide is also used as an Industrial Fumigant.	<b>TWA:</b> 5 ppm <b>IDLH:</b> 100 ppm  <b>Routes:</b> Inhalation Local Skin/Eye Impacts	<b>MW:</b> 64.1 <b>MP:</b> -104°F <b>BP:</b> 14°F <b>VP:</b> 2,432 mmHg <b>Vl:</b> Gas <b>SG:</b> Gas <b>RVD:</b> 2.3 <b>Sol:</b> 10% <b>FLP:</b> Gas <b>IP:</b> 12.3 eV
SO <sub>2</sub>		<b>Evacuation Distances</b> <b>Initial:</b> 400 feet <b>DW Day:</b> 0.5 miles <b>DW Night:</b> 2.1 miles	
Agent Index # A203 <b>Sulfuric Acid</b> CAS # 7664-93-9 NAERG # 137	Colorless to dark brown oily liquid with no odor.	<b>TWA:</b> 0.2 ppm <b>IDLH:</b> 3.7 ppm  <b>Routes:</b> Inhalation Ingestion Local Skin/Eye Impacts	<b>MW:</b> 98 <b>MP:</b> 51°F <b>BP:</b> 554°F <b>VP:</b> 0.001 mmHg <b>Vl:</b> 1.3 ppm <b>SG:</b> 1.84 <b>RVD:</b> 3.4 <b>Sol:</b> Miscible <b>FLP:</b> None <b>IP:</b> —
H <sub>2</sub> SO <sub>4</sub>		<b>Evacuation Distances</b> None established	
Agent Index # A204 <b>Tetraethyl Lead</b> CAS # 78-00-2 NAERG # 131	Colorless liquid with a pleasant, sweet odor.	<b>TWA:</b> 0.006 ppm (as Pb) <b>IDLH:</b> 3 ppm (as Pb)  <b>Routes:</b> Inhalation Skin Absorption (liq) Ingestion Local Skin/Eye Impacts	<b>MW:</b> 323.5 <b>MP:</b> -202°F <b>BP:</b> Decomposes <b>VP:</b> 0.2 mmHg <b>Vl:</b> 260 ppm <b>SG:</b> 1.65 <b>RVD:</b> 11.2 <b>Sol:</b> 0.00002% <b>FLP:</b> 200°F <b>IP:</b> 11.1 eV
Pb(CH <sub>2</sub> CH <sub>3</sub> ) <sub>4</sub>		<b>Evacuation Distances</b> None established	
Agent Index # A205 <b>Tetramethyl Lead</b> CAS # 75-74-1 NAERG # 131	Colorless liquid with a fruity odor.	<b>TWA:</b> 0.007 ppm (as Pb) <b>IDLH:</b> 3.6 ppm (as Pb)	<b>MW:</b> 267.3 <b>MP:</b> -15°F <b>BP:</b> Decomposes <b>VP:</b> 23 mmHg <b>Vl:</b> 30,000 ppm

**INDUSTRIAL "AGENTS" (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Pb(CH <sub>3</sub> ) <sub>4</sub>		<b>Routes:</b> Inhalation Skin Absorption (liq) Ingestion Local Skin/Eye Impacts	<b>SG:</b> 2.00 <b>RVD:</b> 9.2 <b>Sol:</b> 0.002% <b>FLP:</b> 100°F <b>IP:</b> 8.5 eV
		<b>Evacuation Distances</b> None established	
Agent Index # A206  <b>Toluene-2,4-diisocyanate</b> CAS # 584-84-9 NAERG # 156	Colorless to pale-yellow solid or liquid with a sharp, pungent odor.	<b>Ceiling:</b> 0.003 ppm <b>IDLH:</b> 2.5 ppm  <b>Routes:</b> Inhalation Ingestion Local Skin/Eye Impacts	<b>MW:</b> 174.2 <b>MP:</b> 71°F <b>BP:</b> 484°F <b>VP:</b> 0.05 mmHg (77°F) <b>Vl:</b> 66 ppm <b>SG:</b> 1.22 <b>RVD:</b> 6.0 <b>Sol:</b> Insoluble <b>FLP:</b> 260°F <b>IP:</b> —
CH <sub>3</sub> C <sub>6</sub> H <sub>3</sub> (NCO) <sub>2</sub>		<b>Evacuation Distances</b> None established	
Agent Index # A207  <b>Tungsten Hexafluoride</b> CAS # 7783-82-6 NAERG # 125	Colorless gas or pale-yellow liquid.	<b>TWA:</b> 5 mg/m <sup>3</sup> (as W) <b>IDLH:</b> —  <b>Routes:</b> Inhalation Ingestion Local Skin/Eye Impacts	<b>MW:</b> 297.9 <b>MP:</b> 36°F <b>BP:</b> 62°F <b>VP:</b> — <b>Vl:</b> — <b>SG:</b> 3.44 <b>RVD:</b> 10.3 <b>Sol:</b> Reacts <b>FLP:</b> — <b>IP:</b> 15.2 eV
WF <sub>6</sub>		<b>Evacuation Distances</b> <b>Initial:</b> 200 feet <b>DW Day:</b> 0.1 miles <b>DW Night:</b> 0.3 miles	

**PRECURSORS AND DUAL-THREAT CHEMICALS**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A208 <b>Ammonium Bifluoride</b> CAS # 1341-49-7 NAERG # 154	White crystalline material.  <b>Common Commercial</b> <b>Use:</b> Used in fluorine production, ceramics, organic synthesis, glass etching, and as a disinfectant.	<b>TWA:</b> 2.5 mg/m <sup>3</sup> (as F) <b>IDLH:</b> —	<b>MW:</b> 57.0 <b>MP:</b> 257°F <b>BP:</b> Decomposes <b>VP:</b> — <b>SG:</b> 1.50 <b>RVD:</b> 2.0 <b>Sol:</b> 58% <b>FLP:</b> None <b>IP:</b> —
NH <sub>5</sub> F <sub>2</sub>	<b>Dual Use:</b> Synthesis of "G" series nerve agents.	<b>Evacuation Distances</b> None established	
Agent Index # A209 <b>Benzilic Acid</b> CAS # 76-93-7 NAERG # 154	White to tan solid with a characteristic odor.  <b>Common Commercial</b> <b>Use:</b> Used in organic synthesis.	<b>TWA:</b> — <b>IDLH:</b> —	<b>MW:</b> 228.3 <b>MP:</b> 302°F <b>BP:</b> 356°F <b>VP:</b> — <b>SG:</b> — <b>RVD:</b> 7.9 <b>Sol:</b> "Freely" (hot water) "Slight" (cold water) <b>FLP:</b> — <b>IP:</b> —
(C <sub>6</sub> H <sub>5</sub> ) <sub>2</sub> C(OH) CO <sub>2</sub> H	<b>Dual Use:</b> Synthesis of Incapacitating Agent BZ.	<b>Evacuation Distances</b> None established	
Agent Index # A210 <b>2-Chloro-N,N-diisopropylethylamine Hydrochloride</b> CAS # 4261-68-1 NAERG # 154	Odorless solid with a slight beige color.  <b>Common Commercial</b> <b>Use:</b> Used in organic synthesis.	<b>TWA:</b> — <b>IDLH:</b> —	<b>MW:</b> 200.2 <b>MP:</b> 271°F <b>BP:</b> — <b>VP:</b> — <b>SG:</b> — <b>RVD:</b> 6.9 <b>Sol:</b> "Soluble" <b>FLP:</b> — <b>IP:</b> —
[(CH <sub>3</sub> ) <sub>2</sub> CH] <sub>2</sub> NCH <sub>2</sub> - CH <sub>2</sub> Cl HCl	<b>Dual Use:</b> Synthesis of various "V" series Nerve Agents.	<b>Evacuation Distances</b> None established	
Agent Index # A211	Colorless liquid with a faint ether-like odor.	<b>Ceiling:</b> 1 ppm <b>IDLH:</b> 7 ppm	<b>MW:</b> 80.5 <b>MP:</b> -90°F

**PRECURSORS AND DUAL-THREAT CHEMICALS (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
<b>2-Chloroethanol</b> CAS # 107-07-3 NAERG # 131	<b>Common Commercial</b> <b>Use:</b> Used as a solvent and in the manufacture of insecticides and pharmaceuticals.		<b>BP:</b> 262°F <b>VP:</b> 5 mm Hg <b>SG:</b> 1.20 <b>RVD:</b> 2.8 <b>Sol:</b> Miscible <b>FLP:</b> 140°F <b>IP:</b> 10.9 eV
$\text{ClCH}_2\text{CH}_2\text{OH}$	<b>Dual Use:</b> Synthesis of various sulfur and nitrogen based Vesicants.	<b>Evacuation Distances</b> None established	
Agent Index # A212	Liquid.	<b>TWA:</b> — <b>IDLH:</b> —	<b>MW:</b> 181.2 <b>MP:</b> —
<b>Diethyl N,N-Dimethylphosphoramidate</b> CAS # 2404-03-7 NAERG # 153	<b>Common Commercial</b> <b>Use:</b> Used in organic synthesis.	<b>Evacuation Distances</b> None established	<b>BP:</b> — <b>VP:</b> — <b>SG:</b> — <b>RVD:</b> 6.2 <b>Sol:</b> — <b>FLP:</b> — <b>IP:</b> —
$(\text{CH}_3)_2\text{NP}(\text{O})-(\text{OCH}_2\text{CH}_3)_2$	<b>Dual Use:</b> Synthesis of various "G" series Nerve Agents.		
Agent Index # A213	Colorless liquid with a nauseating, ammonia-like odor.	<b>TWA:</b> 10 ppm <b>IDLH:</b> 100 ppm	<b>MW:</b> 117.2 <b>MP:</b> -94°F <b>BP:</b> 325°F <b>VP:</b> 1 mm Hg <b>SG:</b> 0.89 <b>RVD:</b> 4.0 <b>Sol:</b> Miscible <b>FLP:</b> 126°F <b>IP:</b> 8.6 eV
<b>Diethylaminoethanol</b> CAS # 100-37-8 NAERG # 132	<b>Common Commercial</b> <b>Use:</b> Used as a textile softener and in the manufacture of pharmaceuticals	<b>Evacuation Distances</b> None established	
$(\text{CH}_3\text{CH}_2)_2\text{NCH}_2\text{CH}_2\text{OH}$	<b>Dual Use:</b> Synthesis of various "V" series Nerve Agents.		
Agent Index # A214	Colorless liquid with a mild odor.	<b>TWA:</b> — <b>IDLH:</b> —	<b>MW:</b> 166.2 <b>MP:</b> — <b>BP:</b> 388°F
<b>Diethylethylphosphonate</b> CAS # 78-38-6 NAERG # 128	<b>Common Commercial</b> <b>Use:</b> Used as a gasoline additive, anti-foam agent, chelating agent, plasticizer, textile conditioner, and antistatic agent.	<b>Evacuation Distances</b> None established	<b>VP:</b> — <b>SG:</b> 1.03 <b>RVD:</b> 5.7 <b>Sol:</b> "Slight" <b>FLP:</b> 220°F <b>IP:</b> —
$\text{CH}_3\text{CH}_2\text{P}(\text{O})-(\text{OCH}_2\text{CH}_3)_2$			

**PRECURSORS AND DUAL-THREAT CHEMICALS (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
	<b>Dual Use:</b> Synthesis of various Nerve Agents.		
Agent Index # A215		<b>TWA:</b> — <b>IDLH:</b> —	<b>MW:</b> 152.1 <b>MP:</b> — <b>BP:</b> —
<b>Diethylmethylphosphonate</b> CAS # 683-08-9 NAERG # 128	<b>Common Commercial Use:</b> Used in organic synthesis.	<b>Evacuation Distances</b> None established	<b>VP:</b> — <b>SG:</b> 1.05 <b>RVD:</b> 5.2 <b>Sol:</b> —
CH <sub>3</sub> P(O)-(OCH <sub>2</sub> CH <sub>3</sub> ) <sub>2</sub>	<b>Dual Use:</b> Synthesis of various Nerve Agents.		<b>FI.P:</b> 167°F <b>IP:</b> —
Agent Index # A216		<b>TWA:</b> — <b>IDLH:</b> —	<b>MW:</b> 136.1 <b>MP:</b> — <b>BP:</b> —
<b>Diethylmethylphosphonite</b> CAS # 15715-41-0 NAERG # 128	<b>Common Commercial Use:</b> Used in organic synthesis.	<b>Evacuation Distances</b> None established	<b>VP:</b> — <b>SG:</b> — <b>RVD:</b> 4.7 <b>Sol:</b> —
CH <sub>3</sub> P(OCH <sub>2</sub> CH <sub>3</sub> ) <sub>2</sub>	<b>Dual Use:</b> Synthesis of various Nerve Agents.		<b>FI.P:</b> — <b>IP:</b> —
Agent Index # A217	Colorless liquid.	<b>TWA:</b> — <b>IDLH:</b> —	<b>MW:</b> 138.1 <b>MP:</b> — <b>BP:</b> —
<b>Diethylphosphite</b> CAS # 762-04-9 NAERG # 128	<b>Common Commercial Use:</b> Used as a paint solvent and lubricant additive.	<b>Evacuation Distances</b> None established	<b>VP:</b> — <b>SG:</b> 1.07 <b>RVD:</b> 4.8 <b>Sol:</b> —
HP(O)(OCH <sub>2</sub> CH <sub>3</sub> ) <sub>2</sub>	<b>Dual Use:</b> Synthesis of various Nerve Agents.		<b>FI.P:</b> 194°F <b>IP:</b> 10.3 eV
Agent Index # A218	Colorless liquid with an ammonia or fish-like odor.	<b>TWA:</b> 5 ppm <b>IDLH:</b> 200 ppm	<b>MW:</b> 101.2 <b>MP:</b> -141°F <b>BP:</b> 183°F <b>VP:</b> 70 mmHg <b>SG:</b> 0.72 <b>RVD:</b> 3.5 <b>Sol:</b> Miscible
<b>Diisopropylamine</b> CAS # 108-18-9 NAERG # 132	<b>Common Commercial Use:</b> Used as an antifoam agent, in organic synthesis, and in the manufacture of detergents, dyes, and pesticides.		<b>FI.P:</b> 20°F <b>IP:</b> 7.7 eV

**PRECURSORS AND DUAL-THREAT CHEMICALS (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
$[(\text{CH}_3)_2\text{CH}]_2\text{NH}$	<b>Dual Use:</b> Synthesis of various "V" series Nerve Agents.	<b>Evacuation Distances</b> None established	
Agent Index # A219	<b>Common Commercial Use:</b> Used in organic synthesis.	<b>TWA:</b> — <b>IDLH:</b> —	<b>MW:</b> 161.3 <b>MP:</b> — <b>BP:</b> —F <b>VP:</b> —
<b>Diisopropylaminoethanethiol</b> CAS # 5842-07-9 NAERG # 132	<b>Dual Use:</b> Synthesis of various "V" series Nerve Agents.	<b>Evacuation Distances</b> None established	<b>SG:</b> — <b>RVD:</b> 5.6 <b>Sol:</b> — <b>FLP:</b> — <b>IP:</b> —
$[(\text{CH}_3)_2\text{CH}]_2\text{NCH}_2\text{CH}_2\text{SH}$			
Agent Index # A220	Colorless Liquid.	<b>TWA:</b> — <b>IDLH:</b> —	<b>MW:</b> 145.3 <b>MP:</b> -39°F <b>BP:</b> 369°F
<b>N,N-Diisopropyl-2-aminoethanol</b> CAS # 96-80-0 NAERG # 132	<b>Common Commercial Use:</b> Used in organic synthesis.	<b>Evacuation Distances</b> None established	<b>VP:</b> 0.08 mmHg <b>SG:</b> 0.83 <b>RVD:</b> 5.0 <b>Sol:</b> "Slight"
$[(\text{CH}_3)_2\text{CH}]_2\text{NCH}_2\text{CH}_2\text{OH}$	<b>Dual Use:</b> Synthesis of various "V" series Nerve Agents.		<b>FLP:</b> 135°F <b>IP:</b> —
Agent Index # A221	Colorless gas or liquid with an ammonia or fish-like odor.	<b>TWA:</b> 10 ppm <b>IDLH:</b> 500 ppm	<b>MW:</b> 45.1 <b>MP:</b> -134°F <b>BP:</b> 44°F
<b>Dimethylamine</b> CAS # 124-40-3 NAERG # 118	<b>Common Commercial Use:</b> Used as a gasoline additive, solvent, and in the manufacture of pesticides, detergents, and pharmaceuticals.	<b>Evacuation Distances</b> None established	<b>VP:</b> 1,292 mmHg <b>SG:</b> 0.67 <b>RVD:</b> 1.6 <b>Sol:</b> 24% (140°F)
$(\text{CH}_3)_2\text{NH}$	<b>Dual Use:</b> Synthesis of various Nerve Agents.		<b>FLP:</b> 20°F <b>IP:</b> 8.2 eV

**PRECURSORS AND DUAL-THREAT CHEMICALS (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A222 <b>Dimethylethylphosphonate</b> CAS # 6163-75-3 NAERG # 128	<b>Common Commercial</b> <b>Use:</b> Used as an antifoam agent, gasoline additive, chelating agent, and in organic synthesis.	<b>TWA:</b> — <b>IDLH:</b> —  <b>Evacuation Distances</b> None established	<b>MW:</b> 138.1 <b>MP:</b> — <b>BP:</b> — <b>VP:</b> — <b>SG:</b> — <b>RVD:</b> 4.8 <b>Sol:</b> — <b>FLP:</b> — <b>IP:</b> —
CH <sub>3</sub> CH <sub>2</sub> P(O)-(OCH <sub>3</sub> ) <sub>2</sub>	<b>Dual Use:</b> Synthesis of various Nerve Agents.		
Agent Index # A223 <b>Dimethylmethylphosphonate</b> CAS # 756-79-6 NAERG # 128	Clear colorless liquid with a pleasant odor.  <b>Common Commercial</b> <b>Use:</b> Used in organic synthesis, used as an additive for gasoline, solvents, and low-temperature hydraulic fluids, as an antifoam agent, plasticizer, textile conditioner, antistatic agent, and in the manufacture of flame retardants.	<b>TWA:</b> — <b>IDLH:</b> —  <b>Evacuation Distances</b> None established	<b>MW:</b> 124.1 <b>MP:</b> — <b>BP:</b> 358°F <b>VP:</b> 1.2 mmHg (77°F) <b>SG:</b> 1.15 <b>RVD:</b> 4.3 <b>Sol:</b> >10% <b>FLP:</b> 156°F <b>IP:</b> 10.0 eV
CH <sub>3</sub> P(O)(OCH <sub>3</sub> ) <sub>2</sub>	<b>Dual Use:</b> Synthesis of various Nerve Agents.		
Agent Index # A224 <b>Dimethylaminophosphoryl Dichloride</b> CAS # 683-85-2 NAERG # 132	<b>Common Commercial</b> <b>Use:</b> Used in organic synthesis.  <b>Dual Use:</b> Synthesis of "G" series nerve agents.	<b>TWA:</b> — <b>IDLH:</b> —  <b>Evacuation Distances</b> None established	<b>MW:</b> 146.0 <b>MP:</b> — <b>BP:</b> 302°F <b>VP:</b> — <b>SG:</b> 1.27 <b>RVD:</b> 5.1 <b>Sol:</b> — <b>FLP:</b> -10°F <b>IP:</b> 9.5 eV
(CH <sub>3</sub> ) <sub>2</sub> NPCl <sub>2</sub>			
Agent Index # A225	Clear colorless liquid.	<b>TWA:</b> — <b>IDLH:</b> —	<b>MW:</b> 110.1 <b>MP:</b> —

**PRECURSORS AND DUAL-THREAT CHEMICALS (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
<b>Dimethyl-phosphite</b> CAS # 868-85-9 NAERG # 128  HP(O)(OCH <sub>3</sub> ) <sub>2</sub>	<b>Common Commercial</b> <b>Use:</b> Used as a lubricant additive.  <b>Dual Use:</b> Synthesis of various Nerve Agents.	<b>Evacuation Distances</b> None established	<b>BP:</b> 339°F <b>VP:</b> 1 mmHg (77°F) <b>SG:</b> 1.20 <b>RVD:</b> 3.8 <b>Sol:</b> >10% <b>FLP:</b> 85°F <b>IP:</b> 10.5 eV
Agent Index # A226  <b>N,N-Dimethyl-phosphoramidic Dichloride</b> CAS # 677-43-0 NAERG # 137  (CH <sub>3</sub> ) <sub>2</sub> NP(O)Cl <sub>2</sub>	<b>Common Commercial</b> <b>Use:</b> Used in organic synthesis.  <b>Dual Use:</b> Synthesis of various Nerve Agents.	<b>TWA:</b> — <b>IDLH:</b> —  <b>Evacuation Distances</b> None established	<b>MW:</b> 162.0 <b>MP:</b> — <b>BP:</b> — <b>VP:</b> — <b>SG:</b> 1.36 <b>RVD:</b> 5.6 <b>Sol:</b> — <b>FLP:</b> — <b>IP:</b> ~ 9 eV
Agent Index # A227 Class Index C05  <b>O-Ethyl 2-Diisopropyl-aminoethyl-methyl phosphonite</b> Agent QL CAS # 57856-11-8 NAERG # 128  CH <sub>3</sub> P(OCH <sub>2</sub> CH <sub>3</sub> )-[OCH <sub>2</sub> CH <sub>2</sub> N[CH(CH <sub>3</sub> ) <sub>2</sub> ] <sub>2</sub> ]	Colorless viscous liquid with strong fishy odor.  <b>Common Commercial</b> <b>Use:</b> None.  <b>Dual Use:</b> Synthesis of the Nerve Agent VX and as a component in the Binary Nerve Agent VX2.	<b>TWA:</b> 0.003 ppm <b>IDLH:</b> 4.7 ppm  <b>Evacuation Distances</b> None established	<b>MW:</b> 235.3 <b>MP:</b> — <b>BP:</b> 450°F <b>VP:</b> 0.01 mmHg (77°F) <b>SG:</b> 0.91 (77°F) <b>RVD:</b> 8.1 <b>Sol:</b> "Slight" <b>FLP:</b> 192°F <b>IP:</b> —
Agent Index # A228  <b>O-Ethyl Methyl-phosphonothioic Acid</b> CAS # 18005-40-8 NAERG # 153	Liquid.  <b>Common Commercial</b> <b>Use:</b> Used in organic synthesis and manufacture of pesticides.	<b>TWA:</b> — <b>IDLH:</b> —  <b>Evacuation Distances</b> None established	<b>MW:</b> 140.1 <b>MP:</b> — <b>BP:</b> — <b>VP:</b> — <b>SG:</b> — <b>RVD:</b> 4.8 <b>Sol:</b> —

**PRECURSORS AND DUAL-THREAT CHEMICALS (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
CH <sub>3</sub> P(O)-(OCH <sub>2</sub> CH <sub>3</sub> )SH	<b>Dual Use:</b> Synthesis of various "V" series Nerve Agents.		FLP: — IP: —
Agent Index # A229	Water-white liquid with an amine odor.	TWA: — IDLH: —	MW: 133.2 MP: -58°F BP: 475°F
<b>Ethyl-diethanol-amine</b> CAS # 139-87-7 NAERG # None	<b>Common Commercial Use:</b> Used as a solvent and in the manufacture of detergents.	<b>Evacuation Distances</b> None established	VP: — SG: 1.01 RVD: 4.6 Sol: — FLP: 253°F IP: —
CH <sub>3</sub> CH <sub>2</sub> N-(CH <sub>2</sub> CH <sub>2</sub> OH) <sub>2</sub>	<b>Dual Use:</b> Synthesis of Nitrogen Mustard HN-1.		
Agent Index # A230	<b>Common Commercial Use:</b> Used in organic synthesis.	TWA: — IDLH: —	MW: 130.9 MP: — BP: 234°F
<b>Ethylphosphinyl Dichloride</b> CAS # 1498-40-4 NAERG # 135	<b>Dual Use:</b> Synthesis of various "G" series Nerve Agents.	<b>Evacuation Distances</b> Initial: 300 feet DW Day: 0.2 miles DW Night: 1.0 miles	VP: — SG: 1.26 RVD: 4.5 Sol: — FLP: 90°F IP: 9.3 eV
CH <sub>3</sub> CH <sub>2</sub> PCl <sub>2</sub>			
Agent Index # A231		TWA: — IDLH: —	MW: 98.0 MP: — BP: —
<b>Ethylphosphinyl Difluoride</b> CAS # 430-78-4 NAERG # 136	<b>Common Commercial Use:</b> Used in organic synthesis.	<b>Evacuation Distances</b> None established	VP: — SG: — RVD: 3.4 Sol: — FLP: — IP: —
CH <sub>3</sub> CH <sub>2</sub> PF <sub>2</sub>	<b>Dual Use:</b> Synthesis of various "G" series Nerve Agents.		
Agent Index # A232	Liquid.	TWA: — IDLH: —	MW: 146.9 MP: — BP: 160°F
<b>Ethylphosphonyl Dichloride</b> CAS # 1066-50-8 NAERG # 154	<b>Common Commercial Use:</b> Used in organic synthesis.	<b>Evacuation Distances</b> None established	VP: — SG: 1.38 RVD: 5.0

**PRECURSORS AND DUAL-THREAT CHEMICALS (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
$\text{CH}_3\text{CH}_2\text{P}(\text{O})\text{Cl}_2$	<b>Dual Use:</b> Synthesis of various "G" series Nerve Agents.		<b>Sol:</b> Reacts <b>FLP:</b> > 282°F <b>IP:</b> —
Agent Index # A233 <b>Ethyl-phosphonothioic Dichloride</b> CAS # 993-43-1 NAERG # 154	<b>Common Commercial Use:</b> Used in organic synthesis and the manufacture of pesticides. <b>Dual Use:</b> Synthesis of various Nerve Agents.	<b>TWA:</b> — <b>IDLH:</b> — <b>Evacuation Distances</b> <b>Initial:</b> 300 feet <b>DW Day:</b> 0.2 miles <b>DW Night:</b> 0.8 miles	<b>MW:</b> 163.0 <b>MP:</b> — <b>BP:</b> — <b>VP:</b> — <b>SG:</b> — <b>RVD:</b> 5.6 <b>Sol:</b> — <b>FLP:</b> — <b>IP:</b> —
$\text{CH}_3\text{CH}_2\text{P}(\text{S})\text{Cl}_2$			
Agent Index # A234 <b>3-Hydroxy-1-methylpiperidine</b> CAS # 3554-74-3 NAERG # 129	Colorless to yellow liquid. <b>Common Commercial Use:</b> Used in organic synthesis and the manufacture of pharmaceuticals.	<b>TWA:</b> — <b>IDLH:</b> — <b>Evacuation Distances</b> None established	<b>MW:</b> 115.2 <b>MP:</b> — <b>BP:</b> ~200°F <b>VP:</b> — <b>SG:</b> 1.00 <b>RVD:</b> 4.0 <b>Sol:</b> — <b>FLP:</b> 158°F <b>IP:</b> —
$(\text{HO})\text{C}_5\text{H}_8\text{NCH}_3$	<b>Dual Use:</b> Synthesis of Incapacitating Agent BZ.		
Agent Index # A235 <b>Isopropyl Alcohol</b> CAS # 67-63-0 NAERG # 129	Colorless liquid with the odor of rubbing alcohol. <b>Common Commercial Use:</b> Used as a solvent, cleaner, disinfectant, and in organic synthesis.	<b>TWA:</b> 400 ppm <b>IDLH:</b> 2,000 ppm (10% LEL) <b>Evacuation Distances</b> None established	<b>MW:</b> 60.1 <b>MP:</b> -127°F <b>BP:</b> 181°F <b>VP:</b> 33 mm Hg <b>SG:</b> 0.79 <b>RVD:</b> 2.1 <b>Sol:</b> Miscible <b>FLP:</b> 53°F <b>IP:</b> 10.1 eV
$(\text{CH}_3)_2\text{CHOH}$			
Agent Index # A236 Mixed with Isopropylamine (A237)	<b>Dual Use:</b> Synthesis of various Nerve Agents and as a component in the Binary Nerve Agent GB2.		

**PRECURSORS AND DUAL-THREAT CHEMICALS (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A237	Colorless liquid or gas with an ammonia-like odor.	<b>TWA:</b> 5 ppm <b>IDLH:</b> 750 ppm	<b>MW:</b> 59.1 <b>MP:</b> -150°F <b>BP:</b> 91°F
<b>Isopropylamine</b> CAS # 75-31-0 NAERG # 132  (CH <sub>3</sub> ) <sub>2</sub> CHNH <sub>2</sub>	<b>Common Commercial Use:</b> Used as a solvent and a dehairing agent, in the manufacture of pharmaceuticals, dyes, insecticides, bactericides, surface-active agents, and textile specialties, and as an intermediate in the synthesis of rubber accelerators.  <b>Dual Use:</b> Used as an acid scavenger in the synthesis of various Nerve Agents including the Binary Nerve Agent GB2.	<b>Evacuation Distances</b> None established	<b>VP:</b> 460 mmHg <b>SG:</b> 0.69 <b>RVD:</b> 2.0 <b>Sol:</b> Miscible <b>FLP:</b> -35°F <b>IP:</b> 8.7 eV
Agent Index # A238	White solid.	<b>TWA:</b> — <b>IDLH:</b> —	<b>MW:</b> 242.3 <b>MP:</b> 165°F <b>BP:</b> —
<b>Methyl Benzilate</b> CAS # 76-89-1 NAERG # 154  (C <sub>6</sub> H <sub>5</sub> ) <sub>2</sub> C(OH)-CO <sub>2</sub> CH <sub>3</sub>	<b>Common Commercial Use:</b> Used in organic synthesis and manufacture of pharmaceuticals.  <b>Dual Use:</b> Synthesis of Incapacitating Agent BZ.	<b>Evacuation Distances</b> None established	<b>VP:</b> — <b>SG:</b> — <b>RVD:</b> 8.3 <b>Sol:</b> — <b>FLP:</b> — <b>IP:</b> —
Agent Index # A239	Clear, colorless liquid.	<b>TWA:</b> — <b>IDLH:</b> —	<b>MW:</b> 119.2 <b>MP:</b> -5.8°F <b>BP:</b> 475°F
<b>Methyldiethanolamine</b> CAS # 105-59-9 NAERG # None	<b>Common Commercial Use:</b> Used in organic synthesis, for absorption of acidic gases, as a catalyst for polyurethane foams and as pH control agent.	<b>Evacuation Distances</b> None established	<b>VP:</b> < 0.01 mmHg <b>SG:</b> 1.04 <b>RVD:</b> 4.1 <b>Sol:</b> "Very" <b>FLP:</b> 260°F

**PRECURSORS AND DUAL-THREAT CHEMICALS (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
CH <sub>3</sub> N-(CH <sub>2</sub> CH <sub>2</sub> OH) <sub>2</sub>	<b>Dual Use:</b> Synthesis of Nitrogen Mustard HN-2.		IP: —
Agent Index # A240	Liquid.	TWA: — IDLH: —	MW: 116.9 MP: —
<b>Methylphosphinyl Dichloride</b> Agent SW CAS # 676-83-5 NAERG # 135	<b>Common Commercial Use:</b> Used in organic synthesis.  <b>Dual Use:</b> Synthesis of various Nerve Agents.	<b>Evacuation Distances</b> Initial: 300 feet DW Day: 0.2 miles DW Night: 0.9 miles	BP: 178°F VP: — SG: 1.30 RVD: 4.0 Sol: Reacts FLP: 118°F IP: 9.5 eV
CH <sub>3</sub> PCl <sub>2</sub> Agent Index # A241 Mixed with Methylphosphonic Dichloride (A243)			
Agent Index # A241	Liquid.	TWA: — IDLH: —	MW: 84.0 MP: —
<b>Methylphosphinyl Difluoride</b> CAS # 753-59-3 NAERG # 136	<b>Common Commercial Use:</b> Used in organic synthesis.  <b>Dual Use:</b> Synthesis of various "G" series Nerve Agents.	<b>Evacuation Distances</b> None established	BP: — VP: — SG: — RVD: 2.9 Sol: — FLP: — IP: 9.8 eV
CH <sub>3</sub> PF <sub>2</sub>			
Agent Index # A242	White solid.	TWA: — IDLH: —	MW: 96.0 MP: 221°F
<b>Methylphosphonic Acid</b> CAS # 993-13-5 NAERG # 154	<b>Common Commercial Use:</b> Used in organic synthesis.  <b>Dual Use:</b> Synthesis of various Nerve Agents.	<b>Evacuation Distances</b> None established	BP: — VP: — SG: — RVD: 3.3 Sol: — FLP: — IP: —
CH <sub>3</sub> P(O)(OH) <sub>2</sub>			
Agent Index # A243	Clear solid or liquid with a stinging, disagreeable odor.	TWA: 0.006 ppm IDLH: 0.3 ppm	MW: 132.9 MP: 89 °F BP: 331°F

**PRECURSORS AND DUAL-THREAT CHEMICALS (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
<b>Methylphosphonic Dichloride</b> Agent DC CAS # 676-97-1 NAERG # 137	<b>Common Commercial Use:</b> None.  <b>Dual Use:</b> Synthesis of various Nerve Agents.	<b>Precautions</b> Reacts with water and common organic materials (e.g., alcohols, antifreeze) to form chlorinated version of Nerve Agents.	VP: 10 mmHg (122 °F) SG: 1.6 (74°F) RVD: 4.8 Sol: Reacts FL.P: 300°F IP: 10.9
CH <sub>3</sub> P(O)Cl <sub>2</sub>		<b>Evacuation Distances</b> Initial: 300 feet DW Day: 0.2 miles DW Night: 0.9 miles	
Agent Index # A245 Class Index # C05  <b>Methylphosphonic Difluoride</b> Agent DF CAS # 676-99-3 NAERG # 154	Clear liquid with pungent acid-like odor  <b>Common Commercial Use:</b> None.  <b>Dual Use:</b> Synthesis of various "G" Series Nerve Agents and as a component in the Binary Nerve Agent GB2.	TWA: 0.002 ppm IDLH: 0.01 ppm  <b>Precautions</b> Reacts with water and common organic materials (e.g., alcohols, antifreeze) to form crude Nerve Agents.	MW: 100.0 MP: -35°F BP: 367°F VP: 36 mmHg (77°F) SG: 1.4 (77°F) RVD: 3.5 Sol: Reacts FL.P: None IP: —
CH <sub>3</sub> P(O)F <sub>2</sub>		<b>Evacuation Distances</b> Initial: 700 feet DW Day: 1.2 miles DW Night: 5.5 miles	
Agent Index # A241 Mixed with Methylphosphinyl Difluoride (A242)			
Agent Index # A246  <b>Methylphosphonothioic Dichloride</b> CAS # 676-98-2 NAERG # 154	<b>Common Commercial Use:</b> Used in organic synthesis.  <b>Dual Use:</b> Synthesis of various Nerve Agents.	TWA: — IDLH: —  <b>Evacuation Distances</b> None established	MW: 149.0 MP: — BP: 309°F VP: — SG: 1.42 RVD: 5.1 Sol: — FL.P: 169°F IP: 8.6 eV
CH <sub>3</sub> P(S)Cl <sub>2</sub>			

**PRECURSORS AND DUAL-THREAT CHEMICALS (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A247	Clear, colorless to yellow, oily liquid or solid with a pungent and musty odor.	<b>TWA:</b> 0.1 ppm <b>IDLH:</b> —	<b>MW:</b> 153.3 <b>MP:</b> 34°F <b>BP:</b> 222°F <b>VP:</b> 40 mm Hg (81°F)
<b>Phosphorus Oxychloride</b> CAS # 10025-87-3 NAERG # 137	<b>Common Commercial Use:</b> Used in organic synthesis and manufacture of insecticides, dye intermediates, flame retardants, and pharmaceuticals.	<b>Evacuation Distances Initial:</b> 200 feet <b>DW Day:</b> 0.2 mile <b>DW Night:</b> 0.6 miles	<b>SG:</b> 1.65 <b>RVD:</b> 5.3 <b>Sol:</b> Reacts <b>FLP:</b> None <b>IP:</b> 11.5 eV
POCl <sub>3</sub>	<b>Dual Use:</b> Synthesis of various Nerve Agents.		
Agent Index # A248	White to pale yellow crystalline solid with a pungent, unpleasant odor.	<b>TWA:</b> 1 mg/m <sup>3</sup> <b>IDLH:</b> 70 mg/m <sup>3</sup>	<b>MW:</b> 208.3 <b>MP:</b> 324°F <b>BP:</b> Sublimes <b>VP:</b> 1 mmHg (132°F)
<b>Phosphorus Pentachloride</b> CAS # 10026-13-8 NAERG # 137	<b>Common Commercial Use:</b> Used in the manufacture of plastics and pesticides.	<b>Precautions</b> Reacts with water to produce hydrogen chloride.	<b>SG:</b> 3.60 <b>RVD:</b> 7.2 <b>Sol:</b> Reacts <b>FLP:</b> None <b>IP:</b> 10.2 eV
PCl <sub>5</sub>	<b>Dual Use:</b> Synthesis of various Nerve Agents.	<b>Evacuation Distances</b> None established	
Agent Index # A249	Greenish-gray to yellow crystalline solid with an odor of rotten eggs.	<b>TWA:</b> 1 mg/m <sup>3</sup> <b>IDLH:</b> 250 mg/m <sup>3</sup>	<b>MW:</b> 222.3/444.6 <b>MP:</b> 550°F <b>BP:</b> 957°F <b>VP:</b> 1 mmHg (572°F)
<b>Phosphorus Pentasulphide</b> CAS # 1314-80-3 NAERG # 139	<b>Common Commercial Use:</b> Used in organic synthesis, and as a lubricating oil additive, and the manufacture of pyrotechnics and pesticides.	<b>Evacuation Distances</b> None established	<b>SG:</b> 2.09 <b>RVD:</b> 7.7 <b>Sol:</b> Reacts <b>FLP:</b> None <b>IP:</b> —
P <sub>2</sub> S <sub>5</sub> /P <sub>4</sub> S <sub>10</sub>	<b>Dual Use:</b> Synthesis of various "V" series Nerve Agents.		

**PRECURSORS AND DUAL-THREAT CHEMICALS (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A250	Clear, colorless and odorless liquid.	<b>TWA:</b> — <b>IDLH:</b> —	<b>MW:</b> 102.2 <b>MP:</b> 41°F <b>BP:</b> 246°F
<b>Pinacolyl Alcohol</b> CAS # 464-07-3 NAERG # 127	<b>Common Commercial</b> <b>Use:</b> Used in organic synthesis.	<b>Evacuation Distances</b> None established	<b>VP:</b> — <b>SG:</b> 0.81 <b>RVD:</b> 3.5
(CH <sub>3</sub> ) <sub>3</sub> CCH(OH)-CH <sub>3</sub>	<b>Dual Use:</b> Synthesis of the Nerve Agent Soman (GD).		<b>Sol:</b> — <b>FLP:</b> 84°F <b>IP:</b> —
Agent Index # A251	Odorless white solid.	<b>TWA:</b> 2.5 mg/m <sup>3</sup> (as F) <b>IDLH:</b> 250 mg/m <sup>3</sup> (as F)	<b>MW:</b> 78.1 <b>MP:</b> 460°F <b>BP:</b> — <b>VP:</b> —
<b>Potassium Bifluoride</b> CAS # 7789-29-9 NAERG # 154	<b>Common Commercial</b> <b>Use:</b> Used in ceramics, etching glass, in welding fluxes, and as a wood preservative.	<b>Evacuation Distances</b> None established	<b>SG:</b> 2.37 <b>RVD:</b> None <b>Sol:</b> 39% <b>FLP:</b> None <b>IP:</b> —
KHF <sub>2</sub>	<b>Dual Use:</b> Synthesis of various "G" series Nerve Agents.		
Agent Index # A252	White solid with a faint almond-like odor. Odor is not detectable by all individuals.	<b>TWA:</b> 5 mg/m <sup>3</sup> <b>IDLH:</b> 25 mg/m <sup>3</sup>	<b>MW:</b> 65.1 <b>MP:</b> 1,173°F <b>BP:</b> 2,957°F <b>VP:</b> 0 mmHg <b>SG:</b> 1.55
<b>Potassium Cyanide</b> CAS # 151-50-8 NAERG # 157	<b>Common Commercial</b> <b>Use:</b> Used in organic synthesis, electroplating and as a pesticide.	<b>Precautions</b> May react with water to produce hydrogen cyanide.	<b>RVD:</b> None <b>Sol:</b> 72% (77°F) <b>FLP:</b> None <b>IP:</b> —
KCN	<b>Dual Use:</b> Synthesis of some "G" series Nerve Agents and various Blood Agents.	<b>Evacuation Distances</b> None established	
Agent Index # A253	White crystalline solid.	<b>TWA:</b> 2.5 mg/m <sup>3</sup> (as F) <b>IDLH:</b> 250 mg/m <sup>3</sup> (as F)	<b>MW:</b> 58.1 <b>MP:</b> 1,576°F <b>BP:</b> 2,741°F

**PRECURSORS AND DUAL-THREAT CHEMICALS (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
<b>Potassium Fluoride</b> CAS # 7789-23-3 NAERG # 154	<b>Common Commercial</b> <b>Use:</b> Used in organic synthesis, electroplating and the manufacture of pesticides.		<b>VP:</b> 0 mm Hg <b>SG:</b> 2.48 <b>RVD:</b> None <b>Sol:</b> 92% <b>FLP:</b> None <b>IP:</b> —
KF	<b>Dual Use:</b> Synthesis of various "G" series Nerve Agents.	<b>Evacuation Distances</b> None established	
Agent Index # A254	Almost white crystalline powder.	<b>TWA:</b> — <b>IDLH:</b> —	<b>MW:</b> 127.2 <b>MP:</b> 433°F <b>BP:</b> — <b>VP:</b> — <b>SG:</b> — <b>RVD:</b> 4.4 <b>Sol:</b> "Soluble" <b>FLP:</b> — <b>IP:</b> < 8.1
<b>3-Quinuclidinol</b> CAS # 1619-34-7 NAERG # 154	<b>Common Commercial</b> <b>Use:</b> Used in organic synthesis and the manufacture of pharmaceuticals.		
HC(CHOHCH <sub>2</sub> -) (CH <sub>2</sub> CH <sub>2</sub> -) <sub>2</sub> N	<b>Dual Use:</b> Synthesis of Incapacitating Agent BZ.	<b>Evacuation Distances</b> None established	
Agent Index # A255	White crystalline solid.	<b>TWA:</b> 2.5 mg/m <sup>3</sup> (as F) <b>IDLH:</b> 250 mg/m <sup>3</sup> (as F)	<b>MW:</b> 62.0 <b>MP:</b> 1,819°F <b>BP:</b> 3,099°F <b>VP:</b> 0 mmHg <b>SG:</b> 2.56 <b>RVD:</b> None <b>Sol:</b> 4.3% <b>FLP:</b> None <b>IP:</b> —
<b>Sodium Bifluoride</b> CAS # 1333-83-1 NAERG # 154	<b>Common Commercial</b> <b>Use:</b> Used in etching glass, rust removal, welding fluxes, disinfectants, laundry operations, and as a pesticide.	<b>Evacuation Distances</b> None established	
NaHF <sub>2</sub>	<b>Dual Use:</b> Synthesis of various "G" series Nerve Agents.		
Agent Index # A256	White solid with a faint almond-like odor. Odor is not detectable by all individuals.	<b>TWA:</b> 5 mg/m <sup>3</sup> <b>IDLH:</b> 25 mg/m <sup>3</sup>	<b>MW:</b> 49.0 <b>MP:</b> 1,047°F <b>BP:</b> 2,725°F <b>VP:</b> 0 mm Hg

**PRECURSORS AND DUAL-THREAT CHEMICALS (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
<b>Sodium Cyanide</b> CAS # 143-33-9 NAERG # 157  NaCN	<b>Common Commercial</b> <b>Use:</b> Used in organic synthesis, electroplating, precious metal extraction, as a pesticide, and in the manufacture of dyes, pigments, and pharmaceuticals.  <b>Dual Use:</b> Synthesis of some "G" series Nerve Agents and various Blood Agents.	<b>Precautions</b> May react with water to produce hydrogen cyanide.  <b>Evacuation Distances</b> None established	<b>SG:</b> 1.60 <b>RVD:</b> None <b>Sol:</b> 58% (77°F) <b>Fl.P:</b> None <b>IP:</b> —
Agent Index # A257  <b>Sodium Fluoride</b> CAS # 7681-49-4 NAERG # 154  NaF	White odorless solid. Industrial material may be dyed blue.  <b>Common Commercial</b> <b>Use:</b> Used in etching glass, as an antiseptic, wood preservative, and pesticide, and in the manufacture of insecticides and welding fluxes.  <b>Dual Use:</b> Synthesis of various "G" series Nerve Agents.	<b>TWA:</b> 2.5 mg/m <sup>3</sup> (as F) <b>IDLH:</b> 250 mg/m <sup>3</sup> (as F)  <b>Evacuation Distances</b> None established	<b>MW:</b> 42.0 <b>MP:</b> 1,819°F <b>BP:</b> 3,099°F <b>VP:</b> 0 mmHg <b>SG:</b> 2.78 <b>RVD:</b> None <b>Sol:</b> 4% <b>Fl.P:</b> None <b>IP:</b> —
Agent Index # A258  <b>Sodium Sulfide</b> CAS # 1313-82-2 NAERG # 135  Na <sub>2</sub> S	Clear white to yellow solid with a weak odor of rotten eggs.  <b>Common Commercial</b> <b>Use:</b> Used in metallurgy, dehairing hides, and wool pulling, as well as manufacturing paper and pharmaceuticals.  <b>Dual Use:</b> Various sulfur based Vesicants.	<b>TWA:</b> — <b>IDLH:</b> —  <b>Evacuation Distances</b> None established	<b>MW:</b> 78.4 <b>MP:</b> 1,742°F <b>BP:</b> — <b>VP:</b> — <b>SG:</b> 1.86 <b>RVD:</b> 2.7 <b>Sol:</b> 15% <b>Fl.P:</b> — <b>IP:</b> —

**PRECURSORS AND DUAL-THREAT CHEMICALS (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A259 <b>Sulfur</b> CAS # 7704-34-9 NAERG # 133  S <sub>8</sub>	Yellow crystals, powder or solid.  <b>Common Commercial Use:</b> Used in the manufacture of pyrotechnics, and as a pesticide.	<b>TWA:</b> — <b>IDLH:</b> —  <b>Evacuation Distances</b> None established	<b>MW:</b> 256.5 <b>MP:</b> 237°F <b>BP:</b> 832°F (sublimes) <b>VP:</b> — <b>SG:</b> 2.07 <b>RVD:</b> 8.8 <b>Sol:</b> Insoluble <b>FLP:</b> 334°F <b>IP:</b> 10.4 eV
Agent Index # A260 Mixed with Dimethyl-polysulfides	<b>Dual Use:</b> Synthesis of various "V" series Nerve Agents and as a component in Binary Nerve Agent VX2.		
Agent Index # A261  <b>Sulfur Dichloride</b> CAS # 10545-99-0 NAERG # 137  SCl <sub>2</sub>	Light amber to yellowish red, fuming, oily liquid with a penetrating odor.  <b>Common Commercial Use:</b> Used in organic synthesis, and the manufacture of insecticides, vulcanizing oils and rubber.  <b>Dual Use:</b> Synthesis of various sulfur based Vesicants.	<b>TWA:</b> — <b>IDLH:</b> —  <b>Evacuation Distances</b> None established	<b>MW:</b> 135.0 <b>MP:</b> 105°F <b>BP:</b> 280°F <b>VP:</b> 6.8 mmHg <b>SG:</b> 1.69 <b>RVD:</b> 4.7 <b>Sol:</b> Reacts <b>FLP:</b> None <b>IP:</b> 9.5 eV
Agent Index # A262  <b>Sulfur Monochloride</b> CAS # 10025-67-9 NAERG # 137	Light-amber to yellow-red fuming oily liquid with a pungent, nauseating, irritating odor.  <b>Common Commercial Use:</b> Used in gold extraction, wood treatment, and the manufacture of insecticides, dyes, and pharmaceuticals.	<b>TWA:</b> 1 ppm <b>IDLH:</b> 5 ppm  <b>Evacuation Distances</b> <b>Initial:</b> 200 feet <b>DW Day:</b> 0.1 miles <b>DW Night:</b> 0.4 miles	<b>MW:</b> 135.0 <b>MP:</b> -107°F <b>BP:</b> 280°F <b>VP:</b> 7 mmHg <b>SG:</b> 1.68 <b>RVD:</b> 4.7 <b>Sol:</b> Reacts <b>FLP:</b> 245°F <b>IP:</b> 9.4 eV

**PRECURSORS AND DUAL-THREAT CHEMICALS (CONTINUED)**

Name	Physical Description	Exposure Hazards	Properties
$S_2Cl_2$	<b>Dual Use:</b> Synthesis of various sulfur based Vesicants.		
Agent Index # A263 <b>Thickeners</b>	Varies.  <b>Common Commercial Use:</b> Comprised of various plastics, resins, and rubbers.  <b>Dual Use:</b> Used to increase the viscosity and persistence of various chemical warfare agents.		
Agent Index # A264  <b>Thiodiglycol</b> CAS # 111-48-8 NAERG # None	Liquid.  <b>Common Commercial Use:</b> Used as a printing-ink solvent, antioxidant, lubricant additive, rubber accelerator and in the manufacture of plastics and pesticides.	<b>TWA:</b> — <b>IDLH:</b> —  <b>Evacuation Distances</b> None established	<b>MW:</b> 122.2 <b>MP:</b> 3°F <b>BP:</b> 540°F <b>VP:</b> — <b>SG:</b> 1.18 <b>RVD:</b> 4.2 <b>Sol:</b> Miscible <b>FLP:</b> 320°F <b>IP:</b> —
$(HOCH_2CH_2)_2S$	<b>Dual Use:</b> Synthesis of various sulfur based Vesicants.		
Agent Index # A265	Colorless to yellow to reddish liquid with a pungent, suffocating odor similar to sulfur dioxide. Liquid fumes when exposed to moist air.	<b>Ceiling:</b> 1 ppm <b>IDLH:</b> —  <b>Precautions</b> Reacts with water to produce hydrogen chloride and sulfur dioxide.	<b>MW:</b> 119.0 <b>MP:</b> -156°F <b>BP:</b> 169°F <b>VP:</b> 100 mmHg (70°F) <b>SG:</b> 1.64 <b>RVD:</b> 4.1 <b>Sol:</b> Reacts

**PRECURSORS AND DUAL-THREAT CHEMICALS (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
<b>Thionyl Chloride</b> CAS # 7719-09-7 NAERG # 137  $\text{SOCl}_2$	<b>Common Commercial</b> <b>Use:</b> Used in organic synthesis, and the manufacture of plastics, pharmaceuticals, and pesticides.  <b>Dual Use:</b> Synthesis of various Nerve Agents and Vesicants.	<b>Evacuation Distances</b> None established	<b>FLP:</b> None <b>IP:</b> —
<b>Triethanolamine</b> CAS # 102-71-6 NAERG # None  $(\text{HOCH}_2\text{CH}_2)_3\text{N}$	Colorless, water-white to pale-yellow viscous liquid or solid with a slight ammonia odor.  <b>Common Commercial</b> <b>Use:</b> Used in detergents, emulsifiers, surfactants, as a corrosion inhibitor for lubricants, and in the manufacture of cosmetics.  <b>Dual Use:</b> Synthesis of the nitrogen based Vesicant HN-3.	<b>TWA:</b> 2.5 ppm <b>IDLH:</b> —  <b>Evacuation Distances</b> None established	<b>MW:</b> 149.2 <b>MP:</b> 71°F <b>BP:</b> 636°F <b>VP:</b> < 0.01 mmHg <b>SG:</b> 1.13 <b>RVD:</b> 5.2 <b>Sol:</b> Miscible <b>FLP:</b> 365°F <b>IP:</b> 7.9 eV
<b>Triethyl Phosphite</b> CAS # 122-52-1 NAERG # 129  $(\text{CH}_3\text{CH}_2\text{O})_3\text{P}$	Clear colorless liquid with an obnoxious odor (stench).  <b>Common Commercial</b> <b>Use:</b> Used as a lubricant additive, plasticizer, and in the manufacture of pesticides.  <b>Dual Use:</b> Synthesis of various Nerve Agents.	<b>TWA:</b> — <b>IDLH:</b> —  <b>Evacuation Distances</b> None established	<b>MW:</b> 166.2 <b>MP:</b> -170°F <b>BP:</b> 313°F <b>VP:</b> — <b>SG:</b> 0.97 <b>RVD:</b> 5.8 <b>Sol:</b> Reacts <b>FLP:</b> 126°F <b>IP:</b> 8.4 eV

**PRECURSORS AND DUAL-THREAT CHEMICALS (CONTINUED)**

<b>Name</b>	<b>Physical Description</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A268	Colorless liquid.	<b>TWA:</b> 2 ppm <b>IDLH:</b> —	<b>MW:</b> 124.1 <b>MP:</b> -108°F <b>BP:</b> 232°F
<b>Trimethyl Phosphite</b> CAS # 121-45-9 NAERG # 129	<b>Common Commercial Use:</b> Used as a gasoline additive, and in the manufacture of pesticides, paints, and coatings.	<b>Evacuation Distances</b> None established	<b>VP:</b> 21 mmHg <b>SG:</b> 1.05 <b>RVD:</b> 4.3 <b>Sol:</b> Insoluble <b>FLP:</b> 79°F <b>IP:</b> 8.4 eV
(CH <sub>3</sub> O) <sub>3</sub> P	<b>Dual Use:</b> Synthesis of various Nerve Agents.		

**TOXINS**

<b>Name</b>	<b>Symptoms</b>	<b>Toxicology</b>	<b>Properties</b>
Agent Index # A269 Class Index # C22		Abrin is a cytotoxin that inhibits protein synthesis.	Obtained from the jequirity beans plant.
<b>Abrin</b> CAS # 1393-62-0			Abrin is a yellowish-white powder that is soluble in salt water (with turbidity). It is fairly heat stable.
Agent Index # A270 Class Index # C22		Aflatoxins are delayed action cytotoxins that inhibit the synthesis of nucleic acids. Aflatoxins produce liver cancer and are possibly the most potent natural carcinogens known.	Obtained from various molds.  Aflatoxins are colorless to pale-yellow crystalline materials.
<b>Aflatoxins</b> CAS # (toxin B <sub>1</sub> ) 1162-65-8			

## TOXINS (CONTINUED)

Name	Symptoms	Toxicology	Properties
Agent Index # A271 Class Index # C22  <b>Anatoxin-A</b> CAS # 64285-06-9	Symptoms include twitching, incoordination, tremors, paralysis, and respiratory arrest. Symptoms begin within 5 minutes.	Anatoxin-A is a very rapid-acting paralytic neurotoxin that binds to the same receptor as acetylcholine. However acetylcholinesterase does not hydrolyze the toxin.	Obtained from blue-green algae.  Anatoxin-A is water soluble, but destroyed by heat, light, and high pH.
Agent Index # A272 Class Index # C22  <b>Batrachotoxin</b> CAS # 23509-16-2	Symptoms include loss of balance and coordination, profound weakness, irregular heart rhythms, convulsions and cyanosis. These symptoms are produced in rapid succession. Once in the body, the toxin can become stored in body fat and may have a cumulative effect. Batrachotoxin has no effect on the skin but produces a long-lasting painful stinging sensation in contact with the smallest scratch.	Batrachotoxin is a very rapid-acting paralytic neurotoxin that increases the sodium channel permeability.	Obtained from South American poison-dart frogs.  Batrachotoxin is not water soluble; however, it can be dissolved in such solvents as alcohols, fuels, and oils. The toxin is stable to both low and moderately high pH. Batrachotoxin is relatively non-persistent in the environment. However, the dried toxin can remain efficacious for at least a year.

## TOXINS (CONTINUED)

Name	Symptoms	Toxicology	Properties
Agent Index # A273 Class Index # C22  <b>Botulinum Toxins</b> CAS # (toxin A) 93384-43-1	Symptoms include dizziness, difficulty swallowing and speaking, blurred or double vision, sensitivity to light and muscular weakness progressing from the head downward, and in some cases, nausea and profuse vomiting. Symptoms from ingestion usually begin within 12 to 72 hours but can be delayed for up to 8 days, while symptoms from inhalation have a more rapid onset, usually 3 to 6 hours.	Botulinum toxin is a delayed-action paralytic neurotoxin that blocks the release of acetylcholine. An antitoxin is available but the paralysis is difficult to treat once symptoms appear.	Obtained from <i>Clostridium botulinum</i> bacteria.  Botulinum toxin can be a white powder or colorless crystals. It is readily soluble in water and is stable in solution for up to 7 days when protected from heat and/or light. However, the toxin is destroyed by heat and decomposes when exposed to air for more than 12 hours.
Agent Index # A274 Class Index # C22  <b>Brevetoxins</b> CAS # (toxin B) 79580-28-2	Toxins are lipid soluble and once in the body can become stored in body fat and may have a cumulative effect.	Brevetoxins are neurotoxins that activate the sodium channel.	Obtained from the dinoflagellate that causes "red-tide."  Brevetoxins are light tan crystalline materials. They are insoluble in water and very unstable.
Agent Index # A275 Class Index # C22  <b><math>\beta</math>-Bungarotoxin</b> CAS # —		$\beta$ -Bungarotoxin is a neurotoxin that prevents the release of acetylcholine.	Obtained from banded krait venom.
Agent Index # A276 Class Index # C22  <b>Cardiotoxin</b> CAS # 11061-96-4	Symptoms include heart irregularities and low blood pressure.	Cardiotoxin is a rapid acting toxin that causes irreversible depolarization of cell membranes and muscle contractions.	Obtained from cobra venom.  Cardiotoxin is detoxified by exposure to heat and ultraviolet light.

## TOXINS (CONTINUED)

Name	Symptoms	Toxicology	Properties
Agent Index # A277 Class Index # C22  <b><math>\alpha</math>-Conotoxin</b> CAS # 115797-06-3	Symptoms include extreme flaccid paralysis with respiratory and circulatory failure.	$\alpha$ -Conotoxin is a paralytic neurotoxin that blocks acetylcholine receptors.	Obtained from fish-hunting sea snails.  $\alpha$ -Conotoxin is water soluble and highly stable.
Agent Index # A278 Class Index # C22  <b>Crotoxin</b> CAS # 9007-40-3	Local effects from injection include localized pain, redness, hemorrhage, and cell necrosis. Systemic effects include dizziness, sensory and motor depression, and shock leading to collapse and death.	Crotoxin is a rapid-acting neurotoxin. Rattlesnake antivenin is available.	Obtained from rattlesnake venom.
Agent Index # A279 Class Index # C22  <b>Grayanotoxins</b> CAS # —		Produces hypotensive action.	Obtained from the leaves of various species of Rhododendrons.  Grayanotoxins are crystalline materials that are soluble in hot water and alcohols.
Agent Index # A280 Class Index # C22  <b>Microcystin</b> CAS # 101043-37-2	Symptoms include shivering, increased breathing rate and depth progressing to twitching, convulsions, and death.	Microcystin is a rapid-acting cytotoxin that disrupts cell membranes in the liver producing severe and rapid liver damage. Shock and death occur within a matter of hours.	Obtained from blue-green algae.  Microcystin is soluble in water, low and moderately high pH, as well as some organic solvents such as alcohols.

## TOXINS (CONTINUED)

Name	Symptoms	Toxicology	Properties
Agent Index # A281 Class Index # C22  <b>Palytoxin</b> CAS # 11077-03-5	Symptoms may include drowsiness, weakness, vomiting, respiratory distress, diarrhea, convulsions, shock, low body temperature, and death.	Palytoxin is a rapid-acting neurotoxin that causes irreversible depolarization of nerve and muscle tissue. It has a very potent effect on the coronary artery and may also cause delayed effects including disintegration of red blood cells.	Obtained from a bacterium associated with soft corals.  Palytoxin is soluble in water and alcohol. It is stable to heat, and both low and high pH.
Agent Index # A282 Class Index # C22  <b>Ricin</b> CAS # 9009-86-3	Initial symptoms are delayed from 6 hours to 3 days and include nausea, vomiting, bloody diarrhea, abdominal cramps, breathing difficulty, kidney failure, and circulatory collapse. Symptoms may persist for 10 to 12 days before death or recovery.	Ricin is a delayed-action cytotoxin that inhibits protein synthesis. An antitoxin is available but must be administered early in order to avoid severe tissue damage.	Obtained from the castor bean.  Ricin is soluble and stable in water and moderately low pH. It is relatively heat stable. It is persistent in the environment.

## TOXINS (CONTINUED)

Name	Symptoms	Toxicology	Properties
Agent Index # A283 Class Index # C22  <b>Saxitoxin</b> CAS # 35523-89-8	Symptoms from ingestion include a tingling or burning sensation of the lips, face, and tongue, progressing to the fingertips, arms, legs and neck. Additional symptoms include incoordination, dizziness, vomiting, nausea, headache, drooling, and abdominal pain. Symptoms occur in 10 minutes to 4 hours depending on the route of exposure. Severe flaccid paralysis can lead to death from respiratory failure in 1 to 24 hours. If the casualty survives 18 hours, recovery is usually rapid and complete.	Saxitoxin is a rapid-acting paralytic neurotoxin that blocks transient sodium channels and inhibits depolarization of nerve cells. Faulty identification of this toxin as a chemical nerve agent with resultant use of atropine would increase fatalities.	Obtained from the dinoflagellate that causes paralytic shellfish poisoning.  Saxitoxin is very soluble in water and slightly soluble in alcohols. It is easily stored as a hydrochloride salt.
Agent Index # A284 Class Index # C22  <b>Scorpion Venoms</b> CAS # General	Initial symptoms for inhalation exposure are unknown but may include watery eyes, dimness of vision, difficulty in breathing, rigid paralysis, and ultimately respiratory or congestive heart failure.	These venoms are delayed-action neurotoxins that cause continuous release of acetylcholine and other neurotransmitters. Antivenins are available but should be administered within two hours of exposure.	Obtained from various members of the scorpion family.  These venoms tend to be water soluble and heat stable.

## TOXINS (CONTINUED)

Name	Symptoms	Toxicology	Properties
Agent Index # A285 Class Index # C22  <b>Snake Venoms</b> CAS # General	Symptoms vary depending on the specific venom.	These venoms are a rapid-acting mixture of various types of toxins including neurotoxins, cardiotoxins, and cytotoxins.	Obtained from various species of snakes.  Snake venoms are usually water soluble. Some are very stable while heat and/or ultraviolet light detoxify others.
Agent Index # A286 Class Index # C22  <b>Staphylococcus Enterotoxin B</b> CAS # 11100-45-1	Symptoms include the sudden onset of vomiting, abdominal cramps, nausea, explosive watery diarrhea, and severe weakness. Symptoms usually continue for 6 to 8 hours but rarely longer than 48 hours. Inhalation of toxin may result in difficulty breathing due to fluid accumulation in the lungs.	SEB is a rapid-acting cytotoxin capable of producing either incapacitating or lethal effects.	Obtained from the <i>Staphylococcus aureus</i> bacteria.  Purified SEB toxin is a white, fluffy material that is water soluble. It is stable to heat and cold as well as in both high and low pH.
Agent Index # A287 Class Index # C23  <b>T-2 Mycotoxin</b> CAS # 21259-20-1	Initial symptoms may occur with minutes or may be delayed as long as 24 hours. Low-dose symptoms include nausea, shortness of breath, dizziness, eye and skin irritation (itching), blistering, and chest pains. In addition to the above symptoms, high-doses cause bloody vomit or diarrhea, massive hemorrhage, and shock. Death may be delayed for several weeks.	T-2 toxin is a rapid-acting cytotoxin capable of producing incapacitating or lethal effects.	Obtained from various molds.  The purified T-2 toxin may be colorless crystals, a white powder or a clear to yellowish oil. It is water soluble and stable to heat but sensitive to low pH. It is very stable and can be stored at room temperature for years. Persistence in the environment is 5 to 7 days after a release.

## TOXINS (CONTINUED)

Name	Symptoms	Toxicology	Properties
Agent Index # A288 Class Index # C22  <b>Tetanus Toxin</b> CAS # —	Symptoms include muscle spasms (frequently of the jaw muscle) progressing to rigid paralysis. Generalized spasms can be induced by sensory stimulation.	Tetanus toxin is a delayed-action neurotoxin that blocks the release of acetylcholine. An antitoxin is available.	Obtained from the bacterium <i>Clostridium tetani</i> .
Agent Index # A289 Class Index # C22  <b>Tetrodotoxin</b> CAS # 4368-28-9	Symptoms include nausea, vomiting, dizziness, paleness, and malaise. A sensation of tingling or prickling that progresses to numbness may be present. General weakness, dilation of the pupils, twitching, tremors, and loss of coordination follow. Death is due to respiratory arrest.	Tetrodotoxin is a rapid-acting neurotoxin that inhibits sodium channels in nerves and muscles.	Obtained from puffer fish.  Purified tetrodotoxin is colorless crystals or a white powder. It is slightly water soluble. It is stable to heat but is destroyed by high or low pH.

## PATHOGENS

Name	Symptoms	Exposure Hazards	Properties
Agent Index # A290 Class Index # C24  <b>Anthrax</b> <i>Bacillus anthracis</i> Type: Bacteria	Inhalation: Mild and nonspecific (i.e., flu-like) progressing to respiratory distress with fever and shock following in 3 to 5 days. Death occurs shortly thereafter.  Skin: Itching followed by lesion progressing into papular, then vesicular, to black eschar surrounded by swelling. Usually little or no pain.	<b>Routes:</b> Inhalation Ingestion Abraded Skin Vector (Biting Flies)  <b>Secondary Hazards:</b> Bacterial Spores Blood Fomites	<b>Incubation:</b> hours to 7 days <b>Mortality Rate:</b> Cutaneous: ≤ 20% Inhalation: ≤ 100% <b>Reservoir:</b> Horses, Sheep  <b>Direct Person-to-Person Transmission is rare.</b>

**PATHOGENS (CONTINUED)**

<b>Name</b>	<b>Symptoms</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A291 Class Index # C24  <b>Brucellosis</b> <i>Brucella abortus</i> ; <i>Brucella melitensis</i> ; <i>Brucella suis</i> Type: Bacteria	Continued, intermittent or irregular fever, headache, weakness, chills and generalized aching. Onset may be acute or insidious.	<b>Routes:</b> Ingestion Abraded Skin Mucous Membranes  <b>Secondary Hazards:</b> Blood Body Fluids	<b>Incubation:</b> 5 to 60 days <b>Mortality Rate:</b> ≤ 2% <b>Reservoir:</b> Cattle, Swine, Goats, Sheep  <b>Direct Person-to-Person Transmission does not occur.</b>
Agent Index # A292 Class Index # C25  <b>Chikungunya</b> Type: Virus	Arthritis in wrist, knee, ankle and small joints of extremities. A rash may develop in 1 to 10 days. May present hemorrhagic symptoms. Recovery may be prolonged.	<b>Routes:</b> Vector (Mosquitoes)  <b>Secondary Hazards:</b> Vector Cycle	<b>Incubation:</b> 3 to 11 days <b>Mortality Rate:</b> 0% <b>Reservoir:</b> —  <b>Direct Person-to-Person Transmission does not occur.</b>
Agent Index # A293 Class Index # C26  <b>Cholera</b> <i>Vibrio cholerae</i> Type: Bacteria	Sudden onset of profuse but painless watery diarrhea. Vomiting may be present in some cases.	<b>Routes:</b> Ingestion  <b>Secondary Hazards:</b> Fecal Vomit Fomites Vectors (mechanical)	<b>Incubation:</b> hours to 5 days <b>Mortality Rate:</b> 1% – 50% <b>Reservoir:</b> Humans  <b>Direct Person-to-Person Transmission is possible (fecal/oral).</b>
Agent Index # A294 Class Index # C24  <b>Coccidioidomycosis</b> <i>Coccidioides immitis</i> Type: Fungus	Respiratory infection: asymptomatic or flu-like (fever, chills, cough).  Disseminated form: (approximately 0.1% of cases) Lesions in lungs with abscesses throughout the body. Frequently fatal.	<b>Routes:</b> Inhalation Abraded Skin  <b>Secondary Hazards:</b> Fungal Spores Fomites (rarely)	<b>Incubation:</b> Inhalation: 7 to 28 days Disseminated: ≤ years <b>Mortality Rate:</b> Inhalation: 1% Disseminated: ≤ 50%  <b>Reservoir:</b> Soil <b>Direct Person-to-Person Transmission does not occur.</b>

**PATHOGENS (CONTINUED)**

<b>Name</b>	<b>Symptoms</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A295 Class Index # C25  <b>Congo-Crimean Hemorrhagic Fever</b> Type: Virus	Sudden onset of fever, malaise, weakness, headache, severe pain in the limbs. Flushing of the face and chest. A rash appears on the chest and stomach, spreading to the rest of the body. May present hemorrhagic symptoms. Recovery may be prolonged.	<b>Routes:</b> Vector (Ticks)  <b>Secondary Hazards:</b> Blood Body Fluids Fomites containing ticks	<b>Incubation:</b> 3 to 12 days <b>Mortality Rate:</b> ≤ 50% <b>Reservoir:</b> Rodents, Birds, Ticks  <b>Direct Person-to-Person Transmission is possible.</b>
Agent Index # A296 Class Index # C25  <b>Dengue &amp; Dengue Hemorrhagic Fever</b> Type: Virus	Normal: Sudden onset of fever with intense headache, pain behind the eyes, nausea, and vomiting. Fever may be diphasic. A rash with generalized reddening of the skin occurs. Hemorrhage may be present. Recovery may be prolonged and accompanied with fatigue and depression.  Hemorrhagic: Above symptoms suddenly worsen. A marked weakness occurs with severe restlessness and facial pallor. Skin becomes blotchy and extremities are cool. Hemorrhage is in the form of petechia and may progress to bleeding nose and gums. Death usually occurs from shock.	<b>Routes:</b> Vector (Mosquitoes)  <b>Secondary Hazards:</b> Vector Cycle	<b>Incubation:</b> 3 to 14 days <b>Mortality Rate:</b> Dengue: "Rare" DHF: ≤ 40% <b>Reservoir:</b> Humans, Monkeys, Mosquitoes  <b>Direct Person-to-Person Transmission does not occur.</b>

**PATHOGENS (CONTINUED)**

<b>Name</b>	<b>Symptoms</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A297 Class Index # C24  <b>Diphtheria</b> <i>Corynebacterium diphtheriae</i> Type: Bacteria	Sudden onset of moderate fever, chills, general malaise, and mild sore throat. The infection is primarily of the nose and throat, but may involve other mucous membranes or even the skin. Paralysis of the soft palate or the eyes may occur. There may be cardiac complications. The production of a grayish to white membrane in the throat is characteristic of the disease. There is also a characteristic odor associated with infected individuals. Carriers may become chronic and asymptomatic. The pathogen produces a cytotoxic exotoxin for which an antitoxin is available.	<b>Routes:</b> Inhalation Ingestion Mucous Membranes  <b>Secondary Hazards:</b> Fomites	<b>Incubation:</b> 1 to 7 days <b>Mortality Rate:</b> ≤ 12% <b>Reservoir:</b> Humans  <b>Direct Person-to-Person Transmission is possible.</b>
Agent Index # A298 Class Index # C25  <b>Eastern Equine Encephalitis</b> Type: Virus	Range from mild fever and headache to high fever, headache, stupor, tremors, coma, and spastic paralysis.	<b>Routes:</b> Vector (Mosquitoes)  <b>Secondary Hazards:</b> Vector Cycle	<b>Incubation:</b> 5 to 15 days <b>Mortality Rate:</b> < 60% <b>Reservoir:</b> Mosquitoes, Rodents, Birds  <b>Direct Person-to-Person Transmission does not occur.</b>
Agent Index # A299 Class Index # C24  <b>Ebola Hemorrhagic Fever</b> Type: Virus	Sudden onset of fever, malaise, headache and rash, progressing to vomiting, diarrhea, and hemorrhage.	<b>Routes:</b> Inhalation (Reston only) Ingestion Abraded Skin Mucous Membranes	<b>Incubation:</b> 2 to 21 days <b>Mortality Rate:</b> ≤ 70% <b>Reservoir:</b> —  <b>Direct Person-to-Person Transmission is possible.</b>

**PATHOGENS (CONTINUED)**

Name	Symptoms	Exposure Hazards	Properties
		<b>Secondary Hazards:</b> Blood Body Fluids Fecal Fomites	
Agent Index # A300 Class Index # C24  <b>Gas Gangrene</b> <i>Clostridium perfringens</i> Type: Bacteria	<p>Cutaneous: Anaerobic infection of skin lesions resulting in the production of gas within affected tissue. Foul odor and a brownish discharge are present. Skin infections are usually painless; whereas the first symptom of muscle involvement is localized pain that rapidly increases in severity. Skin at the site of the wound becomes discolored. Blisters filled with dark-red liquid may form. Symptoms progress to stupor, delirium, coma, and death.</p> <p>Ingestion: Infection produces gangrene of the small intestine.</p>	<b>Routes:</b> Ingestion Abraded Skin  <b>Secondary Hazards:</b> Bacterial Spores	<b>Incubation:</b> Cutaneous: 6 hrs to 6 days Muscle: 6 hrs to 3 days  <b>Mortality Rate:</b> High <b>Reservoir:</b> Soils  <b>Direct Person-to-Person Transmission does not occur.</b>
Agent Index # A301 Class Index # C27  <b>Glanders</b> <i>Pseudomonas mallei</i> Type: Bacteria	Symptoms include discharge of mucus and pus from the nose, ulcers in the nose and throat, and pneumonia. May produce pulmonary abscesses and fluid in the chest cavity. Illness may be either acute or chronic.	<b>Routes:</b> Inhalation Ingestion Abraded Skin Mucous Membranes  <b>Secondary Hazards:</b> Body Fluids Fomites	<b>Incubation:</b> 1 to 14 days <b>Mortality Rate:</b> High <b>Reservoir:</b> Horses, Donkeys, Mules  <b>Direct Person-to-Person Transmission does not occur.</b>

**PATHOGENS (CONTINUED)**

<b>Name</b>	<b>Symptoms</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A302 Class Index # C24  <b>Guanarito</b> <b>Hemorrhagic Fever</b> Type: Virus	Gradual onset of malaise, headache, sustained fever progressing to hemorrhagic symptoms including nose bleed, bloody vomit, and blood in stool or urine.	<b>Routes:</b> Inhalation Ingestion Abraded Skin  <b>Secondary Hazards</b> Blood Body Fluids Fomites	<b>Incubation:</b> 7 to 16 days <b>Mortality Rate:</b> ≤ 30% <b>Reservoir:</b> Rodents  <b>Direct Person-to-Person Transmission is rare.</b>
Agent Index # A303 Class Index # C24  <b>Hantaan</b> Type: Virus	Sudden onset of high fever, headache, malaise, and anorexia, progressing lower back pain often with nausea and vomiting. A sudden drop in blood pressure and hemorrhagic symptoms follows. Normal blood pressure returns and there is a dramatic drop in urine production. Recovery may be prolonged.	<b>Routes:</b> Inhalation  <b>Secondary Hazards:</b> Fecal (Rodents) Fomites from rodents	<b>Incubation:</b> 2 to 60 days <b>Mortality Rate:</b> ≤ 5% <b>Reservoir:</b> Rodents  <b>Direct Person-to-Person Transmission does not occur.</b>
Agent Index # A304 Class Index # C26  <b>Hemorrhagic Colitis</b> <i>E. coli</i> 0157:H7 Type: Bacteria	Bowel movements range from non-bloody diarrhea to stools that are almost 100% blood. There is generally no fever associated with the infection. The infective dose is extremely low.	<b>Routes:</b> Ingestion  <b>Secondary Hazards:</b> Fecal	<b>Incubation:</b> 3 to 8 days <b>Mortality Rate:</b> — <b>Reservoir:</b> Cattle, Humans  <b>Direct Person-to-Person Transmission is possible (fecal/oral).</b>

**PATHOGENS (CONTINUED)**

<b>Name</b>	<b>Symptoms</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A305 Class Index # C24  <b>Histoplasmosis</b> <i>Histoplasma capsulatum</i> Type: Fungi	Disease may take an acute or chronic form. Acute cases may be asymptomatic, mild (general malaise, fever, chills, headache, muscle and/or chest pain), or disseminated (debilitating fever, gastric symptoms, infection of the lymph system; often fatal without treatment).	<b>Routes:</b> Inhalation Ingestion Abraded Skin  <b>Secondary Hazards:</b> Fungal Spores Body Fluids Body Tissue Fomites	<b>Incubation:</b> 3 to 17 days <b>Mortality Rate:</b> ≤ 1% <b>Reservoir:</b> Soils, Guano (Birds, Bats)  <b>Direct Person-to-Person Transmission does not occur.</b>
Agent Index # A306 Class Index # C25  <b>Japanese Encephalitis</b> Type: Virus	Range from mild fever and headache to high fever, headache, stupor, tremors, coma and spastic paralysis.	<b>Routes:</b> Vector (Mosquitoes)  <b>Secondary Hazards:</b> Vector Cycle	<b>Incubation:</b> 5 to 15 days <b>Mortality Rate:</b> ≤ 60% <b>Reservoir:</b> Mosquitoes, Rodents, Birds  <b>Direct Person-to-Person Transmission does not occur.</b>
Agent Index # A307 Class Index # C24  <b>Junin Hemorrhagic Fever</b> Type: Virus	Gradual onset of malaise, headache, sustained fever progressing to hemorrhagic symptoms including nose bleed, bloody vomit, and blood in stool or urine.	<b>Routes:</b> Inhalation Ingestion Abraded Skin  <b>Secondary Hazards:</b> Blood Body Fluids Fomites	<b>Incubation:</b> 7 to 16 days <b>Mortality Rate:</b> ≤ 30% <b>Reservoir:</b> Rodents  <b>Direct Person-to-Person Transmission is rare.</b>

**PATHOGENS (CONTINUED)**

<b>Name</b>	<b>Symptoms</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A308 Class Index # C25  <b>Kyasanur Forest</b> Type: Virus	Sudden onset of chills, headache, fever, pain in lower back and limbs, severe prostration, red and inflamed eyes, diarrhea, and vomiting progressing to hemorrhage from gums, nose, GI tract and lungs. Recovery may be prolonged.	<b>Routes:</b> Vector (Ticks)  <b>Secondary Hazards:</b> Vector Cycle Fomites containing ticks	<b>Incubation:</b> 3 to 8 days <b>Mortality Rate:</b> ≤ 10% <b>Reservoir:</b> Rodents, Shrews, Monkeys  <b>Direct Person-to-Person Transmission does not occur.</b>
Agent Index # A309 Class Index # C24  <b>Lassa Fever</b> Type: Virus	Gradual onset of malaise, fever, headache, sore throat, cough, nausea, vomiting, and diarrhea with chest and abdominal pain progressing to hemorrhage and seizure. Deafness may occur.	<b>Routes:</b> Inhalation Abraded Skin Mucous Membranes  <b>Secondary Hazards:</b> Blood Body Fluids Fecal Fomites	<b>Incubation:</b> 6 to 21 days <b>Mortality Rate:</b> ≤ 15% (hospitalized) <b>Reservoir:</b> Rodents  <b>Direct Person-to-Person Transmission is possible.</b>
Agent Index # A310 Class Index # C24  <b>Legionnaire's Disease</b> <i>Legionella pneumophila</i> Type: Bacteria	Anorexia, malaise, and headache progressing to fever, chills, abdominal pain, diarrhea, and pneumonia.	<b>Routes:</b> Inhalation  <b>Secondary Hazards:</b> None	<b>Incubation:</b> 2 to 10 days <b>Mortality Rate:</b> ≤ 39% (hospitalized) <b>Reservoir:</b> Water systems  <b>Direct Person-to-Person Transmission does not occur.</b>
Agent Index # A311 Class Index # C25  <b>Louping Ill</b> Type: Virus	Range from mild fever and headache to high fever, headache, stupor, tremors, and coma. Initial phase does not appear to involve the central nervous system; however, 4 to 10 days after apparent recovery, there is a return of fever with encephalitis.	<b>Routes:</b> Ingestion Vector (Ticks)  <b>Secondary Hazards:</b> Vector Cycle Fomites containing ticks	<b>Incubation:</b> 7 to 14 days <b>Mortality Rate:</b> Low <b>Reservoir:</b> Ticks, Sheep, Deer  <b>Direct Person-to-Person Transmission does not occur.</b>

**PATHOGENS (CONTINUED)**

<b>Name</b>	<b>Symptoms</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A312 Class Index # C24  <b>Lymphocytic Choriomeningitis</b> Type: Virus	Presents marked diversity of manifestations from flu-like to meningitis. Recovery may be prolonged.	<b>Routes:</b> Inhalation Ingestion Abraded Skin  <b>Secondary Hazards:</b> Body Fluids Fecal Fomites	<b>Incubation:</b> 8 to 13 days <b>Mortality Rate:</b> Low <b>Reservoir:</b> Mice, Hamsters  <b>Direct Person-to-Person Transmission does not occur.</b>
Agent Index # A313 Class Index # C24  <b>Lyssa</b> Rabies Type: Virus	Headache, fever, and malaise progressing to excitability, fear of water, delirium, convulsions, and death.	<b>Routes:</b> Inhalation Abraded Skin Vector (Mammals)  <b>Secondary Hazards:</b> Body Fluids	<b>Incubation:</b> 21 to 56 days <b>Mortality Rate:</b> ≤ 100% <b>Reservoir:</b> Mammals  <b>Direct Person-to-Person Transmission is possible but not likely.</b>
Agent Index # A314 Class Index # C24  <b>Machupo</b> Type: Virus	Gradual onset of malaise, headache, sustained fever progressing to hemorrhagic symptoms including nose bleed, bloody vomit, and blood in stool or urine.	<b>Routes:</b> Inhalation Ingestion Abraded Skin  <b>Secondary Hazards:</b> Blood Body Fluids Fomites	<b>Incubation:</b> 7 to 16 days <b>Mortality Rate:</b> ≤ 30% <b>Reservoir:</b> Rodents  <b>Direct Person-to-Person Transmission is rare.</b>
Agent Index # A315 Class Index # C24  <b>Marburg</b> Type: Virus	Sudden onset of fever, malaise, headache and rash, progressing to vomiting, diarrhea, and hemorrhage.	<b>Routes:</b> Ingestion Abraded Skin Mucous Membranes  <b>Secondary Hazards:</b> Blood Body Fluids Fecal Fomites	<b>Incubation:</b> 3 to 9 days <b>Mortality Rate:</b> ≤ 25% <b>Reservoir:</b> —  <b>Direct Person-to-Person Transmission is possible.</b>

**PATHOGENS (CONTINUED)**

<b>Name</b>	<b>Symptoms</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A316 Class Index # C25  <b>Mediterranean Spotted Fever</b> Type: Rickettsiae	Mild to severe fever with a red rash usually on the palms of the hands and soles of the feet. There is usually a lesion at the site of the bite that may resemble a small ulcer with a black center surrounded by a red circle.	<b>Routes:</b> Vector (Ticks) Abraded Skin  <b>Secondary Hazards:</b> Fomites containing ticks	<b>Incubation:</b> 5 to 7 days <b>Mortality Rate:</b> ≤ 3% <b>Reservoir:</b> Ticks  <b>Direct Person-to-Person Transmission does not occur.</b>
Agent Index # A317 Class Index # C24  <b>Melioidosis</b> <i>Pseudomonas pseudomalle</i> Type: Bacteria	Presents a range of manifestations from asymptomatic involvement of the lungs to necrotizing pneumonia and/or fatal blood poisoning. May simulate typhoid fever or tuberculosis.	<b>Routes:</b> Inhalation Ingestion Abraded Skin  <b>Secondary Hazards:</b> Body Fluids	<b>Incubation:</b> 2 days to years <b>Mortality Rate:</b> — <b>Reservoir:</b> Soils, Water, Rodents, Farm animals  <b>Direct Person-to-Person Transmission does not occur.</b>
Agent Index # A318 Class Index # C27  <b>Monkey Pox</b> Type: Virus	Clinical symptoms closely resemble small pox and include extreme fatigue, fever, muscular and back pain, with evolution of maculas progressing successively to papules, vesicles, pustules, and scabs.	<b>Routes:</b> Inhalation Abraded Skin Mucous Membranes  <b>Secondary Hazards:</b> Aerosol Contact Body Fluids Fomites	<b>Incubation:</b> 7 to 15 days <b>Mortality Rate:</b> ≤ 15% <b>Reservoir:</b> Monkeys, Squirrels  <b>Direct Person-to-Person Transmission is possible.</b>
Agent Index # A319 Class Index # C25  <b>Murray Valley Encephalitis</b> Type: Virus	Range from mild fever and headache to high fever, headache, stupor, tremors, coma, and spastic paralysis.	<b>Routes:</b> Vector (Mosquitoes)  <b>Secondary Hazards:</b> Vector Cycle	<b>Incubation:</b> 5 to 15 days <b>Mortality Rate:</b> ≤ 60% <b>Reservoir:</b> Mosquitoes, Rodents, Birds  <b>Direct Person-to-Person Transmission does not occur.</b>

**PATHOGENS (CONTINUED)**

Name	Symptoms	Exposure Hazards	Properties
Agent Index # A320 Class Index # C27  <b>Newcastle Disease</b> <i>Paramyxovirus 1</i> Type: Virus	Symptoms include conjunctivitis with tearing and pain. May progress to a generalized illness with flu-like symptoms including elevated temperature, chills, and sore throat.	<b>Routes:</b> Inhalation Mucous Membranes  <b>Secondary Hazards:</b> Fomites from fowl	<b>Incubation:</b> 1 to 4 days <b>Mortality Rate:</b> — <b>Reservoir:</b> Birds  <b>Direct Person-to-Person Transmission does not occur.</b>
Agent Index # A321 Class Index # C25  <b>Omsk Hemorrhagic Fever</b> Type: Virus	Sudden onset of chills, headache, fever, pain in lower back and limbs, severe prostration, red and inflamed eyes, diarrhea, and vomiting progressing to hemorrhage from gums, nose, GI tract, and lungs. Recovery may be prolonged.	<b>Routes:</b> Vector (Ticks)  <b>Secondary Hazards:</b> Vector Cycle Fomites containing ticks	<b>Incubation:</b> 3 to 8 days <b>Mortality Rate:</b> ≤ 10% <b>Reservoir:</b> Rodents, Ticks  <b>Direct Person-to-Person Transmission does not occur.</b>
Agent Index # A322 Class Index # C25  <b>O'nyong-nyong</b> Type: Virus	Arthritis in wrist, knee, ankle and small joints of extremities. A rash may develop in 1 to 10 days. May present hemorrhagic symptoms. Recovery may be prolonged.	<b>Routes:</b> Vector (Mosquitoes)  <b>Secondary Hazards:</b> Vector Cycle	<b>Incubation:</b> 3 to 11 days <b>Mortality Rate:</b> 0% <b>Reservoir:</b> —  <b>Direct Person-to-Person Transmission does not occur.</b>
Agent Index # A323 Class Index # C25  <b>Oropouche Virus Disease</b> Type: Virus	Initial symptoms include fever, headache, malaise, joint and/or muscle pain, inflammation of the eyes with an intolerance to light. There may also be occasional nausea and vomiting. May progress to inflammation of the meninges and/or the brain.	<b>Routes:</b> Vector (Mosquitoes)  <b>Secondary Hazards:</b> Vector Cycle	<b>Incubation:</b> 3 to 21 days <b>Mortality Rate:</b> ≤ 1% <b>Reservoir:</b> Mosquito  <b>Direct Person-to-Person Transmission does not occur.</b>

**PATHOGENS (CONTINUED)**

<b>Name</b>	<b>Symptoms</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A324 Class Index # C25  <b>Plague</b> <i>Yersinia pestis</i> Type: Bacteria	Initial signs and symptoms may be nonspecific and include fever, chills, malaise, muscle pain, nausea, sore throat, and headache. In bubonic plague, the lymph system becomes impacted with swelling and tenderness in nodes near the site of the bite. Fluid from the swollen node (bubo) is infectious. If the lungs become infected, pneumonia may develop. Respiratory involvement poses significant hazard of person-to-person transmission through aerosol generated by coughing.	<b>Routes:</b> Inhalation Abraded Skin Vector (Fleas)  <b>Secondary Hazards:</b> Body Fluids Vector Cycle Fomites containing fleas	<b>Incubation:</b> 1 to 7 days  <b>Mortality Rate:</b> Bubonic: ≤ 60% Pneumonic: ≤ 100%  <b>Reservoir:</b> Rodents  <b>Direct Person-to-Person Transmission is possible.</b>
Agent Index # A325 Class Index # C25  <b>Powassan Encephalitis</b> Type: Virus	Range from mild fever and headache to high fever, headache, stupor, tremors, and coma. Initial phase does not appear to involve the central nervous system; however, 4 to 10 days after apparent recovery, there is a return of fever with encephalitis.	<b>Routes:</b> Ingestion Vector (Ticks)  <b>Secondary Hazards:</b> Vector Cycle Fomites containing ticks	<b>Incubation:</b> 7 to 14 days  <b>Mortality Rate:</b> ≤ 10%  <b>Reservoir:</b> Ticks, Rodents, Birds  <b>Direct Person-to-Person Transmission does not occur.</b>
Agent Index # A326 Class Index # C27  <b>Psittacosis</b> <i>Chlamydia psittaci</i> Type: Bacteria	Variable symptoms including fever, headache, rash, chills, and/or upper or lower respiratory infection. Disease is usually mild or moderate but can be severe, especially in the untreated elderly.	<b>Routes:</b> Inhalation  <b>Secondary Hazards:</b> Body Fluids	<b>Incubation:</b> 7 to 28 days  <b>Mortality Rate:</b> —  <b>Reservoir:</b> Birds  <b>Direct Person-to-Person Transmission is rare.</b>

**PATHOGENS (CONTINUED)**

<b>Name</b>	<b>Symptoms</b>	<b>Exposure Hazards</b>	<b>Properties</b>
<p>Agent Index # A327 Class Index # C24</p> <p><b>Q Fever</b> <i>Coxiella burnetii</i> Type: Rickettsiae</p>	<p>Variable symptoms ranging from inapparent or nonspecific to severe. Initial acute symptoms include sudden onset of fever, chills, severe sweating, headache, weakness, and malaise. May progress to pneumonia or infection of the heart.</p>	<p><b>Routes:</b> Inhalation</p> <p><b>Secondary Hazards:</b> Body Fluids Fecal Fomites</p>	<p><b>Incubation:</b> 14 to 21 days</p> <p><b>Mortality Rate:</b> ≤ 2%</p> <p><b>Reservoir:</b> Sheep, Cattle, Cats, Dogs, Rodents, Birds, Ticks</p> <p><b>Direct Person-to-Person Transmission is rare.</b></p>
<p>Agent Index # A328 Class Index # C25</p> <p><b>Relapsing Fever</b> <i>Borrelia recurrentis</i> Type: Bacteria</p>	<p>Periods of fever (lasting 2 to 9 days) followed by periods without fever (lasting 2 to 4 days). The number of cycles varies from 1 to 10.</p>	<p><b>Routes:</b> Vector (Lice, Ticks)</p> <p><b>Secondary Hazards:</b> Vector Cycle (Lice) Fomites containing vectors</p>	<p><b>Incubation:</b> 5 to 15 days</p> <p><b>Mortality Rate:</b> ≤ 10%</p> <p><b>Reservoir:</b> Humans, Ticks</p> <p><b>Direct Person-to-Person Transmission does not occur.</b></p>
<p>Agent Index # A329 Class Index # C25</p> <p><b>Rift Valley Fever</b> Type: Virus</p>	<p>Initial symptoms include fever, headache, malaise, joint and/or muscle pain, inflammation of the eyes with an intolerance to light. There may also be occasional nausea and vomiting. May progress to hemorrhagic complications or encephalitis.</p>	<p><b>Routes:</b> Inhalation Mucos-membranes Vector (Mosquitoes)</p> <p><b>Secondary Hazards:</b> Blood Vector Cycle Vector (mechanical)</p>	<p><b>Incubation:</b> 3 to 12 days</p> <p><b>Mortality Rate:</b> ≤ 1%</p> <p><b>Reservoir:</b> Mosquito</p> <p><b>Direct Person-to-Person Transmission does not occur.</b></p>
<p>Agent Index # A330 Class Index # C25</p> <p><b>Rocio Encephalitis</b> Type: Virus</p>	<p>Range from mild fever and headache to high fever, headache, stupor, tremors, coma, and spastic paralysis.</p>	<p><b>Routes:</b> Vector (Mosquitoes)</p> <p><b>Secondary Hazards</b> Vector Cycle</p>	<p><b>Incubation:</b> 5 to 15 days</p> <p><b>Mortality Rate:</b> ≤ 60%</p> <p><b>Reservoir:</b> Mosquitoes, Rodents, Birds</p> <p><b>Direct Person-to-Person Transmission does not occur.</b></p>

**PATHOGENS (CONTINUED)**

<b>Name</b>	<b>Symptoms</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A331 Class Index # C25  <b>Rocky Mountain Spotted Fever</b> <i>Rickettsia rickettsii</i> Type: Rickettsiae	Sudden onset of moderate to high fever, malaise, deep muscular pain, severe headache, chills, and bloodshot eyes. A rash appears on the third day in approximately half of all cases and may progress to hemorrhage.	<b>Routes:</b> Abraded Skin Vector (Ticks)  <b>Secondary Hazards:</b> None	<b>Incubation:</b> 3 to 14 days <b>Mortality Rate:</b> ≤ 20% <b>Reservoir:</b> Ticks  <b>Direct Person-to-Person Transmission does not occur.</b>
Agent Index # A332 Class Index # C25  <b>Russian Spring-Summer Encephalitis</b> Type: Virus	Symptoms range from mild fever and headache to high fever, headache, stupor, tremors, coma, focal epilepsy, and flaccid paralysis (especially in the shoulders).	<b>Routes:</b> Ingestion Vector (Ticks)  <b>Secondary Hazards:</b> Vector Cycle Fomites containing ticks	<b>Incubation:</b> 7 to 14 days <b>Mortality Rate:</b> 40% <b>Reservoir:</b> Ticks, Rodents, Birds  <b>Direct Person-to-Person Transmission does not occur.</b>
Agent Index # A333 Class Index # C24  <b>Sabia Hemorrhagic Fever</b> Type: Virus	Gradual onset of malaise, headache, sustained fever progressing to hemorrhagic symptoms including nose bleed, bloody vomit, and blood in stool or urine.	<b>Routes:</b> Inhalation Ingestion Abraded Skin  <b>Secondary Hazards:</b> Blood Body Fluids Fomites	<b>Incubation:</b> 7 to 16 days <b>Mortality Rate:</b> ≤ 30% <b>Reservoir:</b> Rodents  <b>Direct Person-to-Person Transmission is rare.</b>
Agent Index # A334 Class Index # C26  <b>Shigellosis</b> <i>Shigella dysenteriae</i> Type: Bacteria	Symptoms begin with fever and abdominal pains followed by diarrhea, vomiting, and dehydration. In serious cases, stool may contain blood, mucus, and pus. May progress to toxemia. Infection requires very few organisms.	<b>Routes:</b> Ingestion  <b>Secondary Hazards:</b> Fecal Fomites Mechanical Vector (Flies)	<b>Incubation:</b> 1 to 7 days <b>Mortality Rate:</b> ≤ 20% <b>Reservoir:</b> Humans  <b>Direct Person-to-Person Transmission is possible (fecal/oral).</b>

**PATHOGENS (CONTINUED)**

<b>Name</b>	<b>Symptoms</b>	<b>Exposure Hazards</b>	<b>Properties</b>
<p>Agent Index # A335 Class Index # C24</p> <p><b>Sin Nombre</b> Type: Virus</p>	<p>Initial symptoms include fever, muscular pain, and nausea followed by an abrupt onset of respiratory distress with low blood pressure. This progresses rapidly to severe respiratory failure and shock.</p>	<p><b>Routes:</b> Inhalation</p> <p><b>Secondary Hazards:</b> Body Fluids (Mouse) Fecal (Mouse) Fomites from mice</p>	<p><b>Incubation:</b> 2 to 42 days <b>Mortality Rate:</b> ≤ 50% <b>Reservoir:</b> Mice</p> <p><b>Direct Person-to-Person Transmission is does not occur.</b></p>
<p>Agent Index # A336 Class Index # C24</p> <p><b>Smallpox</b> Type: Virus</p>	<p>Initial symptoms are flu-like including headache, chills, high fever (106° to 107°F), and aches in back and limbs. An Initial macular rash appears progressing to papules, and then blisters. The blisters in turn form crusts. The blisters and crusts cause severe itching.</p>	<p><b>Routes:</b> Inhalation Abraded Skin Mucous Membranes</p> <p><b>Secondary Hazards:</b> Aerosol Contact Body Fluids Fomites</p>	<p><b>Incubation:</b> 7 to 16 days <b>Mortality Rate:</b> ≤ 35% <b>Reservoir:</b> Humans</p> <p><b>Direct Person-to-Person Transmission is possible.</b></p>
<p>Agent Index # A337 Class Index # C25</p> <p><b>St. Louis Encephalitis</b> Type: Virus</p>	<p>Range from mild fever and headache to high fever, headache, stupor, tremors, coma, and spastic paralysis.</p>	<p><b>Routes:</b> Vector (Mosquitoes)</p> <p><b>Secondary Hazards:</b> Vector Cycle</p>	<p><b>Incubation:</b> 5 to 15 days <b>Mortality Rate:</b> ≤ 60% <b>Reservoir:</b> Mosquitoes, Rodents, Birds</p> <p><b>Direct Person-to-Person Transmission does not occur.</b></p>
<p>Agent Index # A338 Class Index # C25</p> <p><b>Trench Fever</b> <i>Rickettsia quintana</i> Type: Rickettsiae</p>	<p>Initial onset may be either sudden or slow. Symptoms include fever with pain and soreness in muscles, bones, and joints. Shins are especially painful and tender. May produce a transient macular rash. Symptoms may continue to reappear years after the primary infection.</p>	<p><b>Routes:</b> Vector (Lice)</p> <p><b>Secondary Hazards:</b> Vector Cycle Fomites containing lice</p>	<p><b>Incubation:</b> 7 to 30 days <b>Mortality Rate:</b> 0% <b>Reservoir:</b> Humans</p> <p><b>Direct Person-to-Person Transmission does not occur.</b></p>

**PATHOGENS (CONTINUED)**

<b>Name</b>	<b>Symptoms</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A339 Class Index # C25  <b>Tularemia</b> <i>Francisella tularensis</i> Type: Bacteria	Bites: Early symptoms include ulceration at the location of the bite with swelling of the regional lymph node.  Ingestion: Throat and abdominal pain with diarrhea, and vomiting.  Inhalation: Pneumonia and increased fatality rates in untreated individuals.	<b>Routes:</b> Inhalation Ingestion Abraded Skin Mucous Membranes Vector (Ticks, Mosquitoes, Biting Flies)  <b>Secondary Hazards:</b> Body Fluids/Tissues Fomites containing ticks	<b>Incubation:</b> 1 to 14 days <b>Mortality Rate:</b> ≤ 15% <b>Reservoir:</b> Rabbits, Muskrats, Ticks  <b>Direct Person-to-Person Transmission does not occur.</b>
Agent Index # A340 Class Index # C26  <b>Typhoid Feve</b> <i>Salmonella typhi</i> Type: Bacteria	Insidious onset of sustained fever, severe headache, malaise, loss of appetite, and usually constipation (although it may cause diarrhea). Individuals may become asymptomatic carriers capable of spreading the disease (e.g. Typhoid Mary).	<b>Routes:</b> Ingestion  <b>Secondary Hazards</b> Fecal Vector (mechanical)	<b>Incubation:</b> 3 to 90 days <b>Mortality Rate:</b> ≤ 10% <b>Reservoir:</b> Humans  <b>Direct Person-to-Person Transmission is possible (fecal/oral).</b>
Agent Index # A341 Class Index # C25  <b>Typhus, Endemic</b> <i>Rickettsia mooseri</i> Type: Rickettsiae	Sudden onset of headache, chills, prostration, fever and general pains with a macular rash.	<b>Routes:</b> Inhalation Abraded Skin Vector (Fleas)  <b>Secondary Hazards:</b> Vector Cycle Fomites containing fleas	<b>Incubation:</b> 7 to 14 days <b>Mortality Rate:</b> ≤ 1% <b>Reservoir:</b> Rats, Mice  <b>Direct Person-to-Person Transmission does not occur.</b>

**PATHOGENS (CONTINUED)**

<b>Name</b>	<b>Symptoms</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A342 Class Index # C25  <b>Typhus, Epidemic</b> <i>Rickettsia prowazeki</i> Type: Rickettsiae	Sudden onset of headache, chills, prostration, fever, and general pains with a macular rash. Disease may reappear years after initial attack and without involvement of lice.	<b>Routes:</b> Inhalation Abraded Skin Vector (Lice)  <b>Secondary Hazards:</b> Vector Cycle Fomites containing lice	<b>Incubation:</b> 7 to 14 days <b>Mortality Rate:</b> ≤ 40% <b>Reservoir:</b> Humans, Flying Squirrels  <b>Direct Person-to-Person Transmission does not occur.</b>
Agent Index # A343 Class Index # C25  <b>Typhus, Scrub</b> <i>Rickettsia tsutsugamushi</i> Type: Rickettsiae	Sudden onset of headache, chills, profuse sweating, prostration, fever, and general pains with a dull red to dark purple rash. Rash appears first on the trunk then spreads to the arms and legs. Pulmonary, encephalitic, and/or cardiac complications can occur. Recovery is prolonged.	<b>Routes:</b> Vector (Mites) <b>Secondary Hazards:</b> Vector Cycle Fomites containing mites	<b>Incubation:</b> 6 to 21 days <b>Mortality Rate:</b> ≤ 30% <b>Reservoir:</b> Mites  <b>Direct Person-to-Person Transmission does not occur.</b>
Agent Index # A344 Class Index # C25  <b>Venezuelan Equine Encephalitis</b> Type: Virus	Initial symptoms are flu-like with abrupt onset of severe headache, chills, fever, pain behind the eyes, nausea, and vomiting. Fever may be diphasic. CNS symptoms range from drowsiness to disorientation, convulsions, paralysis, coma, and death.	<b>Routes</b> Inhalation Vector (Mosquitoes)  <b>Secondary Hazards:</b> Vector Cycle Blood Body Fluids	<b>Incubation:</b> 1 to 6 days <b>Mortality Rate:</b> ≤ 1% <b>Reservoir:</b> Rodents, Horses  <b>Direct Person-to-Person Transmission is possible.</b>

**PATHOGENS (CONTINUED)**

<b>Name</b>	<b>Symptoms</b>	<b>Exposure Hazards</b>	<b>Properties</b>
Agent Index # A345 Class Index # C25 <b>Vesicular Stomatitis Fever</b> Type: Virus	Produces flu-like symptoms including headache, fever, eye pain, malaise, nausea, vomiting, diarrhea, sore throat as well as pain in the limbs and back. Blisters and/or lesions may appear in the mouth, throat, and occasionally on the hands. Illness may produce a prolonged mental depression.	<b>Routes:</b> Vector (Sandflies, Midges)  <b>Secondary Hazards:</b> Vector Cycle	<b>Incubation:</b> 3 to 6 days <b>Mortality Rate:</b> ≤ 1% <b>Reservoir:</b> Suspected to be Sandfly, Rodents, Non-human Primates  <b>Direct Person-to-Person Transmission is does not occur.</b>
Agent Index # A346 Class Index # C25 <b>Western Equine Encephalitis</b> Type: Virus	Range from mild fever and headache to high fever, headache, stupor, tremors, coma, and spastic paralysis.	<b>Routes:</b> Vector (Mosquitoes)  <b>Secondary Hazards:</b> Vector Cycle	<b>Incubation:</b> 5 to 15 days <b>Mortality Rate:</b> ≤ 14% <b>Reservoir:</b> Mosquitoes, Rodents, Birds  <b>Direct Person-to-Person Transmission does not occur.</b>
Agent Index # A347 Class Index # C25 <b>Yellow Fever</b> Type: Virus	Symptoms are of short duration and varying severity. Characterized by sudden onset of fever, chills, headache, backache, generalized muscle pain, prostration, nausea, vomiting, and jaundice. May progress to hemorrhage of the nose and gums, and there may be blood in the stool.	<b>Routes:</b> Vector (Mosquitoes)  <b>Secondary Hazards</b> Vector Cycle Blood Body Fluids	<b>Incubation:</b> 3 to 6 days <b>Mortality Rate:</b> ≤ 50% <b>Reservoir:</b> Humans, Mosquitoes, Vertebrates  <b>Direct Person-to-Person Transmission does not occur.</b>

**PATHOGENS (CONTINUED)**

Name	Symptoms	Exposure Hazards	Properties
Agent Index # A348 Class Index # C26	Symptoms include pain in the lower-right abdominal area	<b>Routes:</b> Ingestion	<b>Incubation:</b> 3 to 10 days
<b>Yersiniosis</b> <i>Yersinia pseudotuberculosis</i> Type: Bacteria	resembling appendicitis, as well as fever, vomiting, and possibly diarrhea. May also produce arthritis. Infection may become systemic. Carriers may be asymptomatic.	<b>Secondary Hazards:</b> Fecal Fomites	<b>Mortality Rate:</b> Low <b>Reservoir:</b> Birds, Rodents, Small Mammals  <b>Direct Person-to-Person Transmission is rare (fecal/oral).</b>

# **Section III**

# **Class Indices**

# 3

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## *Class Indices*

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### **Class Index C00 Unknown Agent(s)**

#### **Toxicology**

##### ***Effects:***

Agents can produce both local and systemic effects. Assume that exposure to solids, liquids, or vapors from agents is hazardous and will potentially cause death within minutes after exposure. However, effects from some agents do not appear for up to 24 hours after exposure. Lack of immediate symptoms should not be taken as evidence that individuals have not been exposed. Some agents are carcinogenic.

##### ***Pathways:***

Agents are potentially hazardous through inhalation, skin and eye exposure, ingestion, and abraded skin (e.g., breaks in the skin or penetration of skin by debris).

#### **Characteristics**

##### ***Physical Appearance/Odor:***

Agents can be solids, liquids, or gases. Agents may be colorless when pure but yellow to brown to black depending on impurities. Liquid agents have a consistency ranging from near that of water up to that of motor oil. Most agents have poor warning properties. If the properties of these agents do give an indication of their presence, then they are usually only detected at levels much greater than is considered safe. Furthermore, any potential warning property, as well as any distinguishing physical characteristic such as color, may not be apparent because multiple agents have been employed or the materials released may be impure.

<b><i>Odor</i></b>	<b><i>Potential Class of Agent</i></b>
Pepper-like odor	Halogenated tear agents (C17) Tear agents in solvents (C19)
Garlic-like odor	Sulfur mustard agents (C07) Mixed sulfur/arsenical mustard agents (C10) Arsenical blood agents (C13) Vomiting agents (C20)
Fishy odor	Nitrogen mustard agents (C09)
“Musty” odor	Nitrogen mustard agents (C09)
“Sweetish” odor	Non-halogenated tear agents (C18) Tear agents in solvents (C19)
“Soft-soap” like odor	Nitrogen mustard agents (C09)
Horseradish-like odor	Sulfur mustard agents (C07) Mixed sulfur/arsenical mustard agents (C10)
Odor of bitter almonds or peach kernels	G-series nerve agents (C01) General blood agents (C12) Vomiting agents (C20)
Odor of sour or rotten fruit	Non-halogenated tear agents (C18)
Odor of new mown hay or freshly cut grass	Choking agents (C14)
Fruity or floral odors	G-series nerve agents (C01) Arsenical mustard agents (C08) Halogenated tear agents (C17) Tear agents in solvents (C19)
Biting or irritating odors	Arsenical mustard agents (C08) General blood agents (C12) Choking agents (C14) Tear Agents (C17 - C19) Vomiting agents (C20)

***Persistence:***

Agents can be either persistent or nonpersistent. Persistence of agents released in enclosed spaces (e.g., inside buildings) is dramatically increased.

***Environmental Fate:***

Vapors from most agents have a density greater than air and tend to collect in low places. Many agents are absorbed into porous material, including painted surfaces. These materials could continue to re-release vapor after exposure has ceased. Most agents have minimal solubility in water.

**Additional Hazards*****Fire:***

Agents may be volatilized during a fire or be spread by efforts to extinguish the fire. Agents may be decomposed by heat to produce other toxic and/or corrosive gases. In addition, agents may react with steam or water during a fire to produce toxic and/or corrosive vapors. Hydrogen produced by the action of the corrosive vapors on metals or other corrodible materials may be present.

**Protection*****Evacuation (See Specific Agent in Agent Index):***

Immediately isolate an area around any liquid or solid contamination for at least 700 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index, Chapter 2). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized, persistence of the agent and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible. Depending on the persistence of the agent and the potential for condensation of agent from the cloud, evacuation of the threatened population after passage of the initial cloud may be appropriate.

***Field Detection/Identification (See Detector Characteristics in Section IV, General Section):******Military***

CAM:                   Semi-quantitative identification of nerve agents (C01 - C05) and most blister agents (C07, C09, C10)

M256A1 Kit: Qualitative identification of nerve agents (C01 - C05), blister agents (C07, C08, C10, C11), and general blood agents (C12)

Rapid diagnostic assays for detection of biological agents are available for Anthrax; Crimean-Congo Hemorrhagic Fever; Dengue (DF, DHF, DSS); Mediterranean Spotted Fever; Q Fever; Plague; Relapsing Fever; Rift Valley Fever; Sandfly Fever, Naples; Sandfly Fever, Sicilian; Sindbis Fever; Tularemia; Typhus, Murine (Endemic); and West Nile Fever/Encephalitis.

Rapid diagnostic assays for detection of toxin agents are available for Botulinum Toxin; Clostridium Perfringens Toxin; Staphylococcal Enterotoxin B; and Staphylococcal Enterotoxins A/C1,2,3/D

### *Civilian*

APD 2000: Semi-quantitative identification of nerve agents (C01 - C05), most blister agents (C07 - C10), and limited tear agents (pepper spray and mace)

Photo Ionization Detectors: General surveys of organic agent vapors other than phosgene and the cyanide agents. However, because these systems will not differentiate between hazardous materials and any other ionizable chemical vapor, interpretation of the screening results is necessary.

Flame Ionization Detectors: General surveys of organic agent vapors. However, because these systems will not differentiate between hazardous materials and any other ionizable chemical vapor, interpretation of the screening results is necessary.

Colorimetric Tubes: Many of these tubes have cross sensitivities and care must be taken to correctly interpret the results.

Phosphoric Acid esters:	Nerve agents (C01 - C05)
Thioethers:	Sulfur blister agents (C07, C10)
Organic Basic Nitrogen Compounds:	Nitrogen blister agents (C09), V and GV-series nerve agents (C02, C03)
Organic Arsenic Compounds:	Arsenical blister agents (C08, C10), arsenical blood agents (C13) and vomiting agents (C20)
Hydrogen Cyanide:	Specific to this blood agent (C12)
Cyanogen Chloride:	Specific to this blood agent (C12)
Phosgene:	Some choking agents (C14)
Chloroformates:	Some choking agents (C14)



Involuntary twitching, jerking, or trembling	Blood agents (C12 – C13) Incapacitating agents (C16) Nerve agents (C01 – C06) Blood agents (C12 – C13) Incapacitating agents (C16)
Convulsions	Nerve agents (C01 – C06) Blood agents (C12 – C13) Choking agents (C14 – C15)
Reddening of lips or skin	Blister agents (C07 – C11) Blood agents (C12 – C13) Incapacitating agents (C16)
Gray area of dead skin that does not blister	Blister agents (C08, C10)
Sunburn like appearance (erythema) of exposed skin	Blister agents (C07 – C11) Toxins posing a dermal hazard (C23)
Pain, burning sensation or stinging of eyes or skin	Blister agents (C07 – C11) Choking agents (C14) Tear Agents (C17 – C19) Toxins posing a dermal hazard (C23)
Pinpointing of pupils (miosis)	Nerve agents (C01 – C06) Incapacitating agents (C16)
Enlargement of pupils (dilation)	Incapacitating agents (C16)
Inability to open the eyes	Blister agents (C07 – C11) Tear Agents (C17 – C19)
Tearing (lacrymation)	Blister agents (C07 – C11) Blood agents (C12) Choking agents (C14) Tear Agents (C17 – C19) Toxins posing a dermal hazard (C23)
Severe coughing or sneezing	Blister agents (C07 – C11) Blood agents (C12) Choking agents (C14) Vomiting agents (C20) Toxins (C22 – C23)
Nosebleed (epistaxis)	Blister agents (C07 – C11) Blood agents (C12) Choking agents (C14) Vomiting agents (C20) Toxins posing a dermal hazard (C23)
Severe runny nose (rhinorrhea)	Nerve agents (C01 – C06) Blister agents (C07 – C11) Vomiting agents (C20) Toxins (C22 – C23)
Difficulty breathing, shortness of breath	Nerve agents (C01 – C06) Blister agents (C07 – C11)

Extremely dry mouth or throat	Choking agents (C14 – C15)
Severe headache	Vomiting agents (C20)
	Incapacitating agents (C16)
	Nerve agents (C01 – C06)
	Blood agents (C12 – C13)
	Choking agents (C14 – C15)
	Vomiting agents (C20)
	Incapacitating agents (C16)
Involuntary defecation and urination	Nerve agents (C01 – C06)
Nausea	Blister agents (C08, C10)
	Blood agents (C12 – C13)
	Choking agents (C14 – C15)
	Vomiting agents (C20)
	Incapacitating agents (C16)
	Toxins (C22 – C23)
Vomiting	Nerve agents (C01 – C06)
	Blister agents (C08, C10)
	Blood agents (C12 – C13)
	Choking agents (C14 – C15)
	Vomiting agents (C20)
	Incapacitating agents (C16)
Localized sweating	Nerve agents (C01 – C06)
Excessive sweating	Nerve agents (C01 – C06)
Inability to sweat	Incapacitating agents (C16)

***Patient Management:***

Refer to appropriate Class Index based on Field Detection/Identification or casualty Signs & Symptoms

***Fatality Management:***

Refer to appropriate Class Index based on Field Detection/Identification or casualty Signs & Symptoms

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## Class Index C01

### Nerve Agents – “G” Series

#### General Chemical Structure

R-P(O)(X)-OR' or R<sub>2</sub>N-P(O)(CN)-OR' or R-P(S)(X)-OR'

#### Toxicology

##### **Effects:**

Nerve Agents are the most toxic of the known chemical agents. Liquids or vapors from these agents are hazardous and can cause death within minutes after exposure. Nerve Agents disrupt the function of the nervous system by interfering with the enzyme acetylcholinesterase. The major effects will be on skeletal muscles, certain organs, and the central nervous system. These compounds are similar to, but much more deadly than, agricultural organophosphate pesticides.

##### **Pathways:**

“G” series Nerve Agents are hazardous through inhalation, skin and eye exposure, ingestion, and abraded skin (e.g., breaks in the skin or penetration of skin by debris).

##### **Exposure Hazards (See Specific Agent in Agent Index):**

LC<sub>50s</sub> for inhalation of “G” series Nerve Agents are as low as 1 ppm (10 minute exposure).

LD<sub>50s</sub> for skin exposure to liquid “G” series Nerve Agents are as low as 0.3 gm per individual.

**The rate of detoxification of these agents by the body is very low and exposures are essentially cumulative.**

##### **Latency Period:**

Vapor: Effects from vapor exposure begin to appear 30 seconds to 2 minutes after exposure.

Liquid: There is almost always a latent period with no visible effects between the time of exposure and the onset of symptoms. Effects from liquid exposure begin to appear from several minutes up to 18 hours after exposure. Onset

of symptoms from exposure to large amounts of liquid agent may appear as rapidly as 1 minute after exposure. Generally, the more rapid the onset of symptoms, the larger the amount of agent involved in the exposure.

## **Characteristics**

### ***Physical Appearance/Odor:***

“G” series Nerve Agents are colorless to brownish liquids with a consistency ranging from near that of water up to that of light machine oil. These agents have little or no odor when pure. Agents can be thickened with various substances to increase persistency and percutaneous hazard. When thickened, agents have a consistency similar to honey. Conversely, various solvents can be added to dilute the agents. Solvents may also dramatically increase the rate that agents penetrate the skin.

### ***Persistency:***

Unthickened “G” series Nerve Agents can be either non-persistent or persistent depending on the specific agent as well as weather conditions. Evaporation rates range from near that of water up to that of light machine oil. Thickened agents last significantly longer.

### ***Environmental Fate:***

“G” series Nerve Agent vapors have a density greater than air and tend to collect in low places. Nerve Agents are absorbed into porous material, including painted surfaces, and these materials could continue to re-release vapor after exposure has ceased. Clothing may re-release agent for up to 30 minutes after contact with vapor. Solubility in water ranges from completely soluble to almost insoluble. The liquid densities of these agents are slightly greater than that of water.

## **Additional Hazards**

**Exposure of skin to various solvents (e.g., acetone, alcohols, ethers, gasoline) prior to exposure to nerve agents may increase the percutaneous hazard and decreases survival time associated with agent exposure.**

### ***Fire:***

“G” series Nerve Agents may be volatilized during a fire or be spread by efforts to extinguish the fire. Agents may be decomposed by heat to produce other toxic and/or corrosive gases. In addition, “G” series Nerve Agents may react with steam or water during a fire to produce toxic and/or corrosive

vapors. Hydrogen produced by the action of the corrosive vapors on metals or other corrodible materials may be present.

**Reactivity:**

Most of the "G" series Nerve Agents decompose slowly in water. Raising the pH increases the rate of decomposition significantly. Reaction with dry bleach may produce toxic gases.

**Hazardous Decomposition Products:**

- Hydrolysis: Most "G" series Nerve Agents produce hydrogen fluoride (HF) when hydrolyzed. Some may produce hydrogen cyanide (HCN) or hydrogen chloride (HCl).
- Combustion: Volatile "G" series Nerve Agents decomposition products may include hydrogen fluoride (HF), hydrogen chloride (HCl), hydrogen cyanide (HCN), sulfur oxides (SO<sub>x</sub>), phosphorous oxides (PO<sub>x</sub>) as well as potentially toxic organo-phosphates. In addition, toxic phosphate residue may remain.

**Protection**

**Evacuation (See Specific Agent in Agent Index):**

Immediately isolate an area around any liquid or solid contamination for at least 700 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized, persistence of the agent and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible. Depending on the persistence of the agent and the potential for condensation of agent from the cloud, evacuation of the threatened population after passage of the initial cloud may be appropriate.

**Field Detection/Identification (See Detector Characteristics in General Section):**

- Military: *Vapor:* "G" series Nerve Agents can be detected by the M8A1 Alarm, M256A1 Kit, CAM, and by the MM-1 in the FOX NBC Reconnaissance System.
- Liquids:* "G" series Nerve Agents can be detected by M8 and M9 papers, the MM-1 in the FOX NBC Reconnaissance System, and in water by the M272 Kit.

Civilian: The ADP 2000 provides semi-quantitative identification of nerve agents. Colorimetric tubes are available which are designed to qualitatively detect vapors of phosphoric acid esters as well as the decomposition products hydrogen fluoride (HF), hydrogen chloride (HCl) and hydrogen cyanide (HCN). Detection of agents with PIDs or FIDs may be possible. Detection and identification with FT-IR is possible provided that the appropriate reference spectra are available.

**Personal Protective Requirements (See PPE in General Section):**

“G” series Nerve Agents pose both a severe respiratory and severe contact hazard. Wear appropriate fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). Structural firefighters’ protective clothing is recommended for fire situations only; it is not effective in spill or release events. Thickened agents pose a less significant vapor hazard but a much more significant contact hazard.

**Decontamination:**

Vapor: *Casualties/personnel:* Skin decontamination may not be necessary after exposure to vapor alone. If decontamination is deemed appropriate, wash the entire potentially exposed area with a bleach solution avoiding contact with sensitive areas such as the eyes. The bleach solution should be no less than one part household bleach in nine parts water. Rinse with copious amounts of water. In all cases, clothing should be removed because it may contain “trapped” vapor.

*Small Areas:* Ventilation. In heavily contaminated areas, decontamination with copious amounts of aqueous sodium hydroxide solution (a minimum of 10 percent by weight) may be required. If sodium hydroxide solution is not available, then sodium carbonate may be used. Removal of porous material, including painted surfaces, that may have absorbed Nerve Agent vapor may be required as these materials could continue to re-release vapor after exposure has ceased.

Liquid: *Casualties/personnel:* Remove contaminated clothing immediately. Remove as much of the agent from the skin as fast as possible. Minimize spreading the agent during this process. Wash the entire potentially exposed area with a bleach solution avoiding contact with sensitive areas such as the eyes. The bleach solution should be no less than one

part household bleach in nine parts water. Rinse with copious amounts of water. In all cases, clothing should be removed because it may contain “trapped” liquid or vapor. *Small Areas:* Puddles of liquid must be contained by covering with vermiculite, diatomaceous earth, clay, fine sand, sponges, or towels. Place the absorbed material into containers with a high-density polyethylene liner. Decontaminate the area with copious amounts of aqueous sodium hydroxide solution (a minimum of 10 percent by weight). If sodium hydroxide solution is not available, then sodium carbonate may be used. Removal of porous material, including painted surfaces, that may have absorbed Nerve Agent liquid may be required as these materials could continue to re-release liquid and/or vapor after exposure has ceased.

## **First Aid**

### ***Signs & Symptoms:***

Vapor: Miosis (pin-pointing of pupils) and rhinorrhea (runny nose) may be the first indications of exposure to nerve agent vapor. Miosis is indicative of vapor exposure unless liquid agent has been in contact with the eyes. Difficulty breathing (shortness of breath or tightness of the chest) may also be present. Inhalation of lethal amounts of vapor can cause loss of consciousness and convulsions within 30 seconds to 2 minutes of exposure, followed by cessation of breathing and flaccid paralysis after several more minutes.

Liquid: Localized sweating, nausea, vomiting, involuntary urination/defecation, and a feeling of weakness are signs of small to moderate Nerve Agent exposure. Involvement of the gastrointestinal tract (i.e., vomiting, urination, or defecation) is generally indicative of liquid agent exposure. Large exposures cause copious secretions, loss of consciousness, convulsions progressing into flaccid paralysis, and cessation of breathing.

### ***Patient Management:***

Decontaminate casualty insuring that all agent has been removed. Ventilate patient (there maybe an increase in airway resistance due to constriction of the airway and the presence of secretions). If breathing is difficult, administer oxygen. Administer antidotes as soon as possible.

***Antidotes:***

Atropine alone or in combination with pralidoxime chloride (2-PAMCl) or other oxime. Diazepam may be required to control severe convulsions.

***Fatality Management:***

Remove all clothing; decontaminate with straight household bleach then incinerate at an appropriate facility. Wash cadaver with a bleach solution insuring the solution is introduced into the ears, nostrils, mouth, and any wounds. Pay particular attention to hair, scalp, pubic areas, fingernails and folds of skin where agent may get trapped. The solution should be no less than one part household bleach in one part water. Solution may be buffered with sodium bisulfate to a neutral pH in order to minimize the corrosive impacts on the cadaver. The bleach solution should remain in contact with the cadaver for a minimum of 5 minutes. Wash with soap and water. Cadaver should be screened for volatile agents. Agents that have been absorbed into the cadaver pose minimal secondary risk; however, it is prudent to perform air monitoring during all examinations. **Latex gloves do not offer sufficient protection prior to decontamination.**

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## Class Index C02

### Nerve Agents – “V” Series

#### General Chemical Structure



#### Toxicology

##### **Effects:**

Nerve Agents are the most toxic of the known chemical agents. Solids, liquids, or vapors from these agents are hazardous and can cause death within minutes after exposure. Nerve Agents disrupt the function of the nervous system by interfering with the enzyme acetylcholinesterase. The major effects will be on skeletal muscles, certain organs, and the central nervous system. These compounds are similar to, but much more deadly than, agricultural organophosphate pesticides.

##### **Pathways:**

Although Nerve Agents are hazardous through inhalation, skin and eye exposure, ingestion, and abraded skin (e.g., breaks in the skin or penetration of skin by debris), the primary risk posed by “V” series Nerve Agents is through percutaneous exposure.

##### **Exposure Hazards (See Specific Agent in Agent Index):**

LC<sub>50s</sub> for inhalation of “V” series Nerve Agents are as low as 0.3 ppm (10 minute exposure).

LD<sub>50s</sub> for skin exposure to liquid “V” series Nerve Agents are as low as 0.01 gm per individual.

**The rate of detoxification of these agents by the body is very low and exposures are essentially cumulative.**

##### **Latency Period:**

Vapor: Effects from vapor exposure begin to appear 30 seconds to 2 minutes after exposure.

Liquid: There is almost always a latent period with no visible effects between the time of exposure and the onset of

symptoms. Effects from liquid exposure begin to appear from several minutes up to 18 hours after exposure. Onset of symptoms from exposure to large amounts of liquid agent may appear as rapidly as 1 minute after exposure. Generally, the more rapid the onset of symptoms, the larger the amount of agent involved in the exposure.

Solid:

Moist (sweaty) areas are more susceptible to solid Nerve Agents. There is almost always a latent period with no visible effects between the time of exposure and the onset of symptoms. Effects from solid exposure begin to appear from several minutes up to 18 hours after exposure. Onset of symptoms from exposure to large amounts of solid agent may appear as rapidly as 1 minute after exposure. Generally, the more rapid the onset of symptoms, the larger the amount of agent involved in the exposure.

## **Characteristics**

### ***Physical Appearance/Odor:***

“V” series Nerve Agents can be either solids or liquids. Liquids are colorless to brownish in color. Liquid agents have a consistency ranging from near that of light machine oil up to that of motor oil. These agents have little or no odor when pure. Liquid agents can also be thickened with various substances to increase their persistency and percutaneous hazard. When thickened, agents have a consistency similar to honey. Conversely, various solvents can be added to dilute the agents. Solvents may also dramatically increase the rate that agents penetrate the skin.

### ***Persistency:***

All unthickened “V” series Nerve Agents are classified as persistent. Evaporation rates ranging from near that of light machine oil up to that of motor oil. Thickened agents last significantly longer.

### ***Environmental Fate:***

Although “V” series Nerve Agents have very little vapor pressure, significant amounts of vapor can accumulate in confined or enclosed spaces. Vapors have a density greater than air and tend to collect in low places. Nerve Agents are absorbed into porous material, including painted surfaces, and these materials could continue to re-release vapor after exposure has ceased (clothing may re-release agent for up to 30 minutes after contact with vapor). “V” series Nerve Agents are unusual in that they may be more soluble in cool water than warm water. The liquid density of these agents is slightly greater than that of water.

## Additional Hazards

Exposure of skin to various solvents (e.g., acetone, alcohols, ethers, gasoline) prior to exposure to nerve agents may increase the percutaneous hazard and decrease survival time associated with agent exposure.

### **Fire:**

Nerve Agents may be volatilized during a fire or be spread by efforts to extinguish the fire. Agents may be decomposed by heat to produce other toxic gases.

### **Reactivity:**

Most of these Nerve Agents are decomposed slowly in water. Raising the pH increase the rate of decomposition significantly.

### **Hazardous Decomposition Products:**

- Hydrolysis: Extremely hazardous decomposition products, some with toxicities near those of the original agents, are produced by hydrolysis.
- Combustion: Volatile decomposition products may include sulfur oxides ( $\text{SO}_x$ ), nitrogen oxides ( $\text{NO}_x$ ), phosphorous oxides ( $\text{PO}_x$ ) as well as potentially toxic organophosphates. In addition, toxic phosphate residue may remain.

## Protection

### **Evacuation (See Specific Agent in Agent Index):**

Immediately isolate an area around any liquid or solid contamination for at least 700 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized, persistence of the agent and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible. Depending on the persistence of the agent and the potential for condensation of agent from the cloud, evacuation of the threatened population after passage of the initial cloud may be appropriate.

**Field Detection/Identification (See Detector Characteristics in General Section):**

**Military:** *Vapor:* "V" series Nerve Agent can be detected by the M8A1 Alarm, M256A1 Kit, CAM, and by the MM-1 in the FOX NBC Reconnaissance System. However, since these agents have minimal vapor pressure, it may be difficult to effectively identify "V" series Nerve Agents vapors except in a confined or enclosed space.  
*Liquids:* "V" series Nerve Agent can be detected by M8 and M9 papers, the MM-1 in the FOX NBC Reconnaissance System, and in water by the M272 Kit.  
*Solids:* There are currently no methods for direct detection of solid agents fielded by the U.S. Military.

**Civilian:** The ADP 2000 provides semi-quantitative identification of nerve agents. Colorimetric tubes are available which are designed to qualitatively detect vapors of phosphoric acid esters. Detection of agents with PIDs or FIDs may be possible. However, since these agents have minimal vapor pressure, it may be difficult to effectively identify "V" series Nerve Agents vapors except in a confined or enclosed space.

**Personal Protective Requirements (See PPE in General Section):**

Although "V" series Nerve Agents pose primarily a severe contact hazard, significant amounts of vapor can accumulate in confined or enclosed spaces and pose a severe respiratory hazard. Wear appropriate fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill or release events. Solid and thickened agents pose a less significant vapor hazard but a much more significant contact hazard. If solid agents have been released, dust control during windy conditions will be essential.

**Decontamination:**

**Vapor:** *Casualties/personnel:* Skin decontamination may not be necessary after exposure to vapor alone. If decontamination is deemed appropriate, wash the entire potentially exposed area with a bleach solution avoiding contact with sensitive areas such as the eyes. The bleach solution should be no less

than one part household bleach in nine parts water. Rinse with copious amounts of water. In all cases, clothing should be removed because it may contain “trapped” vapor.

*Small Areas:* Ventilation. In heavily contaminated areas, decontamination with a fresh solution of HTH pool bleach in denatured alcohol (approximately 9 percent by weight) followed by decontamination with copious amounts of aqueous sodium hydroxide solution (a minimum of 10 percent by weight). Vigorous off-gassing may occur during this process. Removal of porous material, including painted surfaces, that may have absorbed Nerve Agent vapor may be required as these materials could continue to re-release vapor after exposure has ceased.

Liquid:

*Casualties/personnel:* Remove contaminated clothing immediately. Remove as much of the agent from the skin as fast as possible without spreading the material. Wash the entire potentially exposed area with a bleach solution avoiding contact with sensitive areas such as the eyes. The bleach solution should be no less than one part household bleach in nine parts water. Rinse with copious amounts of water. In all cases, clothing should be removed because it may contain “trapped” liquid or vapor.

*Small Areas:* Puddles of liquid must be contained by covering with vermiculite, diatomaceous earth, clay, fine sand, sponges, paper towels or cloth towels. Place the absorbed material into containers with a high-density polyethylene liner. Decontaminate the area with a fresh solution of HTH pool bleach in denatured alcohol (approximately 9 percent by weight) followed by decontamination with copious amounts of aqueous sodium hydroxide solution (a minimum of 10 percent by weight). Vigorous off-gassing may occur during this process. Removal of porous material, including painted surfaces, that may have absorbed Nerve Agent liquid may be required as these materials could continue to re-release liquid and/or vapor after exposure has ceased.

Solids:

*Casualties/personnel:* Remove as much of the agent from the skin as fast as possible without spreading the material. Wash the entire potentially exposed area with a bleach solution avoiding contact with sensitive areas such as the eyes. The bleach solution should be no less than one part household bleach in nine parts water. Rinse with copious amounts of water.

*Small Areas:* Consolidate as much material as possible and place into containers. In heavily contaminated areas, employ vacuum devices equipped with High Efficiency Particulate Air (HEPA) filters to remove as much agent as possible. Decontaminate the area with a fresh solution of HTH pool bleach in denatured alcohol (approximately 9 percent by weight) followed by decontamination with copious amounts of aqueous sodium hydroxide solution (a minimum of 10 percent by weight). Vigorous off-gassing may occur during this process.

## **First Aid**

### ***Signs & Symptoms:***

Vapor: Miosis (pinpointing of pupils) and rhinorrhea (runny nose) may be the first indications of exposure to nerve agent vapor. Miosis is indicative of vapor exposure unless liquid has been in contact with the eyes. Difficulty breathing (shortness of breath or tightness of the chest) may also be present. Lethal amounts of vapor cause loss of consciousness and convulsions within 30 seconds to 2 minutes of exposure, followed by cessation of breathing and flaccid paralysis after several more minutes.

Liquid/Solids: Localized sweating, nausea, vomiting, involuntary urination/defecation, and a feeling of weakness are signs of small to moderate Nerve Agent exposure. Involvement of the gastrointestinal tract (i.e., vomiting, urination, or defecation) is generally indicative of liquid or solid exposure. Large exposures cause copious secretions, loss of consciousness, convulsions progressing into flaccid paralysis, and cessation of breathing.

### ***Patient Management:***

Decontaminate casualty insuring that all agent has been removed. Ventilate patient (there maybe an increase in airway resistance due to constriction of the airway and the presence of secretions). If breathing is difficult, administer oxygen. Administer antidotes as soon as possible.

### ***Antidotes:***

Atropine alone or in combination with pralidoxime chloride (2-PAMCl) or other oxime. Diazepam may be required to control severe convulsions.

***Fatality Management:***

Remove all clothing; decontaminate with straight household bleach then incinerate at an appropriate facility. Wash cadaver with a bleach solution insuring the solution is introduced into the ears, nostrils, mouth, and any wounds. Pay particular attention to hair, scalp, pubic areas, fingernails, and folds of skin where agent may get trapped. The solution should be no less than one part household bleach in one part water. Solution may be buffered with sodium bisulfate to a neutral pH in order to minimize the corrosive impacts on the cadaver. The bleach solution should remain in contact with the cadaver for a minimum of 5 minutes. Wash with soap and water. Cadaver should be screened for volatile agents. Agents that have been absorbed into the cadaver pose minimal secondary risk; however, it is prudent to perform air monitoring during all examinations. **Latex gloves do not offer sufficient protection prior to decontamination.**

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## Class Index C03

### Nerve Agents – “GV” Series

#### General Chemical Structure



#### Toxicology

##### **Effects:**

Nerve Agents are the most toxic of the known chemical agents. The “GV” series is a relatively new sub-class of the standard “G” series Nerve Agents. Solids, liquids or vapors from these agents are hazardous and can cause death within minutes after exposure. Nerve Agents disrupt the function of the nervous system by interfering with the enzyme acetylcholinesterase. The major effects will be on skeletal muscles, some organs, and the central nervous system. These compounds are similar to, but much more deadly than, agricultural organophosphate pesticides.

##### **Pathways:**

“GV” series Nerve Agents are hazardous through inhalation, skin and eye exposure, ingestion, and abraded skin (e.g., breaks in the skin or penetration of skin by debris).

##### **Exposure Hazards (See Specific Agent in Agent Index):**

Human toxicity data for the “GV” series Nerve Agents has not been published or has not been established. However, “GV” Nerve Agents combine attributes of both the “G” series (see Class Index C01) and the “V” series (see Class Index C02). “GV” series Nerve Agents present greater percutaneous hazards than the standard “G” series Nerve Agents and a greater vapor hazard than the “V” series Nerve Agents. Toxicities of the “GV” series Nerve Agents appear to be in a range nearly as low as the “V” series Nerve Agents.

<p><b>The rate of detoxification of these agents by the body is very low and exposures are essentially cumulative.</b></p>
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##### **Latency Period:**

Vapor:                      Effects from vapor exposure begin to appear 30 seconds to 2 minutes after exposure.

- Liquid:** There is almost always a latent period with no visible effects between the time of exposure and the onset of symptoms. Effects from liquid exposure begin to appear from several minutes up to 18 hours after exposure. Onset of symptoms from exposure to large amounts of liquid agent may appear as rapidly as 1 minute after exposure. Generally, the more rapid the onset of symptoms, the larger the amount of agent involved in the exposure.
- Solid:** Moist (sweaty) areas are more susceptible to solid Nerve Agents. There is almost always a latent period with no visible effects between the time of exposure and the onset of symptoms. Effects from solid exposure begin to appear from several minutes up to 18 hours after exposure. Onset of symptoms from exposure to large amounts of solid agent may appear as rapidly as 1 minute after exposure. Generally, the more rapid the onset of symptoms, the larger the amount of agent involved in the exposure.

## **Characteristics**

### ***Physical Appearance/Odor:***

“GV” series Nerve Agents may be liquids or solids.

### ***Persistency:***

“GV” series Nerve Agents are also known as intermediate volatility agents (IVAs). They are significantly more persistent than other “G” series Nerve Agents (see Class Index C01) but with a significantly greater vapor pressure (i.e., pose a greater inhalation hazard) than the “V” series Nerve Agents (see Class Index C02). In general, “GV” series Nerve Agents should be considered persistent.

### ***Environmental Fate:***

“GV” series Nerve Agent are not as stable as either “G” series or “V” series Nerve Agents and tend to decompose on storage. Agent vapors have a density greater than air and tend to collect in low places. Nerve Agents are absorbed into porous material, including painted surfaces, and these materials could continue to re-release vapor after exposure has ceased. Clothing may re-release agent for up to 30 minutes after contact with vapor. Solubility of the agents in water is not available but should be considered moderate. Solubility of the salts of agents should be considered significant. The liquid densities of these agents are greater than that of water.

## Additional Hazards

**Exposure of skin to various solvents (e.g., acetone, alcohols, ethers, gasoline) prior to exposure to nerve agents may increase the percutaneous hazard and decreases survival time associated with agent exposure.**

### **Fire:**

“GV” series Nerve Agents may be volatilized during a fire or be spread by efforts to extinguish the fire. Agents may be decomposed by heat to produce other toxic and/or corrosive gases. In addition, “GV” series Nerve Agents may react with steam or water during a fire to produce toxic and corrosive vapors. Hydrogen produced by the action of the corrosive vapors on metals or other corrodible materials may be present.

### **Reactivity:**

Most of the “GV” series Nerve Agents decompose slowly in water. A significant change in the pH (either higher or lower) increases the rate of decomposition considerably.

### **Hazardous Decomposition Products:**

- Hydrolysis: “GV” series Nerve Agents produce hydrogen fluoride (HF) when hydrolyzed. Additional products, depending on the pH, include amines and complex organophosphates that should be considered to be extremely hazardous.
- Combustion: Volatile “GV” series Nerve Agents decomposition products may include hydrogen fluoride (HF), nitrogen oxides (NO<sub>x</sub>), and phosphorous oxides (PO<sub>x</sub>) as well as potentially toxic organophosphates. In addition, toxic phosphate residue may remain.

## Protection

### **Evacuation (See Specific Agent in Agent Index):**

Immediately isolate an area around any liquid or solid contamination for at least 700 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized, persistence of the agent and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible. Depending on the

persistence of the agent and the potential for condensation of agent from the cloud, evacuation of the threatened population after passage of the initial cloud may be appropriate.

***Field Detection/Identification (See Detector Characteristics in General Section):***

- Military:** Information on detection of “GV” series Nerve Agents is not available. However, based on their similarity to “G” and “V” series agents, it is likely that agent vapor can be detected by the M256A1 Kit and that liquid agents can be detected by M8 and M9 papers.
- Civilian:** The APD 2000 provides semi-quantitative identification of nerve agents. Colorimetric tubes are available which are designed to qualitatively detect vapors of phosphoric acid esters as well as the key decomposition products hydrogen fluoride (HF) and organic amines. Detection of agents with PIDs or FIDs may be possible. Detection and identification with FT-IR is possible provided that the appropriate reference spectra are available.

***Personal Protective Requirements (See PPE in General Section):***

“GV” series Nerve Agents pose both a severe respiratory and severe contact hazard. Wear appropriate fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). Structural firefighters’ protective clothing is recommended for fire situations only; it is not effective in spill or release events. Solid agents pose a less significant vapor hazard but a much more significant contact hazard. Dust control during windy conditions will be essential.

***Decontamination:***

- Vapor:** *Casualties/personnel:* Skin decontamination may not be necessary after exposure to vapor alone. If decontamination is deemed appropriate, wash the entire potentially exposed area with a bleach solution avoiding contact with sensitive areas such as the eyes. The bleach solution should be no less than one part household bleach in nine parts water. Rinse with copious amounts of water. In all cases, clothing should be removed because it may contain “trapped” vapor.
- Small Areas:* Ventilation. In heavily contaminated areas, decontamination with copious amounts of aqueous sodium

hydroxide solution (a minimum of 10 percent by weight) may be required. If sodium hydroxide solution is not available, then sodium carbonate may be used. Removal of porous material, including painted surfaces, that may have absorbed Nerve Agent vapor may be required as these materials continue to re-release vapor after exposure has ceased.

Liquid:

*Casualties/personnel:* Remove contaminated clothing immediately. Remove as much of the agent from the skin as fast as possible without spreading the material. Wash the entire potentially exposed area with a bleach solution avoiding contact with sensitive areas such as the eyes. The bleach solution should be no less than one part household bleach in nine parts water. Rinse with copious amounts of water. In all cases, clothing should be removed because it may contain "trapped" liquid or vapor.

*Small Areas:* Puddles of liquid must be contained by covering with vermiculite, diatomaceous earth, clay, fine sand, sponges, paper towels or cloth towels. Place the absorbed material into containers with a high-density polyethylene liner. Decontaminate the area with copious amounts of aqueous sodium hydroxide solution (a minimum of 10 percent by weight). If sodium hydroxide solution is not available, then sodium carbonate may be used. Removal of porous material, including painted surfaces, that may have absorbed Nerve Agent liquid may be required as these materials could continue to re-release liquid and/or vapor after exposure has ceased.

Solids:

*Casualties/personnel:* Remove contaminated clothing immediately. Remove as much of the agent from the skin as fast as possible without spreading the material. Wash the entire potentially exposed area with a bleach solution avoiding contact with sensitive areas such as the eyes. The bleach solution should be no less than one part household bleach in nine parts water. Rinse with copious amounts of water.

*Small Areas:* Consolidate as much material as possible and place into containers. In heavily contaminated areas, employ vacuum devices equipped with High Efficiency Particulate Air (HEPA) filters to remove as much agent as possible. Decontaminate the area with copious amounts of aqueous sodium hydroxide solution (a minimum of 10 percent by weight). If sodium hydroxide solution is not available, then sodium carbonate may be used.

## **First Aid**

### ***Signs & Symptoms:***

- Vapor: In contrast to either the "G" or "V" series Nerve Agents, the observable signs and symptoms of exposure to the "GV" series Nerve Agents are more insidious and tend to be very mild and transient. Miosis (pinpointing of pupils) and rhinorrhea (runny nose) may be the first indications of exposure to Nerve Agent vapor. Miosis is indicative of vapor exposure unless liquid has been in contact with the eyes. Difficulty breathing (shortness of breath or tightness of the chest) may also be present. Lethal amounts of vapor cause loss of consciousness and convulsions within 30 seconds to 2 minutes of exposure, followed by cessation of breathing and flaccid paralysis after several more minutes.
- Liquid/Solids: In contrast to either the "G" or "V" series of Nerve Agents, the observable signs of exposure to the "GV" series Nerve Agents are more insidious and tend to be very mild and transient. Even convulsions occurring just prior to death are usually milder than with the other series of Nerve Agents. The progression of signs and symptoms from percutaneous exposure to the "GV" series Nerve Agents may not follow the same order as with the other series Nerve Agents. However, the general signs and symptoms of small to moderate exposure include localized sweating, nausea, vomiting, involuntary urination/defecation, and a feeling of weakness. Involvement of the gastrointestinal tract (i.e., vomiting, urination, or defecation) is indicative of exposure to either liquid or solid agent. Large exposures cause copious secretions, loss of consciousness, convulsions progressing into flaccid paralysis, and cessation of breathing.

### ***Patient Management:***

Decontaminate casualty insuring that all agent has been removed. Ventilate patient (there maybe an increase in airway resistance due to constriction of the airway and the presence of secretions). If breathing is difficult, administer oxygen. Administer antidotes as soon as possible.

### ***Antidotes:***

Atropine alone or in combination with pralidoxime chloride (2-PAMCl) or other oxime. Diazepam may be required to control severe convulsions.

***Fatality Management:***

Remove all clothing; decontaminate with straight household bleach, then incinerate at an appropriate facility. Wash cadaver with a bleach solution insuring the solution is introduced into the ears, nostrils, mouth, and any wounds. Pay particular attention to hair, scalp, pubic areas, fingernails, and folds of skin where agent may get trapped. The solution should be no less than one part household bleach in one part water. Solution may be buffered with sodium bisulfate to a neutral pH in order to minimize the corrosive impacts on the cadaver. The bleach solution should remain in contact with the cadaver for a minimum of 5 minutes. Wash with soap and water. Cadaver should be screened for volatile agents. Agents that have been absorbed into the cadaver pose minimal secondary risk; however, it is prudent to perform air monitoring during all examinations. **Latex gloves do not offer sufficient protection prior to decontamination.**

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## Class Index C04

### Nerve Agents – Novichok

#### General Chemical Structure

Unavailable

#### Toxicology

##### ***Effects:***

Nerve Agents are the most toxic of the known chemical agents. The Novichok series is a new class of Nerve Agents developed by the former Soviet Union. Minimal information has been published about these agents. However, as with other Nerve Agents (see Class Indices C01 through C03), liquids or vapors from these agents are hazardous and can cause death within minutes after exposure. Nerve Agents disrupt the function of the nervous system by interfering with the enzyme acetylcholinesterase. The major effects will be on skeletal muscles, certain organs, and the central nervous system. These compounds are similar to, but much more deadly than, agricultural organophosphate pesticides.

##### ***Pathways:***

Nerve Agents are hazardous through inhalation, skin and eye exposure, ingestion, and abraded skin (e.g., breaks in the skin or penetration of skin by debris).

##### ***Exposure Hazards (See Specific Agent in Agent Index):***

Human toxicity data for the Novichok series Nerve Agents has not been published or has not been established. However, available information indicates that under optimum conditions Novichok agents are 5 to 8 times more effective than nerve agent VX (see Agent Index A010, Class Index C02).

Novichok Nerve Agents may occur in a binary form (see Class Index C05). Components, byproducts, or solvents may have toxic properties and present additional hazards. These materials may also impact the rate that the agents volatilize or penetrate the skin.

**The rate of detoxification of other nerve agents by the body is very low and exposures are essentially cumulative. It should be assumed that novichok agents are also cumulative.**

**Latency Period:**

- Vapor: Unavailable. However, effects from vapor exposure to other classes of nerve agents begin to appear 30 seconds to 2 minutes after exposure (see Class Indices C01 through C03). It is probable that this is also true for Novichok Agents.
- Liquid: Unavailable. However, effects from liquid exposure to other classes of nerve agents begin to appear from several minutes up to 18 hours after exposure (see Class Indices C01 through C03). It is probable that this is also true for Novichok Agents.

**Characteristics****Physical Appearance/Odor:**

Information on any physical characteristics of Novichok Nerve Agents has not been published.

The binary version of these agents will consist of two relatively “nontoxic” chemicals which form the Novichok Nerve Agent when mixed. Prior to mixing, components may be either liquids or solids. Because mixing occurs just prior to, or as a result of, deployment, the crude Nerve Agent formed will be a mixture of the agent, components, and byproducts. The color, odor, and consistency of the crude Nerve Agent will vary based on the quality of the components and the degree of mixing.

**Persistency:**

Information on the persistency of Novichok Nerve Agents has not been published.

**Environmental Fate:**

Novichok Nerve Agent vapors have a density greater than air and tend to collect in low places. As with other Nerve Agents (see Class Indices C01 through C03), it is likely that Novichok Nerve Agents will be absorbed into porous material, including painted surfaces, and these materials could continue to re-release vapor after exposure has ceased. The solubility of these agents in water is unavailable. The liquid densities of these agents is unavailable.

**Additional Hazards**

**Exposure of skin to various solvents (e.g., acetone, alcohols, ethers, gasoline) prior to exposure to nerve agents may increase the percutaneous hazard and decrease survival time associated with agent exposure.**

**Fire:**

Nerve Agents may be volatilized during a fire or be spread by efforts to extinguish the fire. Agents may be decomposed by heat to produce other toxic and/or corrosive gases. If the binary form of the agents is released, flammable solvents used to facilitate mixing of the binary components may be present and pose an additional fire hazard.

**Reactivity:**

Unavailable.

**Hazardous Decomposition Products:**

Hydrolysis: Unavailable.

Combustion: Unavailable.

**Protection****Evacuation (See Specific Agent in Agent Index):**

Immediately isolate an area around any liquid or solid contamination for at least 700 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized, persistence of the agent and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible. Depending on the persistence of the agent and the potential for condensation of agent from the cloud, evacuation of the threatened population after passage of the initial cloud may be appropriate.

**Detection/Identification:**

Military: *Vapor:* It is not known which, if any, detector systems are capable of detecting Novichok Nerve Agents.

*Liquids:* It is not known which, if any, detector systems are capable of detecting Novichok Nerve Agents.

Civilian: Colorimetric tubes are available which are designed to qualitatively detect vapors of phosphoric acid esters. Detection of agents with PIDs or FIDs may be possible. However, it is not known if these agents have enough vapor pressure to facilitate effective field identification.

### ***Personal Protective Requirements (see PPE in General Section):***

As with other Nerve Agents (see Class Indices C01 through C03) Novichok Nerve Agents pose both a severe respiratory and severe contact hazard. Wear appropriate fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill or release events.

### ***Decontamination:***

Vapor:

*Casualties/personnel:* Wash the entire potentially exposed area with a bleach solution avoiding contact with sensitive areas such as the eyes. The bleach solution should be no less than one part household bleach in nine parts water. Rinse with copious amounts of water. In all cases, clothing should be removed because it may contain "trapped" vapor.

*Small Areas:* Ventilation. In heavily contaminated areas, decontamination with a fresh solution of HTH pool bleach in denatured alcohol (approximately 9 percent by weight) followed by decontamination with copious amounts of aqueous sodium hydroxide solution (a minimum of 10 percent by weight). Vigorous off-gassing may occur during this process. Removal of porous material, including painted surfaces, that may have absorbed Nerve Agent vapor may be required as these materials could continue to re-release vapor after exposure has ceased.

Liquid:

*Casualties/personnel:* Remove contaminated clothing immediately. Remove as much of the agent from the skin as fast as possible without spreading the material. Wash the entire potentially exposed area with a bleach solution avoiding contact with sensitive areas such as the eyes. The bleach solution should be no less than one part household bleach in nine parts water. Rinse with copious amounts of water. In all cases, clothing should be removed because it may contain "trapped" liquid or vapor.

*Small Areas:* Puddles of liquid must be contained by covering with vermiculite, diatomaceous earth, clay, fine sand, sponges, paper towels or cloth towels. Place the absorbed material into containers with a high-density polyethylene liner. Decontaminate the area with a fresh solution of HTH pool bleach in denatured alcohol (approximately 9 percent by weight) followed by decontamination with copious

amounts of aqueous sodium hydroxide solution (a minimum of 10 percent by weight). Vigorous off-gassing may occur during this process. Removal of porous material, including painted surfaces, that may have absorbed Nerve Agent liquid may be required as these materials could continue to re-release liquid and/or vapor after exposure has ceased.

## **First Aid**

### ***Signs & Symptoms:***

**Vapor:** Miosis (pinpointing of pupils) and rhinorrhea (runny nose) may be the first indications of exposure to nerve agent vapor. Miosis is indicative of vapor exposure unless liquid has been in contact with the eyes. Difficulty breathing (shortness of breath or tightness of the chest) may also be present. Lethal amounts of vapor cause loss of consciousness and convulsions within 30 seconds to 2 minutes of exposure, followed by cessation of breathing and flaccid paralysis after several more minutes.

**Liquid:** Localized sweating, nausea, vomiting, involuntary urination/defecation, and a feeling of weakness are signs of small to moderate Nerve Agent exposure. Involvement of the gastrointestinal tract (i.e., vomiting, urination, or defecation) is generally indicative of liquid or solid exposure. Large exposures cause copious secretions, loss of consciousness, convulsions progressing into flaccid paralysis, and cessation of breathing.

### ***Patient Management:***

Decontaminate casualty insuring that all agent has been removed. Ventilate patient (there maybe an increase in airway resistance due to constriction of the airway and the presence of secretions). If breathing is difficult, administer oxygen. Administer antidotes as soon as possible.

### ***Antidotes:***

It has not been published how Novichok Nerve Agents will respond to treatment with standard antidotes (i.e., atropine in combination with pralidoxime chloride. See Class Indices C01 through C03). It is known that some of the agents in this class have been designed to be resistant to therapy.

***Fatality Management:***

Remove all clothing; decontaminate with straight household bleach then incinerate at an appropriate facility. Wash cadaver with a bleach solution insuring the solution is introduced into the ears, nostrils, mouth, and any wounds. Pay particular attention to hair, scalp, pubic areas, fingernails, and folds of skin where agent may get trapped. The solution should be no less than one part household bleach in one part water. Solution may be buffered with sodium bisulfate to a neutral pH in order to minimize the corrosive impacts on the cadaver. The bleach solution should remain in contact with the cadaver for a minimum of 5 minutes. Wash with soap and water. Cadaver should be screened for volatile agents. Agents that have been absorbed into the cadaver pose minimal secondary risk; however, it is prudent to perform air monitoring during all examinations. **Latex gloves do not offer sufficient protection prior to decontamination.**

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## Class Index C05

### Nerve Agents – Binary and Components

#### General Chemical Structure

See Class Indices C01 through C04

#### Toxicology

##### **Effects:**

Nerve Agents are the most toxic of the known chemical agents. Solids, liquids, or vapors from these agents are hazardous and can cause death within minutes after exposure. Nerve Agents disrupt the function of the nervous system by interfering with the enzyme acetylcholinesterase. The major effects will be on skeletal muscles, some organs, and the central nervous system. These compounds are similar to, but much more deadly than, agricultural organophosphate pesticides.

##### **Pathways:**

Nerve Agents are hazardous through inhalation, skin and eye exposure, ingestion, and abraded skin (e.g., breaks in the skin or penetration of skin by debris).

##### **Exposure Hazards (See Specific Agent in Agent Index):**

Are the same as the non-Binary Nerve Agents (see Class Indices C01 through C04). Components, byproducts, or solvents may have toxic properties and present additional hazards. These materials may also impact the rate that the Binary Nerve Agents volatilize or penetrate the skin.

<p><b>The rate of detoxification of nerve agents by the body is very low and exposures are essentially cumulative.</b></p>
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##### **Latency Period:**

Vapor:                      Effects from vapor exposure begin to appear 30 seconds to 2 minutes after exposure.

Liquid/Solid: There is almost always a latent period with no visible effects between the time of exposure and the onset of symptoms. Effects from liquid exposure begin to appear from several minutes up to 18 hours after exposure. Onset of symptoms from exposure to large amounts of liquid agent may appear as rapidly as 1 minute after exposure. Generally, the more rapid the onset of symptoms, the larger the amount of agent involved in the exposure.

## **Characteristics**

### ***Physical Appearance/Odor:***

Binary Nerve Agents consist of two relatively “nontoxic” chemicals which form a standard “G” series (Class Index C01), “V” series (Class Index C02), or “GV” series (Class Index C03) Nerve Agent when mixed. Prior to mixing, components may be either liquids or solids. Upon mixing, crude “G” series, “V” series, or “GV” series Nerve Agents are formed. Because mixing occurs just prior to or as a result of deployment, the crude Nerve Agent formed will be a mixture of the agent, components, and byproducts. The color, odor and consistency of the crude Nerve Agent will vary based on the quality of the components and the degree of mixing.

### ***Persistency:***

Binary Nerve Agents may be either non-persistent or persistent. Evaporation rates, decomposition rates, and permeation rates in porous material of the crude Nerve Agents may be different from the standard “G” series, “V” series, or “GV” series agents because of the presence of unreacted components and reaction byproducts.

### ***Environmental Fate:***

Binary Component vapors have a density greater than air and tend to collect in low places. The liquid density of components ranges from slightly less than that of water to greater than that of water.

Nerve Agent vapors have a density greater than air and tend to collect in low places. Nerve Agents are absorbed into porous material, including painted surfaces, and these materials could continue to re-release vapor after exposure has ceased. Clothing may re-releases agent for up to 30 minutes after contact with vapor. Nerve agent solubility in water ranges from completely soluble to almost insoluble. The liquid density of the resulting Nerve Agents is slightly greater than that of water.

## Additional Hazards

**Exposure of skin to various solvents (e.g., acetone, alcohols, ethers, gasoline) prior to exposure to nerve agents may increase the percutaneous hazard and decrease survival time associated with agent exposure.**

### **Fire:**

Binary Nerve Agents may be volatilized during a fire or be spread by efforts to extinguish the fire. Agents may be decomposed by heat to produce other toxic and/or corrosive gases. In addition, either the components or the crude Nerve Agents may react with steam or water during a fire to produce toxic, flammable and/or corrosive vapors. Hydrogen produced by the action of the corrosive vapors on metals or other corrodible materials may be present. Flammable solvents used to facilitate mixing of the binary components may be present and pose an additional fire hazard.

### **Reactivity:**

Many Binary Nerve Agent Components are corrosive or react with water to form corrosive materials. Components may also react with water to produce extremely toxic materials. Other common chemicals, such as alcohols, radiator fluids, dry cleaning solvents, or sulfur containing (vulcanized) products may react with components to form toxic materials. Reaction with dry bleach may produce toxic gases.

### **Hazardous Decomposition Products:**

**Hydrolysis:** In some cases, extremely hazardous decomposition products, some with toxicities near those of the original agents, are produced by hydrolysis of either the components or the Nerve Agents formed. In some cases, components, and the resulting Nerve Agents, may produce hydrogen fluoride (HF) or hydrogen chloride (HCl) when hydrolyzed.

**Combustion:** Volatile decomposition products may include hydrogen chloride (HCl), hydrogen fluoride (HF), sulfur oxides (SO<sub>x</sub>), nitrogen oxides (NO<sub>x</sub>), phosphorous oxides (PO<sub>x</sub>) and potentially toxic organophosphates. In addition, toxic phosphate residue may remain.

## **Protection**

### **Evacuation (See Specific Agent in Agent Index):**

Immediately isolate an area around any liquid or solid contamination for at least 700 feet in all directions. If possible, identify the agent and develop a

downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized, persistence of the agent, and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible. Depending on the persistence of the agent and the potential for condensation of agent from the cloud, evacuation of the threatened population after passage of the initial cloud may be appropriate.

**Field Detection/Identification (See Detector Characteristics in General Section):**

**Military:**            *Nerve Agent Vapor:* Can be detected by the M8A1 Alarm, M256A1 Kit, CAM, and by the MM-1 in the FOX NBC Reconnaissance System.

*Nerve Agent Liquid:* Can be detected by M8 and M9 papers, the MM-1 in the FOX NBC Reconnaissance System, and in water by the M272 Kit.

*Component Liquid/Vapor:* Currently there is no field system employed by the U.S. Military that is designed to detect Binary Nerve Agent Components.

**Civilian:**            The APD 2000 provides semi-quantitative identification of nerve agents. Colorimetric tubes are available which are designed to qualitatively detect vapors of phosphoric acid esters. Colorimetric tubes are available which can detect hydrogen chloride (HCl) and hydrogen fluoride (HF) gases. Detection with PIDs or FIDs may be possible. Detection and identification with FT-IR is possible provided that the appropriate reference spectra are available.

**Personal Protective Requirements (See PPE in General Section):**

Binary Components and the resultant Nerve Agents pose both a severe respiratory and severe contact hazard. Wear appropriate fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill or release events.

**Decontamination:**

**Nerve Vapor:**            *Casualties/personnel:* Skin decontamination may not be necessary after exposure to vapor alone. If decontamination is deemed appropriate, wash the entire potentially exposed area with a bleach solution avoiding contact with sensitive

areas such as the eyes. The bleach solution should be no less than one part household bleach in nine parts water. Rinse with copious amounts of water. In all cases, clothing should be removed because it may contain “trapped” vapor.

*Small Areas:* Ventilation. In heavily contaminated areas, decontamination with copious amounts of aqueous sodium hydroxide solution (a minimum of 10 percent by weight) may be required. If sodium hydroxide solution is not available, then sodium carbonate may be used. Removal of porous material, including painted surfaces, that may have absorbed Nerve Agent vapor may be required as these materials could continue to re-release vapor after exposure has ceased.

Nerve Liquid:

*Casualties/personnel:* Remove contaminated clothing immediately. Remove as much of the agent from the skin as fast as possible without spreading the material. Wash the entire potentially exposed area with a bleach solution avoiding contact with sensitive areas such as the eyes. The bleach solution should be no less than one part household bleach in nine parts water. Rinse with copious amounts of water. In all cases, clothing should be removed because it may contain “trapped” liquid or vapor.

*Small Areas:* Puddles of liquid must be contained by covering with vermiculite, diatomaceous earth, clay, fine sand, sponges, paper towels, or cloth towels. Place the absorbed material into containers with a high-density polyethylene liner. Decontaminate the area with copious amounts of aqueous sodium hydroxide solution (a minimum of 10 percent by weight). If sodium hydroxide solution is not available, then sodium carbonate may be used. Removal of porous material, including painted surfaces, that may have absorbed Nerve Agent liquid may be required as these materials could continue to re-release liquid and/or vapor after exposure has ceased.

Components:

*Casualties/personnel:* Remove contaminated clothing immediately. Remove as much of the agent from the skin as fast as possible without spreading the material. Wash the entire potentially exposed area with copious quantities of water.

*Small Areas:* Puddles of liquid must be contained by covering with vermiculite, diatomaceous earth, clay, fine sand, sponges, paper towels, or cloth towels. Place the absorbed material into containers with a high-density polyethylene liner. Decontaminate the area with copious amounts of aqueous sodium hydroxide solution (a minimum of 10

percent by weight). If sodium hydroxide solution is not available, then sodium carbonate may be used. Removal of porous material, including painted surfaces, that may have absorbed components may be required as these materials could continue to re-release liquid and/or vapor after exposure has ceased.

## **First Aid**

### ***Signs & Symptoms:***

- Nerve Vapor:** Miosis (pinpointing of pupils) and rhinorrhea (runny nose) may be the first indications of exposure to nerve agent vapor. Miosis is indicative of vapor exposure unless liquid has been in contact with the eyes. Difficulty breathing (shortness of breath or tightness of the chest) may also be present. Lethal amounts of vapor cause loss of consciousness and convulsions within 1 to 2 minutes of exposure, followed by cessation of breathing and flaccid paralysis after several more minutes.
- Nerve Liquid:** Localized sweating, nausea, vomiting, involuntary urination/defecation, and a feeling of weakness are signs of small to moderate Nerve Agent exposure. Involvement of the gastrointestinal tract (i.e., vomiting, urination, or defecation) is indicative of liquid exposure. Large exposures cause copious secretions, loss of consciousness, convulsions progressing into flaccid paralysis, and cessation of breathing.
- Components:** Vapors may cause eye and airway irritation, shortness of breath, and a feeling of chest tightness. In extreme cases, lung membranes swell, lungs become filled with liquid (pulmonary edema), and death may result from lack of oxygen. Vapors or liquids may cause skin irritation progressing to second or third degree burns as a result of formation of hydrogen fluoride (HF) when components contact moisture on the skin. Components may also disrupt the function of the nervous system by interfering with the enzyme acetylcholinesterase producing similar symptoms to nerve agents.

### ***Patient Management:***

Decontaminate casualty insuring that all components or agents have been removed. Ventilate patient (there maybe an increase in airway resistance due to constriction of the airway and the presence of secretions). If breathing is difficult, administer oxygen. Administer antidotes as soon as possible.

***Antidotes:***

Nerve Agents: Atropine alone or in combination with pralidoxime chloride (2-PAMCl) or other oxime. Diazepam may be required to control severe convulsions.

Components: Treat hydrogen fluoride (HF) skin burns by soaking in iced zephiran, Epsom salt, or fresh dilute solution of sodium bicarbonate. If available, use calcium gluconate gel to treat burns. Alternatively, magnesium oxide and magnesium sulfate dressing can be used.

***Fatality Management:***

Remove all clothing; decontaminate with straight household bleach then incinerate at an appropriate facility. Wash cadaver with a bleach solution insuring the solution is introduced into the ears, nostrils, mouth, and any wounds. Pay particular attention to hair, scalp, pubic areas, fingernails, and folds of skin where agent may get trapped. The solution should be no less than one part household bleach in one part water. Solution may be buffered with sodium bisulfate to a neutral pH in order to minimize the corrosive impacts on the cadaver. The bleach solution should remain in contact with the cadaver for a minimum of 5 minutes. Wash with soap and water. Cadaver should be screened for volatile agents. Agents that have been absorbed into the cadaver pose minimal secondary risk; however, it is prudent to perform air monitoring during all examinations. **Latex gloves do not offer sufficient protection prior to decontamination.**

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## Class Index C06

### Nerve Agents – Carbamates

#### General Chemical Structure



#### Toxicology

##### **Effects:**

Nerve Agents are the most toxic of the known chemical agents. Solids, liquids or vapors from these agents are hazardous and can cause death within minutes after exposure. Nerve Agents disrupt the function of the nervous system by interfering with the enzyme acetylcholinesterase. The major effects will be on skeletal muscles, certain organs, and the central nervous system. These compounds are similar to, but much more deadly than, agricultural carbamate pesticides.

##### **Pathways:**

Carbamate Nerve Agents are hazardous through inhalation, skin and eye exposure, ingestion, and abraded skin (e.g., breaks in the skin or penetration of skin by debris).

##### **Exposure Hazards (See Specific Agent in Agent Index):**

Human toxicity data for the Carbamate Nerve Agents has not been published or has not been established. However, based on animal studies, toxicities of some agents appear to be in a range nearly as low as the “V” series Nerve Agents (see Class Index C02).

These agents are rapidly detoxified or eliminated from the body and there is little or no cumulative toxicity.

##### **Latency Period:**

- Vapor: Effects from vapor exposure begin to appear 30 seconds to 2 minutes after exposure.
- Liquid: There is almost always a latent period with no visible effects between the time of exposure and the onset of symptoms. Effects from liquid exposure begin to appear from several minutes up to several hours after exposure.

Onset of symptoms from exposure to large amounts of liquid agent may appear as rapidly as 1 minute after exposure. Generally, the more rapid the onset of symptoms, the larger the amount of agent involved in the exposure.

Solid:

Moist (sweaty) areas are more susceptible to solid Nerve Agents. There is almost always a latent period with no visible effects between the time of exposure and the onset of symptoms. Effects from solid exposure begin to appear from several minutes up to several hours after exposure. Onset of symptoms from exposure to large amounts of solid agent may appear as rapidly as 1 minute after exposure. Generally, the more rapid the onset of symptoms, the larger the amount of agent involved in the exposure.

## **Characteristics**

### ***Physical Appearance/Odor:***

Carbamate Nerve Agents may be liquids or solids and have little or no odor. Various solvents can be added to dilute the agents changing both their appearance and physical/chemical properties. Solvents may also dramatically increase the rate that agents penetrate the skin.

### ***Persistency:***

Carbamate Nerve Agents are persistent.

### ***Environmental Fate:***

Carbamate Nerve Agent vapors have a density greater than air and tend to collect in low places. Nerve Agents are absorbed into porous material, including painted surfaces, and these materials could continue to re-release vapor after exposure has ceased. Clothing may continue to re-release vapor after contact with agents has ceased. Solubility in water ranges from completely soluble to almost insoluble. The liquid densities of these agents are slightly greater than that of water.

## **Additional Hazards**

### ***Fire:***

Carbamate Nerve Agents may be volatilized during a fire or be spread by efforts to extinguish the fire. Agents may be decomposed by heat to produce other toxic and/or corrosive gases. In addition, Carbamate Nerve Agents may react with steam or water during a fire to produce toxic and/or corrosive

vapors. Hydrogen produced by the action of the corrosive vapors on metals or other corrodible materials may be present.

**Reactivity:**

Most of the Carbamate Nerve Agents are stable in water. Raising the pH increases the rate of decomposition significantly.

**Hazardous Decomposition Products:**

Hydrolysis:       Complex organic compounds.  
Combustion:       Volatile Carbamate Nerve Agent decomposition products may include hydrogen chloride (HCl), hydrogen bromide (HBr), hydrogen cyanide (HCN), aromatic hydrocarbons, and nitrogen oxides (NO<sub>x</sub>).

**Protection**

**Evacuation (See Specific Agent in Agent Index):**

Immediately isolate an area around any liquid or solid contamination for at least 700 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized, persistence of the agent and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible. Depending on the persistence of the agent and the potential for condensation of agent from the cloud, evacuation of the threatened population after passage of the initial cloud may be appropriate.

**Field Detection/Identification (See Detector Characteristics in General Section):**

Military:        Carbamate Nerve Agents are not identifiable by military detection equipment.  
Civilian:         Detection of agents with PIDs or FIDs may be possible. Detection and identification with FT-IR is possible provided that the appropriate reference spectra are available.

**Personal Protective Requirements (See PPE in General Section):**

Carbamate Nerve Agents pose both a severe respiratory and severe contact hazard. Wear appropriate fully encapsulating protective gear with positive

pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill or release events. Solid agents pose a less significant vapor hazard but a much more significant contact hazard. Dust control during windy conditions will be essential.

### **Decontamination:**

**Vapor:** *Casualties/personnel:* Skin decontamination may not be necessary after exposure to vapor alone. If decontamination is deemed appropriate, wash the entire potentially exposed area with a bleach solution avoiding contact with sensitive areas such as the eyes. The bleach solution should be no less than one part household bleach in nine parts water. Wash with soap and water. Rinse with copious amounts of water. In all cases, clothing should be removed because it may contain "trapped" vapor.

*Small Areas:* Ventilation. In heavily contaminated areas, decontamination with copious amounts of aqueous sodium hydroxide solution (a minimum of 10 percent by weight) may be required. If sodium hydroxide solution is not available, then sodium carbonate may be used. Removal of porous material, including painted surfaces, that may have absorbed Nerve Agent vapor may be required as these materials continue to re-release vapor after exposure has ceased.

**Liquid:** *Casualties/personnel:* Remove contaminated clothing immediately. Remove as much of the agent from the skin as fast as possible without spreading the material. Wash the entire potentially exposed area with a bleach solution avoiding contact with sensitive areas such as the eyes. The bleach solution should be no less than one part household bleach in nine parts water. Rinse with copious amounts of water. In all cases, clothing should be removed because it may contain "trapped" liquid or vapor.

*Small Areas:* Puddles of liquid must be contained by covering with vermiculite, diatomaceous earth, clay, fine sand, sponges, paper towels or cloth towels. Place the absorbed material into containers with a high-density polyethylene liner. Decontaminate the area with copious amounts of aqueous sodium hydroxide solution (a minimum of 10 percent by weight). If sodium hydroxide solution is not available, then sodium carbonate may be used. Removal of porous material, including painted surfaces, that may have absorbed Nerve Agent liquid may be required as these

materials could continue to re-release liquid and/or vapor after exposure has ceased.

Solids:

*Casualties/personnel:* Remove contaminated clothing immediately. Remove as much of the agent from the skin as fast as possible without spreading the material. Wash the entire potentially exposed area with a bleach solution avoiding contact with sensitive areas such as the eyes. The bleach solution should be no less than one part household bleach in nine parts water. Wash with soap and water. Rinse with copious amounts of water. In all cases, clothing should be removed because it may contain “trapped” dust or vapor. *Small Areas:* Consolidate as much material as possible and place into containers. In heavily contaminated areas, employ vacuum devices equipped with High Efficiency Particulate Air (HEPA) filters to remove as much agent as possible. Decontaminate the area with copious amounts of aqueous sodium hydroxide solution (a minimum of 10 percent by weight). If sodium hydroxide solution is not available, then sodium carbonate may be used.

## **First Aid**

### ***Signs & Symptoms:***

- Vapor: Miosis (pinpointing of pupils) and rhinorrhea (runny nose) may be the first indications of exposure to nerve agent vapor. Miosis is indicative of vapor exposure unless liquid agent has been in contact with the eyes. Difficulty breathing (shortness of breath or tightness of the chest) may also be present. Inhalation of lethal amounts of vapor can cause loss of consciousness and convulsions within 30 seconds to 2 minutes of exposure, followed by cessation of breathing and flaccid paralysis after several more minutes.
- Liquid/Solids: Localized sweating, nausea, vomiting, involuntary urination/defecation, and a feeling of weakness are signs of small to moderate Nerve Agent exposure. Involvement of the gastrointestinal tract (i.e., vomiting, urination, or defecation) is generally indicative of liquid agent exposure. Large exposures cause copious secretions, loss of consciousness, convulsions progressing into flaccid paralysis, and cessation of breathing.

### ***Patient Management:***

Decontaminate casualty insuring that all agent has been removed. Ventilate patient (there maybe an increase in airway resistance due to constriction of

the airway and the presence of secretions). If breathing is difficult, administer oxygen. Administer antidotes as soon as possible.

***Antidotes:***

Atropine. Severely poisoned individuals may exhibit tolerance to atropine and require large doses. Oximes such as pralidoxime chloride (2-PAMCl) do not significantly increase the effectiveness of atropine and in some cases may be contraindicated.

***Fatality Management:***

Remove all clothing; decontaminate with straight household bleach then incinerate at an appropriate facility. Wash cadaver with a bleach solution insuring the solution is introduced into the ears, nostrils, mouth, and any wounds. Pay particular attention to hair, scalp, pubic areas, fingernails, and folds of skin where agent may get trapped. The solution should be no less than one part household bleach in one part water. Solution may be buffered with sodium bisulfate to a neutral pH in order to minimize the corrosive impacts on the cadaver. The bleach solution should remain in contact with the cadaver for a minimum of 5 minutes. Wash with soap and water. Cadaver should be screened for volatile agents. Agents that have been absorbed into the cadaver pose minimal secondary risk; however, it is prudent to perform air monitoring during all examinations. **Latex gloves do not offer sufficient protection prior to decontamination.**

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## Class Index C07

### Vesicants – Sulfur Based

#### General Chemical Structure



#### Toxicology

##### **Effects:**

Vesicants affect both exterior and interior parts of the body. Vesicants cause inflammation, blisters, and general destruction of tissues. Vapors have a greater impact on moist areas of the body. Eyes are especially susceptible to Vesicants. Inhalation of Vesicants can cause lung membranes to swell and become filled with liquid (pulmonary edema). Death may result from lack of oxygen. Vesicants are also systemic agents and readily pass through the skin to affect susceptible tissue including those that produce blood. Sulfur Vesicants are carcinogenic.

##### **Pathways:**

Vesicants are hazardous through inhalation, skin and eye exposure, ingestion, and abraded skin (e.g., breaks in the skin or penetration of skin by debris).

##### **Exposure Hazards (See Specific Agent in Agent Index):**

Skin impacts from Sulfur Vesicant vapor occur at concentrations as low as 15 ppm (10 minute exposure). Hot, moist skin is at greater risk. High risk areas include the crotch and armpits.

Eye impacts from Sulfur Vesicant vapor occur at concentrations as low as 3 ppm (10 minute exposure).

LC<sub>50s</sub> for inhalation of Sulfur Vesicants are as low as 6 ppm (10 minute exposure).

LD<sub>50s</sub> for skin exposure to liquid Sulfur Vesicants are as low as 7 gm per individual.

**Sulfur vesicants are slowly detoxified by the body; exposures are essentially cumulative.**

***Latency Period:***

Tissue damage occurs within minutes of exposure to Sulfur Vesicants, but clinical effects may not appear for up to 24 hours. Pulmonary edema caused by inhalation of the agent vapor may be delayed for several hours.

**Characteristics*****Physical Appearance/Odor:***

Sulfur Vesicants may be liquids or solids. Agents may be colorless when pure, but generally are amber to black. Sulfur Vesicants generally have an odor similar to onions, garlic, or horseradish. Agents can be thickened with various substances to increase their persistency and dermal hazard. When thickened, agents have a consistency similar to honey. Sulfur Vesicants have also been absorbed onto finely ground powders (e.g., carbon black) and disseminated as dust clouds. The dust particles carry the absorbed agent into the lower lung and thereby increase the lethality of the agents.

***Persistency:***

Sulfur Vesicants are persistent agents and, under proper conditions, remain hazardous in soils for several years. Thickened agents last significantly longer.

***Environmental Fate:***

Vapors from Sulfur Vesicants have a density greater than air and tend to collect in low places. Liquids are very persistent and have remained hazardous in soils for several years after a release. Agents are absorbed into porous material, including painted surfaces, and these materials could continue to re-release vapor after exposure has ceased. Solubility in water is negligible. The liquid density of these agents is greater than that of water.

**Additional Hazards*****Fire:***

Vesicants may be volatilized during a fire or be spread by efforts to extinguish the fire. Agents may be decomposed by heat to produce other toxic and/or corrosive gases. In addition, Sulfur Vesicants may react with steam or water during a fire to produce toxic and/or corrosive vapors. Hydrogen produced by the action of the corrosive vapors on metals or other corrodible materials may be present.

**Reactivity:**

Sulfur Vesicants are incompatible with strong oxidizers, such as dry HTH pool bleach, and will spontaneously ignite. Lack of solubility inhibits reaction of these agents with water.

**Hazardous Decomposition Products:**

Hydrolysis: Sulfur Vesicants produce hydrogen chloride (HCl) and thioglycols or thioethers when hydrolyzed.

Combustion: Volatile decomposition products may include hydrogen chloride (HCl) and sulfur oxides (SO<sub>x</sub>). In addition, a corrosive and toxic residue may remain.

**Protection****Evacuation (See Specific Agent in Agent Index):**

Immediately isolate an area around any liquid or solid contamination for at least 400 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized, persistence of the agent and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible. Depending on the persistence of the agent and the potential for condensation of agent from the cloud, evacuation of the threatened population after passage of the initial cloud may be appropriate.

**Field Detection/Identification (See Detector Characteristics in General Section):**

Military: *Vapor:* Some, but not all, Sulfur Vesicants can be detected by the M256A1 Kit and the CAM.

*Liquids:* Sulfur Vesicants can be detected by M8 and M9 papers, the MM-1 in the FOX NBC Reconnaissance System, and in water by the M272 Kit.

Civilian: The APD 2000 provides semi-quantitative identification of sulfur vesicants. Colorimetric tubes are available which can detect thioethers. Detection with PIDs or FIDs may be possible. Detection and identification with FT-IR is possible provided that the appropriate reference spectra are available.

### ***Personal Protective Requirements (See PPE in General Section):***

Sulfur Vesicants pose both a severe respiratory and severe contact hazard. Wear appropriate fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill or release events. Impregnated solids or thickened agents pose a less significant vapor hazard but a much more significant contact hazard. If impregnated solids have been released, dust control during windy conditions will be essential.

### ***Decontamination:***

**Vapor:** *Casualties/personnel:* Speed in decontamination is absolutely essential. Immediately wash skin and clothes with a bleach solution that is no less than one part household bleach in nine parts water. Rinse with copious amounts of water. To be effective, decontamination must be completed within one minute of exposure. In all cases, clothing should be removed because it may contain "trapped" vapor.

*Small Areas:* Decontaminate with copious amounts of full strength household bleach. Removal of porous material, including painted surfaces, that may have absorbed Vesicant vapor may be required as these materials could continue to re-release vapor after exposure has ceased.

**Liquid:** *Casualties/personnel:* Speed in decontamination is absolutely essential. Remove contaminated clothing immediately. Remove as much of the agent from the skin as fast as possible without spreading the material. Immediately wash skin and clothes with a bleach solution that is no less than one part household bleach in nine parts water. Rinse with copious amounts of water. To be effective, decontamination must be completed within one minute of exposure. In all cases, clothing should be removed because it may contain "trapped" liquid or vapor.

*Small Areas:* Puddles of liquid must be contained by covering with vermiculite, diatomaceous earth, clay, fine sand, sponges, paper towels or cloth towels. Remove all material and place in a container. Decontaminate the area with copious amounts of full strength household bleach. A 10 weight percent HTH pool bleach/water slurry may be substituted for the bleach solution. Removal of porous material, including painted surfaces, that may have absorbed Vesicant liquid may be required as these materials could continue to re-release vapor after exposure has ceased. Surfaces contaminated with Vesicants and only rinsed may

Impregnated  
Solid:

still evolve sufficient agent vapor to produce a physiological response.

*Casualties/personnel:* Speed in decontamination is absolutely essential. Remove contaminated clothing immediately. Remove as much of the agent from the skin as fast as possible without spreading the material. Immediately wash skin with a bleach solution that is no less than one part household bleach in nine parts water. Rinse with copious amounts of water. To be effective, decontamination must be completed within one minute of exposure. Remove all clothing from casualties regardless of apparent contamination. **Extreme care must be exercised when dealing with impregnated solids as agents may adhere to the skin or clothing and present a contact and inhalation hazard later.** Immediately wash clothes with a bleach solution that is no less than one part household bleach in nine parts water. Rinse with copious amounts of water.

*Small Areas:* Consolidate as much material as possible and place into containers. In heavily contaminated areas, employ vacuum devices equipped with High Efficiency Particulate Air (HEPA) filters to remove as much agent as possible. Decontaminate the area with copious amounts of full strength household bleach. A 10 weight percent HTH pool bleach/water slurry may be substituted for the bleach solution.

## First Aid

### *Signs & Symptoms:*

There is an asymptomatic latent period (4 to 24 hours) followed by inflammation and redness of the skin progressing to blisters. Exposure of the eyes to small amounts of vapor produces irritation and a feeling of grit in the eyes. There may also be inflammation of the eyes. Larger amounts of vapor cause swelling of the eyelids. Pain in the eyes may cause spasms and eventually cause the eyes to close. Upper respiratory signs vary with the amount of exposure and include nasal irritation, scratchy throat, laryngitis, and a feeling of shortness of breath.

### *Patient Management:*

Immediate decontamination of any exposure is essential. Otherwise, treatment consists of symptomatic management of lesions. If a casualty has inhaled sulfur vesicant vapor but does not display any signs or symptoms of

an impacted airway, it may still be appropriate to intubate the casualty since laryngeal spasms or edema may make it difficult or impossible later.

**Asymptomatic individuals suspected of exposure to vesicants should be kept under observation for at least 8 hours.**

***Antidotes:***

No antidote is available.

***Fatality Management:***

Remove all clothing; decontaminate with straight household bleach then incinerate at an appropriate facility. Wash cadaver with a bleach solution insuring the solution is introduced into the ears, nostrils, mouth, and any wounds. Pay particular attention to hair, scalp, pubic areas, fingernails and folds of skin where agent may get trapped. The solution should be no less than one part household bleach in one part water. Solution may be buffered with sodium bisulfate to a neutral pH in order to minimize the corrosive impacts on the cadaver. The bleach solution should remain in contact with the cadaver for a minimum of 5 minutes. Wash with soap and water. Cadaver should be screened for volatile agents. Agents that have been absorbed into the cadaver pose minimal secondary risk; however, it is prudent to perform air monitoring during all examinations. **Latex gloves do not offer sufficient protection prior to decontamination.**

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## Class Index C08

### Vesicants – Arsenic Based

#### General Chemical Structure



#### Toxicology

##### **Effects:**

Vesicants affect both exterior and interior parts of the body. Vesicants cause inflammation, blisters, and general destruction of tissues. Vapors have a greater impact on moist areas of the body. Eyes are especially susceptible to Vesicants. Inhalation of Vesicants can cause lung membranes to swell and become filled with liquid (pulmonary edema). Death may result from lack of oxygen. Arsenical Vesicants are also systemic agents and readily pass through the skin to affect susceptible tissue including blood cells and the liver. Arsenical Vesicants also act as Vomiting Agents (see Class Index C20) and produce violent sneezing and regurgitation. Arsenical Vesicants should be considered carcinogenic.

##### **Pathways:**

Vesicants are hazardous through inhalation, skin and eye exposure, ingestion, and abraded skin (e.g., breaks in the skin or penetration of skin by debris). Liquid agents are much more hazardous than their vapors.

##### **Exposure Hazards (See Specific Agent in Agent Index):**

Skin impacts from Arsenical Vesicant vapor occur at concentrations as low as 17 ppm (10 minute exposure).

Eye impacts from Arsenical Vesicant vapor occur at concentrations as low as 3 ppm (10 minute exposure). Permanent eye damage may occur at concentrations as low as 18 ppm (10 minute exposure).

LC<sub>50s</sub> for inhalation of Arsenical Vesicants are as low as 17 ppm (10 minute exposure).

LD<sub>50s</sub> for skin exposure to liquid Arsenical Vesicants are as low as 2.8 gm per individual.

Although sub-lethal doses of some Arsenical Vesicants are rapidly detoxified by the body, *many agents are not detoxified and exposures are cumulative.*

***Latency Period:***

Arsenical Vesicants produce pain immediately. Skin impacts begin appearing within minutes of exposure, although it may be up to 18 hours before the full lesion develops. Inhalation of high concentrations may be fatal in as short a time as 10 minutes. Pulmonary edema caused by inhalation of the agent vapor may be delayed for several hours.

**Characteristics*****Physical Appearance/Odor:***

Arsenical Vesicants are colorless to brown liquids. These agents generally have fruity or flowery odors although pure materials may be odorless. Agents can be thickened with various substances to increase their persistency and dermal hazard. When thickened, agents have a consistency similar to honey.

***Persistency:***

Arsenical Vesicants are persistent agents. However, agent vapors rapidly react with high humidity to lose most of their vesicant properties. Limited solubility slows the hydrolysis of liquid agents.

***Environmental Fate:***

Vapors from Arsenical Vesicants have a density greater than air and tend to collect in low places. Liquids are persistent but are rapidly decomposed by water. These agents are absorbed into porous material, including painted surfaces, and these materials could continue to re-release vapor after exposure has ceased. Agent vapor is rapidly decomposed by moisture in the air. The rate of hydrolysis of liquid agents is limited by their low solubility in water. The liquid density of these agents is greater than that of water.

**Additional Hazards*****Fire:***

Vesicants may be volatilized during a fire or be spread by efforts to extinguish the fire. Combustion of Arsenical Vesicants will produce volatile, toxic arsenic decomposition products. In addition, Arsenical Vesicants may react with steam or water during a fire to produce toxic, corrosive and/or flammable vapors. Hydrogen produced by the action of the corrosive vapors on metals or other corrodible materials may be present.

**Reactivity:**

Arsenical Vesicant vapors are decomposed rapidly by high humidity. Limited solubility slows the rate of hydrolysis of liquid agents.

**Hazardous Decomposition Products:**

**Hydrolysis:** Arsenical Vesicants produce hydrogen chloride (HCl) and arsenous oxides or arsenic salts when hydrolyzed. Some arsenical decomposition products may also have vesicant properties. Some agents may produce flammable gases.

**Combustion:** Volatile decomposition products may include hydrogen chloride (HCl) and arsenic oxides. In addition, a corrosive and/or toxic residue may remain.

**Protection****Evacuation (See Specific Agent in Agent Index):**

Immediately isolate an area around any liquid or solid contamination for at least 400 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized, persistence of the agent and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible. Depending on the persistence of the agent and the potential for condensation of agent from the cloud, evacuation of the threatened population after passage of the initial cloud may be appropriate.

**Field Detection/Identification (See Detector Characteristics in General Section):**

**Military:** *Vapor:* Lewisite is the only Arsenical Vesicants that can be detected by the M256A1 Kit and the M18A2.  
*Liquids:* Lewisite can be detected by M8 paper and all Arsenical Vesicants can be detected by M9 paper. Arsenical Vesicants can also be detected by the MM-1 in the FOX NBC Reconnaissance System.

**Civilian:** The APD 2000 provides semi-quantitative identification of Lewisite (L). Colorimetric tubes are available which can

detect organic arsenic compounds as well as arsine. Detection with PIDs or FIDs may be possible. Detection and identification with FT-IR is possible provided that the appropriate reference spectra are available.

***Personal Protective Requirements (See PPE in General Section):***

Arsenical Vesicants pose both a severe respiratory and severe contact hazard. Wear appropriate fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill or release events. Thickened agents pose a less significant vapor hazard but a much more significant contact hazard.

***Decontamination:***

Vapor: *Casualties/personnel:* Speed in decontamination is absolutely essential. Immediately wash skin and clothes with a bleach solution that is no less than one part household bleach in nine parts water. Rinse with copious amounts of water. To be effective, decontamination must be completed within one minute of exposure. In all cases, clothing should be removed because it may contain "trapped" vapor.

*Small Areas:* Decontaminate with copious amounts of full strength household bleach. Removal of porous material, including painted surfaces, that may have absorbed Arsenical Vesicant vapor may be required as these materials could continue to re-release vapor after exposure has ceased.

Liquid: *Casualties/personnel:* Speed in decontamination is absolutely essential. Remove contaminated clothing immediately. Remove as much of the agent from the skin as fast as possible without spreading the material. Immediately wash skin and clothes with a bleach solution that is no less than one part household bleach in nine parts water. Rinse with copious amounts of water. To be effective, decontamination must be completed within one minute of exposure. In all cases, clothing should be removed because it may contain "trapped" liquid or vapor.

*Small Areas:* Puddles of liquid must be contained by covering with vermiculite, diatomaceous earth, clay, fine sand, sponges, paper towels, or cloth towels. Remove all material and place in a container. Decontaminate the area with

copious amounts of household bleach. Removal of porous material, including painted surfaces, that may have absorbed Vesicant liquid may be required as these materials could continue to re-release vapor after exposure has ceased. Surfaces contaminated with Vesicants, then only rinsed may still evolve sufficient agent vapor to produce a physiological response.

## **First Aid**

### ***Signs & Symptoms:***

Pain and irritation from exposure to either agent liquid or vapor are immediate. Skin impacts may appear in as short a time as 5 minutes although full progression to blisters may not develop for up to 18 hours. Exposure of the eyes to small amounts of vapor produces immediate tearing and pain. Vomiting may occur as a result of exposure to Arsenical Vesicants. Upper respiratory signs vary with the amount of exposure and include nasal irritation, scratchy throat, laryngitis, and a feeling of shortness of breath.

### ***Patient Management:***

Immediate decontamination of any exposure is essential. Symptomatic management of lesions with administration of antidote for treatment of systemic effects.

**Asymptomatic individuals suspected of exposure to vesicants should be kept under observation for at least 8 hours.**

### ***Antidotes:***

BAL (British-Anti-Lewisite, dimercaprol) will alleviate some effects. BAL is available as a solution in oil for intramuscular administration to counteract systemic effects. BAL skin ointment and BAL ophthalmic ointment are not currently manufactured.

### ***Fatality Management:***

Remove all clothing; decontaminate with straight household bleach then incinerate at an appropriate facility. Wash cadaver with a bleach solution insuring the solution is introduced into the ears, nostrils, mouth, and any wounds. Pay particular attention to hair, scalp, pubic areas, fingernails, and folds of skin where agent may get trapped. The solution should be no less

than one part household bleach in one part water. Solution may be buffered with sodium bisulfate to a neutral pH in order to minimize the corrosive impacts on the cadaver. The bleach solution should remain in contact with the cadaver for a minimum of 5 minutes. Wash with soap and water. Cadaver should be screened for volatile agents. Agents that have been absorbed into the cadaver pose minimal secondary risk; however, it is prudent to perform air monitoring during all examinations. **Latex gloves do not offer sufficient protection prior to decontamination.**

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## Class Index C09

### Vesicants – Nitrogen Based

#### General Chemical Structure



#### Toxicology

##### **Effects:**

Vesicants affect both exterior and interior parts of the body. Vesicants cause inflammation, blisters, and general destruction of tissues. Vapors have a greater impact on moist areas of the body. Eyes are especially susceptible to vesicants. Inhalation of Vesicants can cause lung membranes to swell and become filled with liquid (pulmonary edema). Death may result from lack of oxygen. Vesicants are also systemic agents and readily pass through the skin to affect susceptible tissue including those that produce blood. Nitrogen Vesicants should be considered carcinogenic.

##### **Pathways:**

Vesicants are hazardous through inhalation, skin and eye exposure, ingestion, and abraded skin (e.g., breaks in the skin or penetration of skin by debris).

##### **Exposure Hazards (See Specific Agent in Agent Index):**

Skin impacts from Nitrogen Vesicant vapor occur at concentrations as low as 30 ppm (10 minute exposure).

Eye impacts from Nitrogen Vesicant vapor occur at concentrations as low as 1 ppm (10 minute exposure).

LC<sub>50s</sub> for inhalation of Nitrogen Vesicants are as low as 18 ppm (10 minute exposure).

LD<sub>50s</sub> for skin exposure to liquid Nitrogen Vesicants are as low as 0.7 gm per individual.

<p><b>Nitrogen vesicants are not detoxified by the body; exposures are cumulative.</b></p>
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***Latency Period:***

Tissue damage occurs within minutes of exposure to Nitrogen Vesicants, but clinical effects may not appear for up to 24 hours. Eye irritation may develop immediately. Pulmonary edema caused by inhalation of the agent vapor may be delayed for several hours.

**Characteristics*****Physical Appearance/Odor:***

Nitrogen Vesicants may be liquids or solids. Solid agents are not currently employed by the military. Agents may be colorless to yellow oily liquids. Nitrogen vesicants may be odorless, may have a fishy or musty odor in low concentrations or a fruity odor at higher concentrations.

***Persistency:***

Nitrogen Vesicants are among the most persistent agents and, under proper conditions, remain hazardous in soils for years.

***Environmental Fate:***

Vapors from Nitrogen Vesicants have a density greater than air and tend to collect in low places. Liquids are very persistent. These agents are absorbed into porous material, including painted surfaces, and these materials could continue to re-release vapor after exposure has ceased. Solubility in water ranges from sparingly soluble to insoluble. The liquid density of these agents is greater than that of water.

**Additional Hazards*****Fire:***

Vesicants may be volatilized during a fire or be spread by efforts to extinguish the fire. Agents may be decomposed by heat to produce other toxic and/or corrosive gases. In addition, Nitrogen Vesicants may react with steam or water during a fire to produce toxic and/or corrosive vapors. Hydrogen produced by the action of the corrosive vapors on metals or other corrodible materials may be present. Nitrogen Vesicants tend to polymerize and the polymerization products may present an explosion hazard.

***Reactivity:***

Nitrogen Vesicants tend to polymerize. Polymerization may generate enough heat to cause an explosion. In addition, polymerized components may

present an explosion hazard. Lack of solubility inhibits hydrolysis of Nitrogen Vesicants.

### ***Hazardous Decomposition Products:***

**Hydrolysis:** Nitrogen Vesicants produce hydrogen chloride (HCl) and ethanolamines when hydrolyzed. In addition, these agents form toxic, complex polymerization decomposition products.

**Combustion:** Volatile decomposition products may include hydrogen chloride (HCl) and nitrogen oxides (NO<sub>x</sub>). In addition, a corrosive and/or toxic residue may remain.

### **Protection**

#### ***Evacuation (See Specific Agent in Agent Index):***

Immediately isolate an area around any liquid or solid contamination for at least 400 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized, persistence of the agent and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible. Depending on the persistence of the agent and the potential for condensation of agent from the cloud, evacuation of the threatened population after passage of the initial cloud may be appropriate.

#### ***Field Detection/Identification (See Detector Characteristics in General Section):***

**Military:** *Vapor:* Some, but not all Nitrogen Vesicants can be detected by the CAM.  
*Liquids:* Nitrogen Vesicants can be detected by M8 and M9 papers, and the MM-1 in the FOX NBC Reconnaissance System.  
*Solids:* There are currently no methods for direct detection of solid agents fielded by the U.S. Military.

**Civilian:** The ADP 2000 provides semi-quantitative identification of nitrogen vesicants. Colorimetric tubes are available which can detect organic basic nitrogen compounds. Detection with PIDs or FIDs may be possible. Detection and identification with FT-IR is possible provided that the appropriate reference spectra are available.

### ***Personal Protective Requirements (See PPE in General Section):***

Nitrogen Vesicants pose both a severe respiratory and severe contact hazard. Wear appropriate fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill or release events. Solid agents pose a less significant vapor hazard but a much more significant contact hazard. If solid agents have been released, dust control during windy conditions will be essential.

### ***Decontamination:***

Vapor: *Casualties/personnel:* Speed in decontamination is absolutely essential. Immediately wash skin and clothes with a bleach solution that is no less than one part household bleach in nine parts water. Rinse with copious amounts of water. To be effective, decontamination must be completed within one minute of exposure. In all cases, clothing should be removed because it may contain "trapped" vapor.

*Small Areas:* Decontaminate with copious amounts of full strength household bleach. Removal of porous material, including painted surfaces, that may have absorbed Nitrogen Vesicant vapor may be required as these materials could continue to re-release vapor after exposure has ceased.

Liquid: *Casualties/personnel:* Speed in decontamination is absolutely essential. Remove contaminated clothing immediately. Remove as much of the agent from the skin as fast as possible without spreading the material. Immediately wash skin and clothes with a bleach solution that is no less than one part household bleach in nine parts water. Rinse with copious amounts of water. To be effective, decontamination must be completed within one minute of exposure. **However, to prevent systemic toxicity, decontamination should be done as late as 2 or 3 hours after exposure even if it increases the severity of the local reaction.** In all cases, clothing should be removed because it may contain "trapped" liquid or vapor.

*Small Areas:* Puddles of liquid must be contained by covering with vermiculite, diatomaceous earth, clay, fine sand, sponges, paper towels or cloth towels. Remove all material and place in a container. Decontaminate the area with copious amounts of household bleach. A 10 weight percent HTH/water slurry may be substituted for the bleach solution. Removal of porous material, including

painted surfaces, that may have absorbed Vesicant liquid may be required as these materials could continue to re-release vapor after exposure has ceased. Surfaces contaminated with Vesicants then only rinsed may still evolve sufficient agent vapor to produce a physiological response.

Solid:

*Casualties/personnel:* Speed in decontamination is absolutely essential. Remove contaminated clothing immediately. Remove as much of the agent from the skin as fast as possible without spreading the material. Immediately wash skin with a bleach solution that is no less than one part household bleach in nine parts water. Rinse with copious amounts of water. To be effective, decontamination must be completed within one minute of exposure. **However, to prevent systemic toxicity, decontamination should be done as late as 2 or 3 hours after exposure even if it increases the severity of the local reaction.** Remove all clothing from casualties regardless of apparent contamination. **Extreme care must be exercised when dealing with solids as agents may adhere to the skin or clothing and present a contact and inhalation hazard later.** Immediately wash clothes with a bleach solution that is no less than one part household bleach in nine parts water. Rinse with copious amounts of water.

*Small Areas:* Consolidate as much material as possible and place into containers. In heavily contaminated areas, employ vacuum devices equipped with High Efficiency Particulate Air (HEPA) filters to remove as much agent as possible. Decontaminate the area with copious amounts of full strength household bleach. A 10 weight percent HTH pool bleach/water slurry may be substituted for the bleach solution.

## First Aid

### *Signs & Symptoms:*

Mild vapor exposure may not produce skin lesions. There is an asymptomatic latent period (4 to 24 hours) followed by inflammation and redness of the skin progressing to blisters. Eye impacts, including irritation, tearing, and sensitivity to light may appear immediately. There may also be inflammation of the eyes. Larger amounts of vapor cause swelling of the eyelids. Pain in the eyes may cause spasms and eventually cause the eyes to close. Upper respiratory signs vary with the amount of exposure and include nasal irritation, scratchy throat, laryngitis, and a feeling of shortness of breath.

### ***Patient Management:***

Immediate decontamination of any exposure is essential. If the casualty has been exposed to Nitrogen Vesicant liquid, then **Decontamination should be done as late as 2 or 3 hours after exposure even if it increases the severity of the local reaction.** This must be done to prevent systemic toxicity. Otherwise, treatment consists of symptomatic management of lesions.

**Asymptomatic individuals suspected of exposure to vesicants should be kept under observation for at least 8 hours.**

### ***Antidotes:***

No antidote is available.

### ***Fatality Management:***

Remove all clothing; decontaminate with straight household bleach then incinerate at an appropriate facility. Wash cadaver with a bleach solution insuring the solution is introduced into the ears, nostrils, mouth, and any wounds. Pay particular attention to hair, scalp, pubic areas, fingernails, and folds of skin where agent may get trapped. The solution should be no less than one part household bleach in one part water. Solution may be buffered with sodium bisulfate to a neutral pH in order to minimize the corrosive impacts on the cadaver. The bleach solution should remain in contact with the cadaver for a minimum of 5 minutes. Wash with soap and water. Cadaver should be screened for volatile agents. Agents that have been absorbed into the cadaver pose minimal secondary risk; however, it is prudent to perform air monitoring during all examinations. **Latex gloves do not offer sufficient protection prior to decontamination.**

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## Class Index C10

### Vesicants – Mixture of Sulfur and Arsenic

#### General Chemical Structure

See Class Indices C07 and C08

#### Toxicology

##### **Effects:**

Sulfur/Arsenical Vesicants are mixtures of Sulfur Vesicants (see Class Index C07) and Arsenical Vesicants (see Class Index C08). Sulfur/Arsenical Vesicants affect both exterior and interior parts of the body. They cause inflammation, blisters, and general destruction of tissues. Vapors have a greater impact on moist areas of the body. Eyes are especially susceptible to vesicants. Inhalation of Vesicants can cause lung membranes to swell and become filled with liquid (pulmonary edema). Death may result from lack of oxygen. Sulfur/Arsenical Vesicants are systemic agents and readily pass through the skin to affect susceptible tissue including blood-forming tissues, blood cells, and the liver. Sulfur/Arsenical Vesicants are carcinogenic.

##### **Pathways:**

Vesicants are hazardous through inhalation, skin and eye exposure, ingestion, and abraded skin (e.g., breaks in the skin or penetration of skin by debris).

##### **Exposure Hazards (See Specific Agent in Agent Index):**

Skin impacts from Sulfur/Arsenical Vesicant vapor occur at concentrations as low as 15 ppm (10 minute exposure). Hot, moist skin is at greater risk. High risk areas include the crotch and armpits.

Eye impacts from Sulfur/Arsenical Vesicant vapor occur at concentrations as low as 3 ppm (10 minute exposure). Permanent eye damage may appear at concentrations as low as 18 ppm (10 minute exposure).

LC<sub>50s</sub> for inhalation of Sulfur/Arsenical Vesicants are as low as 6 ppm (10 minute exposure).

LD<sub>50s</sub> for skin exposure to liquid Sulfur/Arsenical Vesicants are as low as 2.8 gms per individual.

**Sulfur/arsenical vesicants are detoxified slowly or not at all by the body; exposures are essentially cumulative.**

### ***Latency Period:***

Sulfur/Arsenical Vesicants produce pain immediately. Skin impacts begin appearing within minutes of exposure, although it may be up to 18 hours before the full lesion develops. Inhalation of high concentrations may be fatal in as short a time as 10 minutes. Pulmonary edema caused by inhalation of the agent vapor may be delayed for several hours.

## **Characteristics**

### ***Physical Appearance/Odor:***

Sulfur/Arsenical Vesicants are liquids. Agents may be colorless when pure, but are generally amber to black. These agents generally have an odor similar to onions, garlic, or horseradish.

### ***Persistency:***

Sulfur/Arsenical Vesicants are persistent agents and, under proper conditions, remain hazardous in soils for several years. Thickened agents last significantly longer.

### ***Environmental Fate:***

Vapors from Sulfur/Arsenical Vesicants have a density greater than air and tend to collect in low places. Liquids are very persistent and have remained hazardous in soils for several years after a release. These agents are absorbed into porous material, including painted surfaces, and these materials could continue to re-release vapor after exposure has ceased. Solubility in water is negligible. The liquid density of these agents is greater than that of water.

## **Additional Hazards**

### ***Fire:***

Vesicants may be volatilized during a fire or be spread by efforts to extinguish the fire. Agents may be decomposed by heat to produce other toxic and/or corrosive gases. In addition, Sulfur/Arsenical Vesicants may react with steam or water during a fire to produce toxic and/or corrosive vapors. Hydrogen produced by the action of the corrosive vapors on metals or other corrodible materials may be present.

**Reactivity:**

Sulfur Vesicants are incompatible with strong oxidizers, such as dry HTH pool bleach, and will spontaneously ignite. Lack of solubility inhibits reaction of these agents with water.

**Hazardous Decomposition Products:**

- Hydrolysis: Sulfur/Arsenical Vesicants produce hydrogen chloride (HCl), thioglycols and/or thioethers and arsenous oxides or arsenic salts when hydrolyzed. Some arsenical decomposition products may also have vesicant properties. Some agents may produce flammable gases.
- Combustion: Volatile decomposition products may include hydrogen chloride (HCl), sulfur oxides (SO<sub>x</sub>) and arsenic oxides. In addition, a corrosive and toxic residue may remain.

**Protection****Evacuation (See Specific Agent in Agent Index):**

Immediately isolate an area around any liquid or solid contamination for at least 400 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized, persistence of the agent and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible. Depending on the persistence of the agent and the potential for condensation of agent from the cloud, evacuation of the threatened population after passage of the initial cloud may be appropriate.

**Field Detection/Identification (See Detector Characteristics in General Section):**

- Military: *Vapor:* Some, but not all components of Sulfur/Arsenical Vesicants can be detected by the M256A1 Kit, the CAM, and the M18A2.
- Liquids:* Some, but not all components of Sulfur/Arsenical Vesicants can be detected by M8 and in water by the M272 Kit. All components of Sulfur/Arsenical Vesicants can be detected by M9 papers, and the MM-1 in the FOX NBC Reconnaissance System.

Civilian: The APD 2000 provides semi-quantitative identification of sulfur mustard/Lewisite mixtures. Colorimetric tubes are available which can detect thioethers, organic arsenic compounds as well as arsine ( $\text{AsH}_3$ ). Detection with PIDs or FIDs may be possible. Detection and identification with FT-IR is possible provided that the appropriate reference spectra are available.

***Personal Protective Requirements (See PPE in General Section):***

Sulfur/Arsenical Vesicants pose both a severe respiratory and severe contact hazard. Wear appropriate fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill or release events. Thickened agents pose a less significant vapor hazard but a much more significant contact hazard.

***Decontamination:***

Vapor: *Casualties/personnel:* Speed in decontamination is absolutely essential. Immediately wash skin and clothes with a bleach solution that is no less than one part household bleach in nine parts water. Rinse with copious amounts of water. To be effective, decontamination must be completed within one minute of exposure. In all cases, clothing should be removed because it may contain "trapped" vapor.

*Small Areas:* Decontaminate with copious amounts of full strength household bleach. Removal of porous material, including painted surfaces, that may have absorbed Vesicant vapor may be required as these materials could continue to re-release vapor after exposure has ceased.

Liquid: *Casualties/personnel:* Speed in decontamination is absolutely essential. Remove contaminated clothing immediately. Remove as much of the agent from the skin as fast as possible without spreading the material. Immediately wash skin and clothes with a bleach solution that is no less than one part household bleach in nine parts water. Rinse with copious amounts of water. To be effective, decontamination must be completed within one minute of exposure. In all cases, clothing should be removed because it may contain "trapped" liquid or vapor.

*Small Areas:* Puddles of liquid must be contained by covering with vermiculite, diatomaceous earth, clay, fine sand, sponges, paper towels, or cloth towels. Remove all material and place in a container. Decontaminate the area with copious amounts of household bleach. A 10 weight percent

HTH pool bleach/water slurry may be substituted for the bleach solution. Removal of porous material, including painted surfaces, that may have absorbed Vesicant liquid may be required as these materials could continue to re-release vapor after exposure has ceased. Surfaces contaminated with Vesicants then only rinsed may still evolve sufficient agent vapor to produce a physiological response.

## **First Aid**

### ***Signs & Symptoms:***

Pain and irritation from exposure to either liquid or vapor are immediate. Skin impacts may appear as short a time as 5 minutes although full progression to blisters may not develop for 4 to 24 hours. Exposure of the eyes to small amounts of vapor produces immediate tearing and pain. Larger amounts of vapor cause swelling of the eyelids. Pain in the eyes may cause spasms and eventually cause the eyes to close. Upper respiratory signs vary with the amount of exposure and include nasal irritation, scratchy throat, laryngitis and a feeling of shortness of breath.

### ***Patient Management:***

Immediate decontamination of any exposure is essential. Symptomatic management of lesions with application of antidote for treatment of systemic effects.

**Asymptomatic individuals suspected of exposure to Vesicants should be kept under observation for at least 8 hours.**

### ***Antidotes:***

No antidote is available for treatment of the sulfur component of Sulfur/Arsenical Vesicants. BAL (British-Anti-Lewisite, dimercaprol) will alleviate some effects of the arsenical component. BAL is available as a solution in oil for intramuscular administration to counteract systemic effects. BAL skin ointment and BAL ophthalmic ointment are not currently manufactured.

### ***Fatality Management:***

Remove all clothing; decontaminate with straight household bleach then incinerate at an appropriate facility. Wash cadaver with a bleach solution insuring the solution is introduced into the ears, nostrils, mouth, and any wounds. Pay particular attention to hair, scalp, pubic areas, fingernails, and folds of skin where agent may get trapped. The solution should be no less than one part household bleach in one part water. Solution may be buffered with sodium bisulfate to a neutral pH in order to minimize the corrosive

impacts on the cadaver. The bleach solution should remain in contact with the cadaver for a minimum of 5 minutes. Wash with soap and water. Cadaver should be screened for volatile agents. Agents that have been absorbed into the cadaver pose minimal secondary risk; however, it is prudent to perform air monitoring during all examinations. **Latex gloves do not offer sufficient protection prior to decontamination.**

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## Class Index C11

### Urticants

#### General Chemical Structure

RC(NO<sub>2</sub>)X

#### Toxicology

##### **Effects:**

Urticants produce instant, almost intolerable pain. They cause local tissue destruction immediately on contact with skin and mucous membranes. Sensations range from mild prickling to almost intolerable pain resembling a severe bee sting. Direct contact of the agent with the skin produces a corrosive type lesion. Skin lesions may not fully heal for over 2 months. Inhalation of Urticant vapor can cause lung membranes to swell and become filled with liquid (pulmonary edema). Death may result from lack of oxygen.

##### **Pathways:**

Urticants are hazardous through inhalation, skin and eye exposure, and ingestion.

##### **Exposure Hazards (See Specific Agent in Agent Index):**

Skin impacts from Urticant vapor occur at concentrations as low as 0.04 ppm (10 minute exposure). Effects may become unbearable at a concentration of 0.6 ppm (one minute exposure).

Eye impacts from Urticant vapor occur at very low concentrations.

LC<sub>50s</sub> for inhalation of Urticants are as low as 69 ppm (10 minute exposure).

LD<sub>50s</sub> for skin exposure to Urticants are as low as 1.8 gm per individual.

##### **Latency Period:**

Urticants produce immediate effects on skin and eyes. Pulmonary edema caused by inhalation of the agent vapor may be delayed for several hours.

## **Characteristics**

### ***Physical Appearance/Odor:***

Urticants are colorless liquids or crystalline solids. Odors are intense, penetrating, disagreeable, and violently irritating.

### ***Persistence:***

Urticants are unstable and decompose rapidly in soil. Agents are relatively nonpersistent on surfaces and in water.

### ***Environmental Fate:***

Vapors from Urticants have a density greater than air and tend to collect in low places. Urticants are unstable and decompose rapidly in soil. Agents dissolve slowly but completely in water and may take days to decompose once in solution.

## **Additional Hazards**

### ***Fire:***

Urticants may be volatilized during a fire or be spread by efforts to extinguish the fire. Agents may be decomposed by heat to produce other toxic and/or corrosive gases. In addition, Urticants may react with steam or water during a fire to produce toxic and/or corrosive vapors. Hydrogen produced by the action of the corrosive vapors on metals or other corrodible materials may be present.

### ***Reactivity:***

Urticants are corrosive to most metals. Traces of iron chloride, formed by action of hydrogen chloride (HCl) — a decomposition product of Urticants — on iron, may cause explosive decomposition. Urticants react violently to alkaline solutions.

### ***Hazardous Decomposition Products:***

- Hydrolysis: Urticants produce hydrogen chloride (HCl) and hydroxylamines.
- Combustion: Volatile decomposition products may include hydrogen chloride (HCl), nitrogen oxides (NO<sub>x</sub>) and toxic dimerization products.

## Protection

### ***Evacuation (See Specific Agent in Agent Index):***

Immediately isolate an area around any liquid or solid contamination for at least 400 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized, persistence of the agent and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible. Depending on the persistence of the agent and the potential for condensation of agent from the cloud, evacuation of the threatened population after passage of the initial cloud may be appropriate.

### ***Field Detection/Identification (See Detector Characteristics in General Section):***

Military:           *Vapor:* Urticants can be detected by the M256A1 Kit and the M18A2 Kit.  
                          *Liquids:* Urticants can be detected by M8 and M9 papers, and the MM-1 in the FOX NBC Reconnaissance System.

Civilian:            Detection with PIDs or FIDs may be possible. Detection and identification with FT-IR is possible provided that the appropriate reference spectra are available.

### ***Personal Protective Requirements (See PPE in General Section):***

Urticants pose both a severe respiratory and severe contact hazard. Wear appropriate fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill or release events.

### ***Decontamination:***

*Casualties/personnel:* Speed in decontamination is absolutely essential. Because of the rapid reaction of Urticants with skin, decontamination will not be entirely effective after pain occurs. Nevertheless, decontamination should be accomplished as rapidly as possible by flushing the area with copious amounts of water to remove any agent that has not reacted with the skin. In all cases, clothing should be removed because it may contain "trapped" agent.

*Small Areas:* Use large amounts of water to wash the agents into collection areas. Rinse water and runoff may contain active agent. Because Urticants are only slowly dissolved in water, and because rinsing may drive agents into cracks and crevices, decontamination will not be entirely effective.

## **First Aid**

### ***Signs & Symptoms:***

Urticant vapors are violently irritating to the eyes. Very low concentrations can cause inflammation, lacrymation, and temporary blindness; higher concentrations can cause corneal corrosion and dimming of vision. Solid, liquid or vapor contact with the skin can cause corrosive type lesions. Within 30 seconds after contact, the skin becomes pale and a red ring surrounds the area. Swelling below the skin follows in about 15 minutes and a wheal is formed. After 24 hours, the skin in the central blanched area becomes brown and dies. A scab is formed in a few days. Healing is accompanied by sloughing of the scab; itching may be present throughout healing. Urticants may cause pulmonary edema through inhalation or skin absorption.

### ***Patient Management:***

Immediate decontamination of any exposure is essential. Otherwise, treatment consists of symptomatic management of lesions.

### ***Antidotes:***

No antidote is available.

### ***Fatality Management:***

Remove all clothing; decontaminate with straight household bleach then incinerate at an appropriate facility. Wash cadaver with a bleach solution insuring the solution is introduced into the ears, nostrils, mouth, and any wounds. Pay particular attention to hair, scalp, pubic areas, fingernails, and folds of skin where agent may get trapped. The solution should be no less than one part household bleach in one part water. Solution may be buffered with sodium bisulfate to a neutral pH in order to minimize the corrosive impacts on the cadaver. The bleach solution should remain in contact with the cadaver for a minimum of 5 minutes. Wash with soap and water. Cadaver should be screened for volatile agents. Agents that have been absorbed into the cadaver pose minimal secondary risk; however, it is prudent to perform air monitoring during all examinations. **Latex gloves do not offer sufficient protection prior to decontamination.**

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## Class Index C12

### Blood Agents – General

#### General Chemical Structure

R-CN or H<sub>2</sub>S

#### Toxicology

##### **Effects:**

Blood Agents are compounds that stop the transfer of oxygen from the blood system to the rest of the body by inhibiting the enzyme cytochrome oxidase. The lack of oxygen rapidly affects all body tissues, especially the central nervous system. Some Blood Agents will also cause lung membranes to swell and become filled with liquid (pulmonary edema).

##### **Pathways:**

Blood Agents are primarily an inhalation hazard. However, liquid agents are hazardous through skin and eye exposure, ingestion, and abraded skin (e.g., breaks in the skin or penetration of skin by debris). At high concentrations, agents vapor may pose a skin absorption hazard. Agents may be mixed with solvents (i.e., carbon disulfide (CS<sub>2</sub>), chloroform (CHCl<sub>3</sub>)) or other hazardous components (i.e., arsenic trichloride (AsCl<sub>3</sub>), stannic chloride (SnCl<sub>4</sub>) or various chloroformic acid esters) to increase their persistency, pulmonary effects, and/or skin/eye toxicity.

##### **Exposure Hazards (See Specific Agent in Agent Index):**

LC<sub>50</sub>s for inhalation of Blood Agents are as low as 180 ppm (10 minute exposure).

LD<sub>50</sub>s for skin exposure to liquid Blood Agents are as low as 7 gm per individual

##### **Latency Period:**

Vapor: Effects from vapor exposure begin to appear 1 to 2 minutes after exposure. Pulmonary edema caused by inhalation of some Blood Agents may be delayed for several hours.

Liquid: Effects from liquid exposure may be delayed from several minutes up to 2 hours after exposure.

## **Characteristics**

### ***Physical Appearance/Odor:***

Blood Agents are either volatile liquids or gases. Most agents are colorless. Odors vary from mildly pleasant to harsh and irritating. The ability to detect the odor of some agents is transient and may provide the impression that agents are no longer present. Some agents, especially in high concentration, may cause eye irritation and tearing. Agents may be mixed with solvents (i.e., carbon disulfide (CS<sub>2</sub>), chloroform (CHCl<sub>3</sub>)) or other hazardous components (i.e., arsenic trichloride (AsCl<sub>3</sub>), stannic chloride (SnCl<sub>4</sub>), or various chloroformic acid esters) to increase their persistency and/or skin/eye toxicity. The color, odor, and consistency of these mixtures will vary depending on the concentration of agents and nature of the solvents/components.

### ***Persistency:***

Blood Agents are non-persistent. Cold weather may increase persistency by decreasing the rate of volatilization of any liquid agents.

### ***Environmental Fate:***

The environmental fate of Blood Agents is highly dependant on the agent. Due to volatile nature of Blood Agents, there is minimal extended risk except in an enclosed or confined space. Blood Agent vapors have densities that range from slightly less than air to significantly greater than air. Vapors, therefore, may or may not collect in low places. The solubility of Blood Agent in water ranges from completely soluble to almost insoluble. The liquid densities of these agents range from approximately half that of water to significantly greater than water.

## **Additional Hazards**

### ***Fire:***

Some Blood Agents are flammable and can form explosive mixtures with air. Some Blood Agents may polymerize and explode when heated. Blood Agents may be volatilized during a fire or be spread by efforts to extinguish the fire. Some Blood Agents are highly water soluble and runoff may pose a significant hazard. In addition, some Blood Agents may react with steam or water during a fire to produce toxic and/or corrosive vapors. Hydrogen produced by the action of the corrosive vapors on metals or other corrodible materials may be present. Solvents mixed with some agents are flammable and may pose an additional fire hazard. Added components may react with steam or water during a fire to produce toxic, flammable, and/or corrosive vapors.

### **Reactivity:**

Many Blood Agents must be stabilized or they will polymerize on standing. Some Blood Agents are slowly hydrolyzed by water to produce corrosive and toxic gases. Blood Agents are incompatible with strong oxidizers; many are incompatible with strong corrosives. Added components may react with water to produce toxic, flammable and/or corrosive vapors.

### **Hazardous Decomposition Products:**

- Hydrolysis: Some Blood Agents are highly soluble and stable in water. Others decompose into hydrogen cyanide (HCN) and corrosives such as hydrogen chloride (HCl) or hydrogen bromide (HBr). Some components may produce arsenous oxides or arsenic salts when hydrolyzed.
- Combustion: Volatile decomposition products may include nitrogen oxides (NO<sub>x</sub>), sulfur oxides (SO<sub>x</sub>) and hydrogen chloride (HCl) or hydrogen bromide (HBr). Some components may produce arsenic oxides.

### **Protection**

#### **Evacuation (See Specific Agent in Agent Index):**

Immediately isolate an area around any liquid or solid contamination for at least 300 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized, persistence of the agent and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible. Depending on the persistence of the agent and the potential for condensation of agent from the cloud, evacuation of the threatened population after passage of the initial cloud may be appropriate.

#### **Field Detection/Identification (See Detector Characteristics in General Section):**

- Military: *Vapor:* Cyanide Blood Agents can be detected by the M256A1 Kit, and by the MM-1 in the FOX NBC Reconnaissance System.
- Liquids:* Cyanide Blood Agents can be detected by M9 papers, the MM-1 in the FOX NBC Reconnaissance System, and in water by the M272 Kit.

Civilian: Colorimetric tubes are available that can detect hydrogen sulfide (H<sub>2</sub>S), hydrogen cyanide (HCN) and cyanogen chloride (ClCN). Detection of some Blood Agents with PIDs or FIDs may be possible. In addition, because of the high flammability of some of the agents, combustible gas indicators can be used to screen for agents. However, the detection limits will be far in excess of lethal limits. Detection and identification with FT-IR is possible provided that the appropriate reference spectra are available.

***Personal Protective Requirements (See PPE in General Section):***

Blood Agents are primarily a respiratory hazard; however, liquids or high vapor concentrations may pose a percutaneous hazard. Wear appropriate fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill or release events.

***Decontamination:***

Vapor: Ventilation. Because the boiling point of some cyanide Blood Agents is near normal room temperature (70°F), agent vapors may condense on cooler surfaces and pose a percutaneous hazard. Liquids can then re-volatilize when the temperature rises.

Liquid: *Casualties/personnel:* Remove wet clothing from individuals and wash exposed skin with large amounts of water. *Small Areas:* Ventilation. In heavily contaminated areas, decontaminate by washing with copious amounts of household bleach followed by rinsing with water.

**First Aid**

***Signs & Symptoms:***

Most indications of Blood Agent poisoning are non-specific. For most cyanides, casualties experience few effects when exposed to less than lethal doses. These may include temporary increase in breathing rate, dizziness, nausea, vomiting, and headache. Classic "cherry-red" skin and lips attributed to cyanide poisoning are not always present. Some Blood Agents may produce eye, nose and throat irritation similar to Tear Agents (see Class Indices C17 through C19). Pulmonary edema caused by some Blood Agents may be delayed for several hours. Inhalation of a high concentration of Blood Agents may produce temporary rapid and deep breathing followed by convulsions and unconsciousness. The casualty will stop breathing within 2 to 4 minutes after exposure. Death will occur 4 to 8 minutes after exposure.

***Patient Management:***

Remove casualty to fresh air and provide oxygen for respiratory distress. Antidote should be administered as soon as possible. If halogenated Blood Agents are suspected, asymptomatic individuals should be monitored for possible complications caused by pulmonary edema.

***Antidotes:***

The Lilly Cyanide Antidote Kit contains amyl nitrite, sodium nitrite, and sodium thiosulfate. Dimethylaminophenol, cobalt edetate, or vitamin B<sub>12a</sub> are alternative antidotes for cyanide poisoning.

***Fatality Management:***

Remove all clothing; ship to appropriate hazardous waste disposal facility. Although most Blood Agents are volatile and will rapidly volatilize, some agents become liquids at or near room temperature and can pose a contact hazard. Solutions of blood agents in water also pose a contact hazard. Wash cadaver with a bleach solution insuring the solution is introduced into the ears, nostrils, mouth, and any wounds. Pay particular attention to hair, scalp, pubic areas, fingernails, and folds of skin where agent may get trapped. The solution should be no less than one part household bleach in one part water. Solution may be buffered with sodium bisulfate to a neutral pH in order to minimize the corrosive impacts on the cadaver. The bleach solution should remain in contact with the cadaver for a minimum of 5 minutes. Wash with soap and water. Cadaver should be screened for volatile agents. Agents that have been absorbed into the cadaver pose minimal secondary risk; however, it is prudent to perform air monitoring during all examinations. **Latex gloves do not offer sufficient protection prior to decontamination.**

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## Class Index C13

### Blood Agents – Arsenic Based

#### General Chemical Structure

$\text{As}_2\text{H}_3$  or Arsenic Alloys

#### Toxicology

##### **Effects:**

Arsenical Blood Agents are compounds that affect the ability of the blood system to carry oxygen by destroying red blood cells. The lack of oxygen rapidly affects all body tissues, especially the central nervous system. Arsenical Blood Agents may also affect the kidneys, liver, and heart. Arsenical Blood Agents are carcinogenic.

##### **Pathways:**

Arsenical Blood Agents are an inhalation hazard.

##### **Exposure Hazards (See Specific Agent in Agent Index):**

Inhalation  $\text{LC}_{50\text{s}}$  of Arsenical Blood Agents are as low as 157 ppm (10 minute exposure).

##### **Latency Period:**

Effects from exposure can be delayed from 20 minutes up to 36 hours depending on the level of exposure.

#### Characteristics

##### **Physical Appearance/Odor:**

Arsenical Blood Agents are gases or solids. Gases are colorless with a mild garlic-like odor. Effects from cumulative exposure may occur at levels below the odor threshold. Solids produce arsine gas ( $\text{AsH}_3$ ) when they come into contact with moisture.

##### **Persistency:**

Gaseous Arsenical Blood Agents are non-persistent. Solid agents will retain the potential to produce arsine ( $\text{AsH}_3$ ) until they react with water.

### ***Environmental Fate:***

Due to the volatile nature of gaseous Arsenical Blood Agents, there is minimal extended risk except in an enclosed or confined space. Solid agents pose an extended risk in that agents will retain the potential to produce arsine gas ( $\text{AsH}_3$ ) until they react with water. Vapors have a density greater than air and tend to collect in low places. Most agents have minimal solubility in water.

### **Additional Hazards**

#### ***Fire:***

Arsenical Blood Agents are highly flammable gases that may form explosive mixtures in air. Hydrogen gas produced by photolytic decomposition of the agents may be present. Decomposition of the agents during a fire will produce poisonous arsenic oxides that may be present in smoke from the fire. Solid agents will react with water to form arsine gas ( $\text{AsH}_3$ ).

#### ***Reactivity:***

Arsenical Blood Agents are incompatible with strong oxidizers and various metals (e.g., aluminum, copper, brass, nickel). Arsenical Blood Agents may decompose on exposure to light to produce hydrogen gas and arsenic metal. Solid agents will react with water to form arsine gas ( $\text{AsH}_3$ ).

#### ***Hazardous Decomposition Products:***

Hydrolysis: Arsenical Blood Agents are rapidly decomposed by water to form arsenic acids and other arsenic products.

Combustion: Volatile decomposition products include arsenic oxides. Arsenical Blood Agents may decompose to hydrogen gas and arsenic metal if heated in a sealed container.

### **Protection**

#### ***Evacuation (See Specific Agent in Agent Index):***

Immediately isolate an area around any liquid or solid contamination for at least 400 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized, persistence of the agent and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible. Depending on the persistence of the agent and the potential for condensation of agent from the

cloud, evacuation of the threatened population after passage of the initial cloud may be appropriate.

***Field Detection/Identification (See Detector Characteristics in General Section):***

**Military:** Arsenical Blood Agents are not identifiable by military detection equipment.

**Civilian:** Colorimetric tubes are available that can detect arsine. Detection of Arsenical Blood Agents with PIDs or FIDs may be possible. In addition, because of the high flammability of the agents, combustible gas indicators can be used to screen for agents. However, the detection limits will be far in excess of lethal limits. Detection and identification with FT-IR is possible provided that the appropriate reference spectra are available.

***Personal Protective Requirements (see PPE in General Section):***

Arsenical Blood Agents are primarily a respiratory hazard. However, decomposition products may pose a contact hazard. Wear appropriate fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill or release events.

***Decontamination:***

Ventilation. If decomposition occurs, arsenic metal or arsenic oxides may be present and require additional appropriate decontamination.

**First Aid**

***Signs & Symptoms:***

Immediate symptoms may include giddiness, headache, lightheadedness, and dizziness. After a latency period, symptoms may include chills, headache, malaise, weakness, dizziness, difficult breathing, abdominal pain, nausea, vomiting, jaundice, bloody urine, and coma.

**Asymptomatic individuals suspected of exposure to arsenical blood agents should be evaluated at a medical facility for hematological, renal and/or hepatic damage.**

***Patient Management:***

Remove casualty to fresh air and provide oxygen for respiratory distress. In severe cases, blood transfusions may be required.

***Antidotes:***

No antidote is available.

***Fatality Management:***

Remove all clothing; ship to appropriate hazardous waste disposal facility. If solid (reactive) agents have been released, care must be taken to remove as much solid agent as possible prior to decontamination. Wash cadaver with copious amounts of soap and water. Pay particular attention to ears, nostrils, mouth, wounds, hair, scalp, pubic areas, fingernails, and folds of skin where agent may get trapped. Cadaver should be screened for volatile agents. Agents that have been absorbed into the cadaver pose minimal secondary risk; however, it is prudent to perform air monitoring during all examinations.

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## **Class Index C14**

### **Choking Agents**

#### **General Chemical Structure**

Halogens or R-C(O)X or MX<sub>x</sub> or M(CO)<sub>x</sub>

#### **Toxicology**

##### ***Effects:***

Choking Agents injure an unprotected person chiefly in the respiratory tract. In extreme cases, membranes swell, lungs become filled with liquid (pulmonary edema), and death results from lack of oxygen. Some agents can also readily pass through the skin to induce systemic intoxication.

##### ***Pathways:***

Choking Agents are primarily an inhalation hazard although in high concentrations, agents and decomposition products may exhibit some corrosive properties on skin. Exposure to solid, liquid or gaseous halogens may pose a significant dermal hazard. Some agents also readily pass through the skin to induce systemic intoxication.

##### ***Exposure Hazards (See Specific Agent in Agent Index):***

LC<sub>50S</sub> for inhalation of Choking Agents are as low as 35 ppm (10 minute exposure).

##### ***Latency Period:***

Pulmonary effects are usually delayed 2 to 24 hours. Exposure to high concentrations may produce immediate symptoms. Generally, the more rapid the onset of symptoms, the more grave the prognosis.

#### **Characteristics**

##### ***Physical Appearance/Odor:***

Choking Agents are either volatile liquids or gases. Most agents are colorless. Odors vary from mildly pleasant to harsh and irritating. Some agents, especially in high concentration, may cause eye irritation and tearing. Choking Agents have been absorbed into porous powders (e.g., pumice) and disseminated as dust clouds. The agents are slowly released by the dust particles thereby greatly increasing the persistency of the agents.

**Persistency:**

Choking Agents are non-persistent. Cold weather may decrease the rate of volatilization of any liquids present and increase persistency. Agents absorbed into porous powders may be significantly more persistent than normal. Decomposition products from the breakdown of some Choking Agents can pose a persistent hazard.

**Environmental Fate:**

Due to volatile nature of Choking Agents, there is minimal extended risk except in an enclosed or confined space. Vapors have a density greater than air and tend to collect in low places. Most agents have minimal solubility in water.

**Additional Hazards****Fire:**

Most Choking Agents are either non-flammable or difficult to ignite. Some Choking Agents are strong oxidizers and will support combustion. Agents may be decomposed by heat to produce other toxic and/or corrosive gases. In addition, Choking Agents may react with steam or water during a fire to produce toxic and/or corrosive vapors. Hydrogen produced by the action of the corrosive vapors on metals or other corrodible materials may be present.

**Reactivity:**

Some Choking Agents readily react with water while others are slowly decomposed by water. Some are oxidizers and will support combustion.

**Hazardous Decomposition Products:**

**Hydrolysis:** Most Choking Agents produce corrosive decomposition products that may include hydrogen chloride (HCl), hydrogen bromide (HBr), hydrogen fluoride (HF), and/or hydrogen cyanide (HCN) as well as metallic hydroxides.

**Combustion:** Volatile decomposition products may include hydrogen chloride (HCl), hydrogen bromide (HBr), hydrogen fluoride (HF), and/or hydrogen cyanide (HCN). Agents containing nickel or arsenic will produce nickel oxides (NiO<sub>x</sub>) or arsenic oxides (AsO<sub>x</sub>).

**Protection****Evacuation (See Specific Agent in Agent Index):**

Immediately isolate an area around any liquid or solid contamination for at least 400 feet in all directions. If possible, identify the agent and develop a

downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized, persistence of the agent and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible. Depending on the persistence of the agent and the potential for condensation of agent from the cloud, evacuation of the threatened population after passage of the initial cloud may be appropriate.

***Field Detection/Identification (See Detector Characteristics in General Section):***

- Military: The only Choking Agent which can be detected in the field is phosgene. This is done with either the M18A2 kit or by the MM-1, which is a component of the FOX NBC Reconnaissance System.
- Civilian: Colorimetric tubes are available that can detect phosgene ( $\text{COCl}_2$ ), nickel tetracarbonyl ( $\text{Ni}(\text{CO})_3$ ), inorganic arsenic compounds, chloroformates and halogens. Detection of some Choking Agents with PIDs or FIDs may be possible. Detection and identification with FT-IR is possible provided that the appropriate reference spectra are available.

***Personal Protective Requirements (See PPE in General Section):***

Choking Agents are primarily a respiratory hazard; however, high concentrations may pose a dermal hazard due to the corrosive/oxidative nature of some of the agents. Wear appropriate fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill or release events. If impregnated solids have been released, dust control during windy conditions will be essential.

***Decontamination:***

- Vapor: Ventilation.
- Liquid: *Casualties/personnel:* Remove wet clothing from exposed individuals and wash exposed skin with large amounts of water.  
*Small Areas:* Most liquid agents are highly volatile and may quickly evaporate. Puddles of liquid may be contained by covering with vermiculite, diatomaceous earth, clay, fine sand, sponges, paper towels, or cloth towels. Remove all material and place in a container.

**Impregnated  
Solid:**

*Casualties/personnel:* Remove contaminated clothing from exposed individuals and wash exposed skin with large amounts of water.

*Small Areas:* Consolidate as much material as possible and place into containers. In heavily contaminated areas, employ vacuum devices equipped with High Efficiency Particulate Air (HEPA) filters to remove as much agent as possible. Ventilate any enclosed or confined spaces.

## **First Aid**

### ***Signs & Symptoms:***

Exposure to low concentrations may not produce immediate effects. However, the severity of poisoning is not related to the presentation or magnitude of immediate symptoms. Symptoms may include eye and airway irritation, tearing, shortness of breath, coughing, wheezing, chest tightness, and delayed pulmonary edema. If halogens have been released, there may be redness of the skin, chemical burns or even thermal burns.

### ***Patient Management:***

Remove casualty to fresh air and provide oxygen for respiratory distress. **Enforce rest as even minimal physical exertion may shorten the clinical latent period.**

**Asymptomatic individuals suspected of exposure to choking agent should be kept under observation for at least 6 hours.**

### ***Antidotes:***

No antidote is available. Chelation therapy may be appropriate for exposure to agents containing heavy metals.

### ***Fatality Management:***

Remove all clothing; ship to appropriate hazardous waste disposal facility. Wash cadaver with copious amounts of soap and water. Pay particular attention to ears, nostrils, mouth, wounds, hair, scalp, pubic areas, fingernails, and folds of skin where agent may get trapped. Cadaver should be screened for volatile agents. Agents that have been absorbed into the cadaver pose minimal secondary risk; however, it is prudent to perform air monitoring during all examinations.

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## Class Index C15

### Choking Agents – Metal Fume

#### General Chemical Structure

MO<sub>x</sub>

#### Toxicology

##### **Effects:**

Choking Agents injure an unprotected person chiefly in the respiratory tract. In extreme cases, membranes swell, lungs become filled with liquid (pulmonary edema), and death results from lack of oxygen. Some agents may also pose a dermal hazard.

##### **Pathways:**

Metal Fume Choking Agents are primarily delivered employing incendiary devices, allowing the smoke plume to carry the agents. These agents are primarily an inhalation hazard although in high concentrations, agents and decomposition products may pose a dermal hazard.

##### **Exposure Hazards (See Specific Agent in Agent Index):**

Human toxicity data for these agents has not been published or has not been established. However, the industrial IDLH levels for these agents are as low as 2 ppms.

##### **Latency Period:**

Pulmonary effects are usually delayed 2 to 24 hours. Exposure to high concentrations may produce immediate symptoms. Generally, the more rapid the onset of symptoms, the more grave the prognosis.

#### Characteristics

##### **Physical Appearance/Odor:**

Agents are odorless solids dispersed as aerosols from incendiary devices. Depending on various factors, the aerosol may or may not be visible.

**Persistency:**

Aerosols of agents are not persistent. However, the solid agents can persist in the environment for extended periods. Since the primary route of exposure to Metal Fume Choking Agents is through inhalation and agents have very little vapor pressure, there is minimal risk once the initial aerosol has settled. However, re-suspension of any dust contaminated with metal oxides can pose a continuing hazard.

**Environmental Fate:**

Metal Fume Choking Agents are metal oxides deployed as dust aerosols that have no appreciable vapor. Once the aerosols settle, there is minimal extended hazard from the agents unless the dust is re-suspended. Oxides are generally insoluble in water.

**Additional Hazards****Fire:**

Metal Fume Choking Agents are generally deployed by an incendiary device. In addition, agents may be volatilized during a fire or be spread by efforts to extinguish the fire.

**Reactivity:**

Agents may be incompatible with strong acids or reducing agents.

**Hazardous Decomposition Products:**

Hydrolysis: None.

Combustion: Metal Fume Choking Agents are combustion decomposition products of heavy metals.

**Protection****Evacuation (See Specific Agent in Agent Index):**

Immediately isolate an area around the fire for at least 200 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the size of the fire, the amount of material aerosolized and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible.

***Field Detection/Identification (See Detector Characteristics in General Section):***

- Military: There are currently no methods for identification of Metal Fume Choking Agents fielded by the U.S. Military.
- Civilian: Samples may be collected and analyzed at a standard laboratory.

***Personal Protective Requirements (See PPE in General Section):***

Metal Fume Choking Agents are primarily a respiratory hazard; however, contact with solid agents may pose both a local and systemic hazard. Wear appropriate fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill or release events. If bulk agents are dispersed without the aid of an incendiary device, dust control during windy conditions will be essential.

***Decontamination:***

*Casualties/personnel:* Remove contaminated clothing. Wash potentially exposed area with copious amounts of water.

*Small Areas:* Consolidate as much solid material as possible and place in appropriate containers. Care should be made to minimize the aerosolization of agent. In heavily contaminated areas, employ vacuum devices equipped with High Efficiency Particulate Air (HEPA) filters to remove as much dust as possible.

**First Aid**

***Signs & Symptoms:***

Exposure to low concentrations may not produce immediate effects. However, the severity of poisoning is not related to the presentation or magnitude of immediate symptoms. Symptoms may include headache, nausea, vomiting, eye and airway irritation, shortness of breath, coughing, wheezing, chest tightness, and delayed pulmonary edema.

***Patient Management:***

Remove casualty to fresh air and provide oxygen for respiratory distress. **Enforce rest as even minimal physical exertion may shorten the clinical latent period.**

**Asymptomatic individuals suspected of exposure to choking agent should be kept under observation for at least 6 hours.**

***Antidotes:***

No antidote is available. Chelation therapy may be appropriate to minimize systemic toxicity.

***Fatality Management:***

Remove all clothing; ship to appropriate hazardous waste disposal facility. Wash cadaver with copious amounts of soap and water. Pay particular attention to ears, nostrils, mouth, wounds, hair, scalp, pubic areas, fingernails, and folds of skin where agent may get trapped. Agents that have been absorbed into the cadaver pose minimal secondary risk.

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## **Class Index C16**

### **Incapacitating Agents**

#### **General Chemical Structure**

Varies greatly.

#### **Toxicology**

##### ***Effects:***

Incapacitating Agents produce their effects mainly by altering or disrupting the higher regulatory activity of the central nervous system. In normal usage, Incapacitating Agents will not cause permanent or long-lasting injury. Unlike Tear Agents (see Class Indices C17 through C19) or Vomiting Agents (see Class Index C20), Incapacitating Agents produce effects that may last for hours or days after exposure to the agent has ceased. There are two main types of Incapacitating Agents. Depressant Incapacitating Agents have the predominant effect of depressing or blocking the activity of the central nervous system, often by interfering with the transmission of neural impulses across synapses. These agents may disturb the higher integrative functions of memory, problem-solving, attention, and comprehension. High doses may produce delirium. Stimulant Incapacitating Agents 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.

##### ***Pathways:***

Incapacitating Agents are primarily a hazard via the inhalation pathway. However, ingestion, abraded skin (e.g., breaks in the skin or penetration of skin by debris) or dermal exposure may also produce effects.

##### ***Exposure Hazards (See Specific Agent in Agent Index):***

This class of agents does not seriously endanger life except at exposures greatly exceeding an effective dose. The military does not consider lethal agents at sub-lethal doses as Incapacitating Agents. Incapacitating effects from agents may occur at concentrations as low as several milligrams per cubic meter.

***Latency Period:***

Effects from exposure may appear in seconds or may be delayed up to several hours depending on the specific agent. Effects from dermal exposure may be delayed up to several days.

**Characteristics*****Physical Appearance/Odor:***

Agents may be solids, liquids, or gases. Many solid agents are actually salts of oily organic compounds. Agents may or may not have an odor.

***Persistence:***

Agents may be non-persistent or persistent depending on the specific agent and environmental conditions.

***Environmental Fate:***

Varies depending on the specific agent. Agents which are salts may be significantly more soluble in water than the parent compound. Neutralization of salts may significantly change the environmental fate of the agents.

**Additional Hazards*****Fire:***

Incapacitating Agents may be volatilized during a fire or be spread by efforts to extinguish the fire. Agents may be decomposed by heat to produce other toxic and/or corrosive gases. In addition, Incapacitating Agents may react with steam or water during a fire to produce toxic and/or corrosive vapors. Hydrogen produced by the action of the corrosive vapors on metals or other corrodible materials may be present.

***Reactivity:***

Some agents may be slowly decomposed by water.

***Hazardous Decomposition Products:***

Hydrolysis: Varies depending on specific agent.

Combustion: Volatile decomposition products may include nitrogen oxides (NO<sub>x</sub>), aromatic hydrocarbons such as benzene, as well as potentially toxic lower molecular weight hydrocarbons.

## **Protection**

### ***Evacuation (See Specific Agent in Agent Index):***

Immediately isolate an area around any liquid or solid contamination for at least 200 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized, persistence of the agent and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible. Depending on the persistence of the agent and the potential for condensation of agent from the cloud, evacuation of the threatened population after passage of the initial cloud may be appropriate.

### ***Field Detection/Identification (See Detector Characteristics in General Section):***

Military:	There are currently no field methods for detection of Incapacitating Agents employed by the U.S. Military.
Civilian:	Varies according to agent used. Many Incapacitating Agents have minimal vapor pressure making field detection difficult.

### ***Personal Protective Requirements (See PPE in General Section):***

While Incapacitating Agents primarily pose a severe respiratory hazard, they may also pose a significant contact hazard. Wear appropriate fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill or release events. Solid agents pose a less significant vapor hazard but a much more significant contact hazard. If solid agents have been released, dust control during windy conditions will be essential.

### ***Decontamination:***

*Casualties/personnel:* Wash the entire potentially exposed area with a bleach solution avoiding contact with sensitive areas such as the eyes. The bleach solution should be no less than one part household bleach in nine parts water. Rinse with copious amounts of water. Delayed effects, as much as 24 hours after exposure, can occur even though the skin was washed within 1 hour of exposure. In all cases, clothing should be removed because it may contain "trapped" agent.

*Small Areas:* In heavily contaminated areas, employ vacuum devices equipped with High Efficiency Particulate Air (HEPA) filters to remove as much agent as possible. Wash all surfaces with straight household bleach followed by soap and water. Rinse with copious amounts of water.

## **First Aid**

### ***Signs & Symptoms:***

Varies according to the specific agent. Care must be taken in that many signs and symptoms associated with exposure to Incapacitating Agents are also associated with an anxiety attack. Potential indications of exposure include restlessness, dizziness, confusion, erratic behavior, inappropriate smiling or laughing, irrational fear, difficulty in expressing self (mumbling, slurred or nonsensical speech), euphoria, lethargy, trembling, pleading, crying, perceptual distortions, hallucinations, disrobing, stumbling or staggering, blurred vision, dilated pupils, flushed face, elevated temperature, dry mouth, stomach cramps, vomiting, change in pulse rate (slow or elevated), change in blood pressure (lowered or elevated), stupor or coma.

### ***Patient Management:***

General treatment consists of observation, supportive care with fluids, and possibly restraint or confinement. Casualties should be isolated in a safe area. Remove any potentially harmful material from individuals suspected of being exposed to Incapacitating Agents including such items as cigarettes, matches, medications, and other small items they might attempt to ingest. Observe casualties for signs of heatstroke as some Incapacitating Agents eliminate the ability of exposed individuals to sweat. Monitor to insure that casualties are breathing. If casualties become comatose and regurgitate, there is a risk that they may aspirate vomituous material. Casualties will usually recover from exposure to Incapacitating Agents without medical treatment; however, full recovery from effects may take several days.

### ***Antidotes:***

Varies depending on the agent. Some of the common potential types of Incapacitating Agents include anticholinergics, indoles, and cannabinoids. Because of the widely differing means of producing incapacitation within these categories, no medication should be given until reasonably certain of the specific agent to which casualties have been exposed.

***Fatality Management:***

Remove all clothing; decontaminate with straight household bleach then incinerate at an appropriate facility. Wash cadaver with a bleach solution insuring the solution is introduced into the ears, nostrils, mouth, and any wounds. Pay particular attention to hair, scalp, pubic areas, fingernails, and folds of skin where agent may get trapped. The solution should be no less than one part household bleach in one part water. Solution may be buffered with sodium bisulfate to a neutral pH in order to minimize the corrosive impacts on the cadaver. The bleach solution should remain in contact with the cadaver for a minimum of 5 minutes. Wash with soap and water. Cadaver should be screened for volatile agents. Agents that have been absorbed into the cadaver pose minimal secondary risk; however, it is prudent to perform air monitoring during all examinations. **Latex gloves do not offer sufficient protection prior to decontamination.**

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## **Class Index C17**

### **Tear Agents – Halogenated**

#### **General Chemical Structure**

Varies greatly.

#### **Toxicology**

##### ***Effects:***

Tear Agents cause tears and intense eye pain. They may also irritate the respiratory tract, causing the sensation that the casualty has difficulty breathing. In high concentrations, tear compounds are irritating to the skin and cause a temporary burning or itching sensation. High concentration can also cause burns, nausea, and/or vomiting. In an enclosed or confined space, very high concentration of Tear Agents can be lethal.

##### ***Pathways:***

Tear Agents are primarily an eye-contact and inhalation hazard. Aerosols and vapors are irritating to the eyes and skin at low concentrations but relatively nontoxic via these pathways.

##### ***Exposure Hazards (See Specific Agent in Agent Index):***

IC<sub>50s</sub> (tearing) impacts from eye exposure to Halogenated Tear Agent vapor occur at concentrations as low as 1 mg/m<sup>3</sup> (10 minute exposure).

LC<sub>50s</sub> for inhalation of Halogenated Tear Agents are as low as 200 mg/m<sup>3</sup> (10 minute exposure).

##### ***Latency Period:***

Tear Agents produce instantaneous effects.

#### **Characteristics**

##### ***Physical Appearance/Odor:***

Halogenated Tear Agents may be liquids or solids. Agents are colorless to yellow in appearance. Odors of Halogenated Tear Agents range from floral to pepper-like.

**Persistence:**

When Tear Agents are employed as aerosols they are not persistent. However, a significant release of Tear Agent can deposit large amounts of solid or liquid material and pose a persist hazard.

**Environmental Fate:**

Tear Agents vapors have a density greater than air and tend to collect in low places. Agents may be absorbed into porous material, including painted surfaces, and these materials may be difficult to decontaminate. Tear Agents are essentially insoluble in water and have densities that range from near water to greater than water. Lack of solubility inhibits reaction of these agents with water.

**Additional Hazards****Fire:**

Halogenated Tear Agents may be volatilized during a fire or be spread by efforts to extinguish the fire. Agents may be decomposed by heat to produce other toxic, corrosive and/or flammable vapors. Hydrogen produced by the action of the corrosive vapors on metals or other corrodible materials may be present.

**Reactivity:**

Halogenated Tear Agents are generally very slowly decomposed by water. Agents may be corrosive and can react with metal. In some cases these reactions may be violent. Most Halogenated Tear Agents are incompatible with strong oxidizers, including chlorine bleach, and may produce toxic decomposition products.

**Hazardous Decomposition Products:**

Hydrolysis: Halogenated Tear Agents may produce hydrogen chloride (HCl), hydrogen cyanide (HCN), hydrogen bromide (HBr), and/or aromatic hydrocarbons as well as complex condensation products when hydrolyzed.

Combustion: Volatile decomposition products of Halogenated Tear Agents may include hydrogen chloride (HCl), hydrogen bromide (HBr), hydrogen cyanide (HCN), phosgene (COCl<sub>2</sub>), benzene and/or halogenated aromatic compounds.

## **Protection**

### ***Evacuation (See Specific Agent in Agent Index):***

Immediately isolate an area around any liquid or solid contamination for at least 200 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized, persistence of the agent and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible. Depending on the persistence of the agent and the potential for condensation of agent from the cloud, evacuation of the threatened population after passage of the initial cloud may be appropriate.

### ***Field Detection/Identification (See Detector Characteristics in General Section):***

Military:	There are currently no methods for identification of Tear Agents fielded by the U.S. Military.
Civilian:	The APD 2000 provides qualitative identification of mace (CN). Colorimetric tubes are available which can detect halogenated hydrocarbons. Detection of agents with PIDs or FIDs may be possible. Detection and identification of agent vapors with FT-IR is possible provided that the appropriate reference spectra are available. Incendiary aerosols of Tear Agents may not be detectable by FT-IR because of defraction of the beam.

### ***Personal Protective Requirements (See PPE in General Section):***

Tear Agents are primarily an eye and respiratory hazard; however, at elevated concentrations, agents may also pose a dermal hazard. Wear appropriate fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill or release events. If solid agents have been released, dust control during windy conditions will be essential.

### ***Decontamination:***

Aerosols/Vapor: *Casualties/personnel:* Ventilation. If decontamination is deemed appropriate, flush skin with cool water followed

by soap and warm water. **Do not use bleach or detergents containing bleach as they may interact with agents to produce toxic decomposition products.**

*Small Areas:* Ventilation. In heavily contaminated areas, employ vacuum devices equipped with High Efficiency Particulate Air (HEPA) filters to remove as much agent as possible. If necessary, wash with copious amounts of alkaline detergent and water. **Do not use bleach or detergents containing bleach as they may interact with agents to produce highly toxic decomposition products.** Porous surfaces may be difficult to decontaminate.

Liquid/Solid:

*Casualties/personnel:* Remove contaminated clothing immediately. Wash skin with copious amounts of cool water followed by soap and warm water. **Do not use bleach or detergents containing bleach as they may interact with agents to produce toxic decomposition products.**

*Small Areas:* Consolidate as much solid material as possible and place in appropriate containers. Care should be made to minimize the aerosolization of agent. Employ vacuum devices equipped with High Efficiency Particulate Air (HEPA) filters to remove as much dust as possible. If necessary, wash (wet-vac) with copious amounts of alkaline detergent and water. **Do not use bleach or detergents containing bleach as they may interact with agents to produce toxic decomposition products.** Porous surfaces may be difficult to decontaminate.

## First Aid

### *Signs & Symptoms:*

Tear Agents produce intense eye pain and tearing. They may also produce burning or stinging sensations of exposed mucous membranes (e.g., nose and mouth) and skin. Symptoms may also include rhinorrhea (runny nose), sneezing, coughing, respiratory discomfort (tightness of the chest or inability to breathe), nausea and/or vomiting. Increases in ambient temperature and/or humidity exacerbate agent effects.

### *Patient Management:*

Casualties will usually recover from exposure to Tear Agents within 15 minutes after removal from the contaminated atmosphere. **Do not allow casualties to rub eyes or skin as this will exacerbate agent effects.**

***Antidotes:***

None.

***Fatality Management:***

Remove all clothing; ship to appropriate hazardous waste disposal facility. Wash cadaver with copious amounts of soap and water. Pay particular attention to ears, nostrils, mouth, wounds, hair, scalp, pubic areas, fingernails, and folds of skin where agent may get trapped. Cadaver should be screened for volatile agents. Cadaver poses no significant secondary hazards after decontamination.

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## **Class Index C18**

### **Tear Agents – Non-Halogenated**

#### **General Chemical Structure**

Varies greatly.

#### **Toxicology**

##### ***Effects:***

Tear Agents cause tears and intense eye pain. They may also irritate the respiratory tract, causing the sensation that the casualty has difficulty breathing. In high concentrations, tear compounds are irritating to the skin and cause a temporary burning or itching sensation. High concentration can also cause burns, nausea, and/or vomiting. In an enclosed or confined space, very high concentration of Tear Agents can be lethal.

##### ***Pathways:***

Tear Agents are primarily an eye-contact and inhalation hazard. Aerosols and vapors are irritating to the eyes and skin at low concentrations but relatively nontoxic via these pathways.

##### ***Exposure Hazards (See Specific Agent in Agent Index):***

IC<sub>50s</sub> (tearing) impacts from eye exposure to Non-Halogenated Tear Agent vapor occur at concentrations as low as 0.15 mg/m<sup>3</sup>.

LC<sub>50s</sub> for inhalation of Non-Halogenated Tear Agents have not been established or are not published.

##### ***Latency Period:***

Tear Agents produce instantaneous effects.

#### **Characteristics**

##### ***Physical Appearance/Odor:***

Non-halogenated Tear Agents may be liquids or solids. Agents are colorless to yellow or brown in appearance. Odors of Non-halogenated Tear Agents range from sweetish to simply producing a burning sensation in the nose and nasal passages.

**Persistency:**

When Tear Agents are employed as aerosols they are not persistent. However, a significant release of Tear Agent can deposit large amounts of solid or liquid material and pose a persist hazard.

**Environmental Fate:**

Tear Agents vapors have a density greater than air and tend to collect in low places. Agents may be absorbed into porous material, including painted surfaces, and these materials may be difficult to decontaminate. Tear Agents are essentially insoluble in water and have densities that range from near water to greater than water. Lack of solubility inhibits reaction of these agents with water.

**Additional Hazards****Fire:**

Non-halogenated Tear Agents may be volatilized during a fire or be spread by efforts to extinguish the fire. Agents may be decomposed by heat to produce other toxic, and/or flammable vapors.

**Reactivity:**

Non-halogenated Tear Agents generally do not react with water or are very slowly decomposed by water. Non-halogenated Tear Agents are incompatible with strong oxidizers, including chlorine bleach, and may produce toxic decomposition products.

**Hazardous Decomposition Products:**

- Hydrolysis: Non-halogenated Tear Agents are generally stable in contact with water. However, should hydrolysis occur, decomposition products may include hydrogen cyanide (HCN) and/or aromatic hydrocarbons.
- Combustion: Volatile decomposition products of Non-halogenated Tear Agents may include hydrogen cyanide (HCN), nitrogen oxides (NO<sub>x</sub>), benzene and/or aromatic hydrocarbons.

**Protection****Evacuation (See Specific Agent in Agent Index):**

Immediately isolate an area around any liquid or solid contamination for at least 400 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index). Adjust the initial isolation

distance as appropriate. Based on the type of release, amount of material aerosolized, persistence of the agent and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible. Depending on the persistence of the agent and the potential for condensation of agent from the cloud, evacuation of the threatened population after passage of the initial cloud may be appropriate.

***Field Detection/Identification (See Detector Characteristics in General Section):***

- Military: There are currently no methods for identification of Tear Agents fielded by the U.S. Military.
- Civilian: Detection of agents with PIDs or FIDs may be possible. Detection and identification of agent vapors with FT-IR is possible provided that the appropriate reference spectra are available. Incendiary aerosols of Tear Agents may not be detectable by FT-IR because of defraction of the beam.

***Personal Protective Requirements (See PPE in General Section):***

Tear Agents are primarily an eye and respiratory hazard; however, at elevated concentrations, agents may also pose a dermal hazard. Wear appropriate fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill or release events. If solid agents have been released, dust control during windy conditions will be essential.

***Decontamination:***

Aerosols/Vapor: *Casualties/personnel:* Ventilation. If decontamination is deemed appropriate, flush skin with cool water followed by soap and warm water. **Do not use bleach or detergents containing bleach as they may interact with agents to produce toxic decomposition products.**

*Small Areas:* Ventilation. In heavily contaminated areas, employ vacuum devices equipped with High Efficiency Particulate Air (HEPA) filters to remove as much agent as possible. If necessary, wash with copious amounts of alkaline detergent and water. **Do not use bleach or detergents containing bleach as they may interact with agents to produce toxic decomposition products.** Porous surfaces may be difficult to decontaminate.

Liquid/Solid: *Casualties/personnel:* Remove contaminated clothing immediately. Wash skin with copious amounts of cool water followed by soap and warm water. **Do not use bleach or detergents containing bleach as they may interact with agents to produce toxic decomposition products.**  
*Small Areas:* Consolidate as much solid material as possible and place in appropriate containers. Care should be made to minimize the aerosolization of agent. Employ vacuum devices equipped with High Efficiency Particulate Air (HEPA) filters to remove as much dust as possible. If necessary, wash (wet-vac) with copious amounts of alkaline detergent and water. **Do not use bleach or detergents containing bleach as they may interact with agents to produce toxic decomposition products.** Porous surfaces may be difficult to decontaminate.

## First Aid

### *Signs & Symptoms:*

Tear Agents produce intense eye pain and tearing. They may also produce burning or stinging sensations of exposed mucous membranes (e.g., nose and mouth) and skin. Symptoms may also include rhinorrhea (runny nose), sneezing, coughing, respiratory discomfort (tightness of the chest or inability to breathe), nausea and/or vomiting. Increases in ambient temperature and/or humidity exacerbate agent effects.

### *Patient Management:*

Casualties will usually recover from exposure to Tear Agents within 15 minutes after removal from the contaminated atmosphere. **Do not allow casualties to rub eyes or skin as this will exacerbate agent effects.**

### *Antidotes:*

None.

### *Fatality Management:*

Remove all clothing; ship to appropriate hazardous waste disposal facility. Wash cadaver with copious amounts of soap and water. Pay particular attention to ears, nostrils, mouth, wounds, hair, scalp, pubic areas, fingernails, and folds of skin where agent may get trapped. Cadaver should be screened for volatile agents. Cadaver poses no significant secondary hazards after decontamination.

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## **Class Index C19**

### **Tear Agents – In Solvents**

#### **General Chemical Structure**

Varies greatly.

#### **Toxicology**

##### ***Effects:***

Tear Agents cause tears and intense eye pain. They may also irritate the respiratory tract, causing the sensation that the casualty has difficulty breathing. In high concentrations, tear compounds are irritating to the skin and cause a temporary burning or itching sensation. High concentration can also cause burns, nausea, and/or vomiting. In an enclosed or confined space, very high concentration of Tear Agents can be lethal. Both Halogenated (Class Index C17) and Non-Halogenated (Class Index C18) Tear Agents may be dispersed in solvents. Typical solvents include propylene glycol, benzene, carbon tetrachloride, chloroform, and/or trioctylphosphite. In many cases, solvents will increase the efficacy of the Tear Agent.

##### ***Pathways:***

Tear Agents are primarily an eye-contact and inhalation hazard. Aerosols and vapors are irritating to the skin and eyes at low concentrations but relatively nontoxic via these routes. Solvents may increase the eye, dermal and/or inhalation hazards of the Tear Agents as well as pose toxic hazards themselves (e.g., chloroform, carbon tetrachloride, and benzene).

##### ***Exposure Hazards (See Specific Agent in Agent Index):***

IC<sub>50S</sub> (tearing) impacts from eye exposure to vapor from Tear Agents dispersed in solvents occur at concentrations as low as 0.15 mg/m<sup>3</sup> (10 minute exposure).

LC<sub>50S</sub> for inhalation of Tear Agents dispersed in solvents occur at concentrations as low as 1,100 mg/m<sup>3</sup> (10 minute exposure).

##### ***Latency Period:***

Tear Agents produce instantaneous effects.

## **Characteristics**

### ***Physical Appearance/Odor:***

Agents are solutions or suspensions in solvents. Agent odor and/or appearance (see Class Indices C17 and C18) may be altered or masked by the solvent.

### ***Persistency:***

When Tear Agents are employed as aerosols, they are not persistent. However, a significant release of Tear Agent can deposit large amounts of solid or liquid material and pose a persist hazard.

### ***Environmental Fate:***

Tear Agents vapors have a density greater than air and tend to collect in low places. Agents may be absorbed into porous material, including painted surfaces, and these materials may be difficult to decontaminate. Tear Agents are essentially insoluble in water and have densities that range from near water to greater than water. Lack of solubility inhibits reaction of these agents with water. Further, solvents used to disperse Tear Agents are generally insoluble in water and will help prevent interaction of the agent with water. Solvents may have densities less than or greater than water and may cause agents to either float or sink in a water column.

## ***Additional Hazards***

### ***Fire:***

Tear Agents may be volatilized during a fire or be spread by efforts to extinguish the fire. Agents may be decomposed by heat to produce other toxic, corrosive and/or flammable vapors. Hydrogen produced by the action of the corrosive vapors on metals or other corrodible materials may be present. Solvents may or may not be flammable. Combustion of solvents may produce toxic, corrosive and/or flammable vapors.

### ***Reactivity:***

Tear Agents generally do not react with water or are very slowly decomposed by water. Tear Agents may be corrosive and react with metal. In some cases these reactions may be violent. Most Tear Agents are incompatible with strong oxidizers, including chlorine bleach, and may produce toxic decomposition products. Solvents used to disperse Tear Agents may be incompatible with strong oxidizers and may decompose to form toxic and/or corrosive decomposition products.

### ***Hazardous Decomposition Products:***

- Hydrolysis: Tear Agents are generally stable or very slowly decomposed by water. Further, solvents used to disperse Tear Agents are generally insoluble in water and will help prevent interaction of the agent with water. However, should hydrolysis occur, decomposition products may include hydrogen chloride (HCl), hydrogen cyanide (HCN), hydrogen bromide (HBr), and/or aromatic hydrocarbons as well as complex condensation products.
- Combustion: Volatile decomposition products of Tear Agents in Solution may include hydrogen chloride (HCl), hydrogen bromide (HBr), hydrogen cyanide (HCN), phosgene (COCl<sub>2</sub>), benzene, nitrogen oxides (NO<sub>x</sub>), aromatic hydrocarbons, and/or halogenated aromatic compounds.

### **Protection**

#### ***Evacuation (See Specific Agent in Agent Index):***

Immediately isolate an area around any liquid or solid contamination for at least 400 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized, persistence of the agent and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible. Depending on the persistence of the agent and the potential for condensation of agent from the cloud, evacuation of the threatened population after passage of the initial cloud may be appropriate.

#### ***Field Detection/Identification (See Detector Characteristics in General Section):***

- Military: There are currently no methods for identification of Tear Agents fielded by the U.S. Military.
- Civilian: The APD 2000 provides qualitative identification of pepper spray (oc). Colorimetric tubes are available which can detect halogenated hydrocarbons. Detection of agents with PIDs or FIDs may be possible. Colorimetric tubes are available which can detect many solvents used to disperse Tear Agents. Detection of solvents used to disperse Tear Agents may be possible with FIDs or PIDs. Detection and identification of either Tear Agent or solvent vapors with FT-IR is

possible provided that the appropriate reference spectra are available. Aerosols of Tear Agents may not be detectable by FT-IR because of defraction of the beam.

***Personal Protective Requirements (See PPE in General Section):***

Tear Agents are primarily an eye and respiratory hazard; however, in elevated concentrations, agents may also pose a dermal hazard. In addition to increasing the efficacy and/or dermal hazard of Tear Agents, solvents themselves may also pose respiratory or contact hazards. Wear appropriate fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill or release events.

***Decontamination:***

Aerosols/Vapor: *Casualties/personnel:* Ventilation. If decontamination is deemed appropriate, flush skin with cool water followed by soap and warm water. **Do not use bleach or detergents containing bleach as they may interact with agents to produce toxic decomposition products.**

*Small Areas:* Ventilation. In heavily contaminated areas, employ vacuum devices equipped with High Efficiency Particulate Air (HEPA) filters to remove as much agent as possible. If necessary, wash with copious amounts of alkaline detergent and water. **Do not use bleach or detergents containing bleach as they may interact with agents to produce toxic decomposition products.** Porous surfaces may be difficult to decontaminate.

Liquid/Solid: *Casualties/personnel:* Remove contaminated clothing immediately. Wash skin with copious amounts of cool water followed by soap and warm water. **Do not use bleach or detergents containing bleach as they may interact with agents to produce toxic decomposition products.**

*Small Areas:* Consolidate as much solid material as possible and place in appropriate containers. Care should be made to minimize the aerosolization of agent. Employ vacuum devices equipped with High Efficiency Particulate Air (HEPA) filters to remove as much dust as possible. If necessary, wash (wet-vac) with copious amounts of alkaline detergent and water. **Do not use bleach or detergents containing bleach as they may interact with agents to produce toxic decomposition products.** Porous surfaces may be difficult to decontaminate.

## **First Aid**

### ***Signs & Symptoms:***

Tear Agents produce intense eye pain and tearing. They may also produce burning or stinging sensations of exposed mucous membranes (e.g., nose and mouth) and skin. Symptoms may also include rhinorrhea (runny nose), sneezing, coughing, respiratory discomfort (tightness of the chest or inability to breath), nausea and/or vomiting. Increases in ambient temperature and/or humidity exacerbate agent effects. Effects from solvents will be minimal in comparison to the impacts caused by Tear Agents.

### ***Patient Management:***

Casualties will usually recover from exposure to Tear Agents within 15 minutes after removal from the contaminated atmosphere. **Do not allow casualties to rub eyes or skin as this will exacerbate agent effects.**

### ***Antidotes:***

None.

### ***Fatality Management:***

Remove all clothing; ship to appropriate hazardous waste disposal facility. Wash cadaver with copious amounts of soap and water. Pay particular attention to ears, nostrils, mouth, wounds, hair, scalp, pubic areas, fingernails, and folds of skin where agent may get trapped. Cadaver should be screened for volatile agents. Cadaver poses no significant secondary hazards after decontamination.

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## Class Index C20

### Vomiting Agents

#### General Chemical Structure

$R_2\text{-AsCl}$  or  $R_2\text{-AsCN}$  or  $R_3\text{-Sb}$  or  $R_4\text{-Pb}$

#### Toxicology

##### **Effects:**

Vomiting Agents, originally developed as sternutators (sneezing agents), cause regurgitation. They may also cause coughing, sneezing, pain in the nose and throat, nasal discharge, and/or tears. Headaches often follow exposure to vomiting agents. Vomiting Agents may produce dermatitis on exposed skin. When released in an enclosed or confined space, vomiting agents can cause serious illness or death. Many vomiting agents contain arsenic as a constituent and decomposition products may pose a serious health hazard.

##### **Pathways:**

Vomiting Agents are primarily an inhalation hazard. Aerosols are irritating to the skin and eyes at low concentrations but relatively nontoxic via these routes. However, direct eye or skin contact with the liquid or solid agents may pose both a significant local and systemic hazard. Ingestion of Vomiting Agents or some decomposition products may pose a significant hazard.

##### **Exposure Hazards (See Specific Agent in Agent Index):**

$IC_{50s}$  (sneezing, and regurgitation) for inhalation of Vomiting Agents are as low as  $1.2 \text{ mg/m}^3$  (10 minute exposure).

$LC_{50s}$  for inhalation of Vomiting Agents are as low as  $1,000 \text{ mg/m}^3$  (10 minute exposure).

##### **Latency Period:**

Depending on dose, the effects from exposure may be delayed from 30 seconds to several minutes and last up to several hours. Mild effects may persist for several days.

## **Characteristics**

### ***Physical Appearance/Odor:***

Vomiting Agents are colorless liquids or colorless to light yellow or green solids. Odors range from non-detectable to pleasantly sweet to garlic or bitter almonds.

### ***Persistency:***

When Vomiting Agents are employed as aerosols they are not persistent. However, liquid or solid agents can persist in the environment for extended periods. If solid agents are deployed as aerosols, there is minimal secondary risk once the initial aerosol has settled. However, resuspension of any dust contaminated with Vomiting Agents can pose a continuing hazard. Decomposition products from the breakdown of Vomiting Agents can pose a persistent hazard.

### ***Environmental Fate:***

Most Vomiting Agents form no appreciable vapor and are deployed as dust aerosols. Once the aerosols settle, there is minimal extended hazard from the agents unless the dusts are resuspended. Decomposition products can be persistent hazards.

## **Additional Hazards**

### ***Fire:***

Vomiting Agents may be volatilized during a fire or be spread by efforts to extinguish the fire. Combustion of Vomiting Agents will produce volatile toxic metal (i.e., arsenic, antimony lead) decomposition products. In addition, combustion of Vomiting Agents may produce other toxic, corrosive and/or flammable vapors. Hydrogen produced by the action of the corrosive vapors on metals or other corrodible materials may be present.

### ***Reactivity:***

Vomiting Agents are generally slow to decompose in water. Some agents are self-protecting and form a protective oxide coating that delays further hydrolysis. Agents may be corrosive to some metals.

### ***Hazardous Decomposition Products:***

Hydrolysis: Vomiting Agents may produce hydrogen chloride (HCl), hydrogen cyanide (HCN), organic oxides of arsenic, antimony, tin, lead, or bismuth when hydrolyzed.

Combustion: Volatile decomposition products of Vomiting Agents may include hydrogen chloride (HCl), hydrogen cyanide (HCN), benzene, and/or oxides of arsenic, antimony, tin, lead, or bismuth.

## **Protection**

### ***Evacuation (See Specific Agent in Agent Index):***

Immediately isolate an area around any liquid or solid contamination for at least 200 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized, persistence of the agent and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible. Depending on the persistence of the agent and the potential for condensation of agent from the cloud, evacuation of the threatened population after passage of the initial cloud may be appropriate.

### ***Field Detection/Identification (See Detector Characteristics in General Section):***

Military: There are currently no methods for identification of Vomiting Agents fielded by the U.S. Military.

Civilian: Colorimetric tubes are available which can detect organic arsenic compounds as well as arsine ( $\text{AsH}_3$ ). However, since these agents form no appreciable vapor, it is unlikely that these methods will be effective in identifying Vomiting Agents.

### ***Personal Protective Requirements (see PPE in General Section):***

Vomiting Agents are primarily a respiratory hazard; however, contact with liquid or solid agents may pose both a local and systemic hazard. Wear appropriate fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill or release events.

### ***Decontamination:***

Aerosols: *Casualties/personnel:* Ventilation. If decontamination is deemed appropriate, wash the entire potentially exposed area with a bleach solution avoiding contact with sensitive

areas such as the eyes. The bleach solution should be no less than one part household bleach in nine parts water. Rinse with copious amounts of water.

*Small Areas:* Ventilation. In heavily contaminated areas, employ vacuum devices equipped with High Efficiency Particulate Air (HEPA) filters to remove as much dust as possible. If necessary, decontaminate by washing with copious amounts of household bleach followed by rinsing with water. Arsenic or antimony metal and/or oxides, due to decomposition of the agents, may be present and require additional decontamination.

Solids:

*Casualties/personnel:* Wash the entire potentially exposed area with a bleach solution avoiding contact with sensitive areas such as the eyes. The bleach solution should be no less than one part household bleach in nine parts water. Rinse with copious amounts of water.

*Small Areas:* Consolidate as much solid material as possible and place in appropriate containers. Care should be made to minimize the aerosolization of agent. Employ vacuum devices equipped with High Efficiency Particulate Air (HEPA) filters to remove as much dust as possible. If necessary, wash with copious amounts of straight household bleach followed by rinsing with water. Arsenic or antimony metal and/or oxides, due to decomposition of the agents, may be present and require additional decontamination.

## **First Aid**

### ***Signs & Symptoms:***

Progression of symptoms is generally irritation of the eyes and mucous membranes, viscous discharge from the nose similar to that caused by a cold, violent uncontrollable sneezing and coughing, severe headache, acute pain and difficulty breathing (tightness of the chest), nausea, and vomiting. Mental depression may occur. Severe effects last from 30 minutes to several hours. Minor effects may persist for 24 hours or longer.

### ***Patient Management:***

Casualties will usually recover from exposure to Vomiting Agents within 2 hours after removal from the contaminated atmosphere. Vigorous exercise may lessen and shorten symptoms.

### ***Antidotes:***

None.

***Fatality Management:***

Remove all clothing; ship to appropriate hazardous waste disposal facility. Wash cadaver with a bleach solution insuring the solution is introduced into the ears, nostrils, mouth, and any wounds. Pay particular attention to hair, scalp, pubic areas, fingernails, and folds of skin where agent may get trapped. The solution should be no less than one part household bleach in one part water. Solution may be buffered with sodium bisulfate to a neutral pH in order to minimize the corrosive impacts on the cadaver. The bleach solution should remain in contact with the cadaver for a minimum of 5 minutes. Wash with soap and water. Cadaver should be screened for volatile agents. Cadaver poses no significant secondary hazards after decontamination.

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## **Class Index C21**

### **Corrosive Smoke**

#### **General Chemical Structure**

Reactive Materials or Acid Halides and (Acid Anhydrides or Concentrated Acids)

#### **Toxicology**

##### ***Effects:***

Corrosive Smoke agents cause inflammation and general destruction of tissues. Inhalation of these agents can cause lung membranes to swell and become filled with liquid (pulmonary edema). Death may result from lack of oxygen.

##### ***Pathways:***

Corrosive Smoke agents are hazardous through inhalation as well as skin and eye exposure. Excessive dermal impacts may induce systemic complications.

##### ***Exposure Hazards (See Specific Agent in Agent Index):***

Human toxicity data for these agents has not been published or has not been established. However, the industrial IDLH levels for these agents are as low as 3 ppms.

##### ***Latency Period:***

Tissue damage occurs within minutes of exposure to corrosives. In some cases, clinical effects may not appear for several hours. Pulmonary edema caused by inhalation of the agent vapor may be delayed for several hours.

#### **Characteristics**

##### ***Physical Appearance/Odor:***

Corrosive Smoke agents are colorless to yellow or black solids or liquids with pungent or biting odors.

***Persistency:***

Corrosives Smoke agents are reactive with most materials and rapidly decompose. However, hazardous residue may remain for extended periods.

***Environmental Fate:***

Vapors from Corrosive Smoke agents have a density greater than air and tend to collect in low places. Agents are either very soluble in water or are rapidly hydrolyzed. Dilution does not significantly reduce the contact hazard posed by these agents. The liquid density of these agents is greater than that of water.

**Additional Hazards*****Fire:***

Some Corrosive Smoke agents are pyroforic and may spontaneously combust in contact with air. Corrosive Smoke agents may be volatilized during a fire or be spread by efforts to extinguish the fire. Agents may be decomposed by heat to produce other toxic and/or corrosive gases. In some cases, Corrosive Smoke agents may react with steam or water during a fire to produce toxic and/or corrosive vapors. These reactions may be very violent. Hydrogen produced by the action of the corrosive vapors on metals or other corrodible materials may be present.

***Reactivity:***

Some Corrosive Smoke agents are pyroforic and may spontaneously combust in contact with air. Corrosive Smoke agents are reactive to most metals and organic materials. If these materials are finely divided, interactions may cause spontaneous ignition. Reactions of most Corrosive Smoke agents with water may be violent to the point of explosive.

***Hazardous Decomposition Products:***

- Hydrolysis: Interaction with water produces additional corrosive materials. Dilution of agents is generally insignificant as a means of reducing the contact hazard.
- Combustion: Volatile decomposition products may include phosphorous pentoxide ( $P_2O_5$ ), hydrogen chloride (HCl) and sulfur oxides ( $SO_x$ ). In addition, a corrosive and toxic residue may remain.

## **Protection**

### ***Evacuation (See Specific Agent in Agent Index):***

Immediately isolate an area around any liquid or solid contamination for at least 200 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized, persistence of the agent and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible. Depending on the persistence of the agent and the potential for condensation of agent from the cloud, evacuation of the threatened population after passage of the initial cloud may be appropriate.

### ***Field Detection/Identification (See Detector Characteristics in General Section):***

**Military:** There are currently no field methods for detection of Corrosive Smokes employed by the U.S. Military.

**Civilian:** Colorimetric tubes are available which can detect sulfuric acid (H<sub>2</sub>SO<sub>4</sub>). Corrosive agents can be detected with litmus or pH paper. Detection and identification with FT-IR is possible provided that the appropriate reference spectra are available. However, an FT-IR may be ineffective due to defraction of the beam by the cloud.

### ***Personal Protective Requirements (see PPE in General Section):***

Corrosive Smoke agents pose both a severe respiratory and severe contact hazard. Wear appropriate fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). If pyroforic agents are involved, fully encapsulating protective gear may not be appropriate unless the material is fire resistant. Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill or release events.

### ***Decontamination:***

*Casualties/personnel:* Speed in decontamination is essential. Remove all clothing and immediately rinse with copious amounts of water. If required, dilute solutions of baking soda may be used to neutralize low pH agents, whereas dilute solutions of vinegar may be used to neutralize high pH agents.

*Small Areas:* Puddles of liquid must be contained by covering with corrosion resistant absorbent materials. Remove all material and place in a corrosion resistant container. Decontaminate the area with copious amounts of the appropriate dilute neutralizing agent (e.g., baking soda or vinegar). Solid baking soda is effective at neutralizing both high and low pH agents; however, reactions may produce excessive heat and violent off-gassing. Dilution is ineffective and may exacerbate the problem.

## **First Aid**

### ***Signs & Symptoms:***

Pain and irritation from exposure to either agent liquid or vapor may be immediate or delayed depending on the concentration of the agent. Skin impacts include pain, red and inflamed skin progressing to severe burns. Exposure of the eyes results in irritation, pain, swelling, corneal erosion. Upper respiratory signs vary with the amount of exposure and may include sneezing, hoarseness, laryngitis, bleeding of the nose and gums, choking, shortness of breath, chest pain, and delayed pulmonary edema.

### ***Patient Management:***

Remove casualty to fresh air and provide oxygen for respiratory distress. Immediately decontaminate any potential exposure. Otherwise, treatment consists of symptomatic management of lesions.

### ***Antidotes:***

None.

### ***Fatality Management:***

Remove all clothing; decontaminate with appropriate neutralizing agent. Wash cadaver with appropriate neutralizing agent followed by soap and water. Pay particular attention to ears, nostrils, mouth, wounds, hair, scalp, pubic areas, fingernails, and folds of skin where agent may get trapped. Cadaver poses no significant secondary hazards after decontamination.

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## Class Index C22

### Toxins

#### General Chemical Structure

Varies greatly.

#### Toxicology

##### **Effects:**

Toxins present a variety of both incapacitating and lethal effect. General types of toxins include those that disrupt the nervous system (neurotoxins), destroy or damage tissue (cytotoxins) or cause the body to release excessive, and therefore harmful, amounts of chemicals that are normally produced by the body (biomediator toxins). Toxins may produce effects that are a combination of these general categories.

##### **Pathways:**

Varies according to the specific toxin. Toxins may be hazardous through inhalation, ingestion, injection (e.g., stings, bites) and/or abraded skin (e.g., breaks in the skin or penetration of skin by debris). Individual Toxins may be effective through multiple pathways. The route of exposure may significantly change the signs and symptoms associated with any given toxin. Generally, effects of toxins are most severe when the toxin is inhaled. Toxins that have been inhaled then coughed up and swallowed may also pose an ingestion hazard. Although there are exceptions (see Class Index C23), the risks posed by toxins through dermal exposure are generally minimal. Because of their efficacy, Toxins may be dissolved in solvents and delivered as dilute solutions. These Toxin solutions may pose a significant percutaneous hazard due to solvent properties.

##### **Exposure Hazards (See Specific Agent in Agent Index):**

LD<sub>50</sub>s for inhalation of Toxins aerosols are as low as 0.00000007 gm per individual.

### ***Latency Period:***

Effects from exposure to Toxins can be delayed from minutes up to days. The impacts from some toxins, especially cytotoxins, may occur within minutes but symptoms may not appear for hours. The route of exposure to the toxin can significantly change the latency period.

## **Characteristics**

### ***Physical Appearance/Odor:***

Toxins may be solids or liquids. They are odorless and tasteless. However, the appearance of a specific toxin may not be discernable since toxins may be deployed as dilute solutions.

### ***Persistency:***

Toxins can be persistent or non-persistent. Generally, Toxins are non-persistent.

### ***Environmental Fate:***

Toxins are non-volatile. Once the aerosol settles, there is minimal inhalation hazard unless the toxins are re-aerosolized. Many toxins are not soluble in water. Some toxins are very stable in the environment and can persist for extended periods.

## **Additional Hazards**

### ***Fire:***

Toxins are not volatile but may be spread by efforts to extinguish the fire. Toxins may be decomposed by heat to produce other toxic gases.

### ***Reactivity:***

Varies depending on the specific toxin but generally toxins selected for warfare purposes are not exceptionally reactive to common materials.

### ***Hazardous Decomposition Products:***

Hydrolysis:       Varies by specific Toxin. Toxins selected for warfare purposes are not exceptionally prone to hydrolysis.

Combustion: Volatile decomposition products may include nitrogen oxides (NO<sub>x</sub>), sulfur oxides (SO<sub>x</sub>) and lower weight toxic hydrocarbons.

## **Protection**

### ***Evacuation (See Specific Agent in Agent Index):***

Immediately isolate an area around any liquid or solid contamination for at least 200 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized, persistence of the agent and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible. Depending on the persistence of the agent and the potential for condensation of agent from the cloud, evacuation of the threatened population after passage of the initial cloud may be appropriate.

### ***Field Detection/Identification (See Detector Characteristics in General Section):***

Portable immunoassay kits have been developed for a limited number of toxins. The kits are capable of identifying toxins within 30 minutes. Kits for additional toxins are under development. Clinical immunoassays (ELISA), as well as chemical analytical methods for detection and identification of toxins are available. These methods can take from 2 to 4 hours to identify individual toxins even under ideal conditions.

### ***Personal Protective Requirements (see PPE in General Section):***

Toxins are generally dispersed as aerosols and pose a severe respiratory hazard. However, toxins are nonvolatile and do not pose an inhalation hazard once the aerosol has settled. Wear appropriate fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). There is a significant hazard posed by contact of contaminated material with abraded skin or injection of toxins through contact with debris. Appropriate protection to avoid any potential abrasion, laceration or puncture of the skin is essential.

### ***Decontamination:***

*Casualties/personnel:* Remove potentially contaminated clothing. Wash skin with soap and water.

*Small Areas:* Wash all surfaces with undiluted household bleach insuring a minimum contact time of 10 minutes. Wash the area with soap and water followed by rinsing with copious amounts of water.

**Extreme care must be exercised when dealing with dry or powdered agents as toxins may adhere to the skin or clothing and present an inhalation hazard later.**

## **First Aid**

### ***Signs & Symptoms:***

Varies depending on the specific toxin. Even symptoms presented by toxins with the same general classification (i.e., neurotoxin, cytotoxin, biomediator toxins) may vary depending on the specific mechanism of action within the body.

### ***Patient Management:***

Ventilate patient if there is difficulty breathing and administer oxygen. Be prepared to treat for shock. If the identity of the toxin is known, administer antidote if available.

### ***Antidotes:***

Antidotes are available for some toxins and others are being developed. However, many toxins affect such basic biochemical mechanisms within the body that potential antidotes often have severe debilitating or toxic side effects. Unlike chemical agents, toxins can cause an immune response. Vaccines are available for some toxins but generally require 4 to 15 weeks for the body to produce antibodies. Passive immunotherapy is effective for some neurotoxins but must be instituted shortly after exposure.

### ***Fatality Management:***

**Extreme care must be exercised when dealing with dry or powdered agents as toxins may adhere to the skin or clothing and present an inhalation hazard.**

Remove all clothing; decontaminate with straight household bleach then incinerate at an appropriate facility. Wash cadaver with a bleach solution insuring the solution is introduced into the ears, nostrils, mouth, and any wounds. Pay particular attention to hair, scalp, pubic areas, fingernails, and folds of skin where agent may get trapped. The solution should be no less than one part household bleach in one part water. Solution may be buffered with sodium bisulfate to a neutral pH in order to minimize the corrosive

impacts on the cadaver. The bleach solution should remain in contact with the cadaver for a minimum of 5 minutes. Wash with soap and water. Agents that have been absorbed into the cadaver pose minimal secondary risk. **Latex gloves do not offer sufficient protection prior to decontamination.**

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## **Class Index C23**

### **Toxins – Dermally Hazardous**

#### **General Chemical Structure**

Varies greatly.

#### **Toxicology**

##### ***Effects:***

Toxins present a variety of both incapacitating and lethal effect. Generally, these Toxins destroy or damage tissue (cytotoxins), but may also disrupt the nervous system (neurotoxins), and/or cause the body to release excessive, and therefore harmful, amounts of chemicals that are normally produced by the body (biomediator toxins).

##### ***Pathways:***

In addition to the hazards posed through inhalation, ingestion, injection (e.g., stings, bites) and/or contact with abraded skin (e.g., breaks in the skin or penetration of skin by debris), these Toxins may damage the eyes as well as any exposed skin surfaces. Local impacts to the nose, throat and/or lungs can result in respiratory problems (e.g., nose bleed, sneezing, pulmonary edema). Toxins that have been inhaled then coughed up and swallowed may also pose an ingestion hazard. Individual Toxins may be effective through multiple pathways. The route of exposure may significantly change the signs and symptoms associated with any given toxin. Generally, effects of toxins are most severe when the toxin is inhaled. Because of their efficacy, Toxins may be dissolved in solvents and delivered as dilute solutions. These Toxin solutions may pose a significant percutaneous hazard due to solvent properties.

##### ***Exposure Hazards (See Specific Agent in Agent Index):***

Skin impacts occur at doses as low as 0.00006 gm per square inch of contaminated skin.

Eye impacts occur at doses as low as 0.000001 gm per eye.

LD<sub>50</sub>s for dermal exposure are as low as 0.1 gm per individual.

LD<sub>50</sub>s for inhalation of Toxins aerosols are as low as 0.002 gm per individual.

### ***Latency Period:***

Local effects from exposure to these Toxins begins within minutes of exposure. Systemic effects may be delayed from hours to days. The route of exposure to the toxin can significantly change the latency period.

## **Characteristics**

### ***Physical Appearance/Odor:***

Toxins may be solids or liquids. They are odorless and tasteless. However, the appearance of a specific toxin may not be discernable since toxins may be deployed as dilute solutions.

### ***Persistence:***

Toxins can be persistent or non-persistent. Generally, Toxins are non-persistent.

### ***Environmental Fate:***

Toxins are non-volatile. Once the aerosol settles, there is minimal inhalation hazard unless the toxins are re-aerosolized. Many toxins are not soluble in water. Some toxins are very stable in the environment and can persist for extended periods.

## **Additional Hazards**

### ***Fire:***

Toxins are not volatile but may be spread by efforts to extinguish the fire. Toxins may be decomposed by heat to produce other toxic gases.

### ***Reactivity:***

Varies depending on the specific toxin but generally toxins selected for warfare purposes are not exceptionally reactive to common materials.

### ***Hazardous Decomposition Products:***

Hydrolysis: Varies by specific Toxin. Toxins selected for warfare purposes are not exceptionally prone to hydrolysis.

Combustion: Volatile decomposition products may include nitrogen oxides (NO<sub>x</sub>), sulfur oxides (SO<sub>x</sub>) and lower weight toxic hydrocarbons.

## **Protection**

### ***Evacuation (See Specific Agent in Agent Index):***

Immediately isolate an area around any liquid or solid contamination for at least 200 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized, persistence of the agent and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible. Depending on the persistence of the agent and the potential for condensation of agent from the cloud, evacuation of the threatened population after passage of the initial cloud may be appropriate.

### ***Field Detection/Identification (See Detector Characteristics in General Section):***

Portable immunoassay kits have been developed for a limited number of toxins. The kits are capable of identifying toxins within 30 minutes. Kits for additional toxins are under development. Clinical immunoassays (ELISA), as well as chemical analytical methods for detection and identification of toxins are available. These methods can take from 2 to 4 hours to identify individual toxins even under ideal conditions.

### ***Personal Protective Requirements (see PPE in General Section):***

These Toxins pose both a severe respiratory and severe contact hazard. Toxins are generally dispersed as aerosols. Although Toxins are nonvolatile and do not pose an inhalation hazard once the aerosol has settled, residue from aerosols of Dermally Hazardous Toxins can still pose a contact threat. Wear appropriate fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). There is a significant hazard posed by contact of contaminated material with abraded skin or injection of toxins through contact with debris. Appropriate protection to avoid any potential abrasion, laceration or puncture of the skin is essential.

### ***Decontamination:***

*Casualties/personnel:* Remove potentially contaminated clothing. Wash skin with soap and water.

*Small Areas:* Wash all surfaces with undiluted household bleach insuring a minimum contact time of 10 minutes. Wash the area with soap and water followed by rinsing with copious amounts of water.

**Extreme care must be exercised when dealing with dry or powdered agents as toxins may adhere to the skin or clothing and present both a contact and an inhalation hazard later.**

## **First Aid**

### ***Signs & Symptoms:***

Early indication of dermal contact include itching, burning skin pain, redness, tenderness, and blistering. Contact of the eyes with these Toxins produces pain, tearing, redness and the sensation of the presence of a foreign body in the eye. Nasal impacts include itching, pain, sneezing, rhinorrhea (runny nose) and bleeding. System signs and symptoms may be delayed and vary depending on the specific toxin. Even symptoms presented by toxins with the same general classification (i.e., neurotoxin, cytotoxin, bio-mediator toxins) may vary depending on the specific mechanism of action within the body.

### ***Patient Management:***

Ventilate patient if there is difficulty breathing and administer oxygen. Be prepared to treat for shock. If the identity of the toxin is known, administer antidote if available.

### ***Antidotes:***

Antidotes are available for some Toxins and others are being developed. However, many Toxins affect such basic biochemical mechanisms within the body that potential antidotes often have severe debilitating or toxic side effects. Unlike chemical agents, toxins can cause an immune response. Vaccines are available for some toxins but generally require 4 to 15 weeks for the body to produce antibodies. Passive immunotherapy is effective for some neurotoxins but must be instituted shortly after exposure.

### ***Fatality Management:***

**Extreme care must be exercised when dealing with dry or powdered agents as toxins may adhere to the skin or clothing and present an inhalation hazard.**

Remove all clothing; decontaminate with straight household bleach then incinerate at an appropriate facility. Wash cadaver with a bleach solution insuring the solution is introduced into the ears, nostrils, mouth, and any wounds. Pay particular attention to hair, scalp, pubic areas, fingernails, and folds of skin where agent may get trapped. The solution should be no less than one part household bleach in one part water. Solution may be buffered with sodium bisulfate to a neutral pH in order to minimize the corrosive impacts on the cadaver. The bleach solution should remain in contact with the cadaver for a minimum of 5 minutes. Wash with soap and water. Agents that have been absorbed into the cadaver pose minimal secondary risk. **Latex gloves do not offer sufficient protection prior to decontamination.**

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## Class Index C24

### Pathogens – Anti-Personnel

#### Health

##### ***Effects:***

Pathogens employed as biological weapons can be used for both lethal and incapacitating purposes. Effects may be due to the production of Toxins (see Class Index C22) by the organism. Anti-personnel pathogens can be bacteria, virus, rickettsiae, or fungus. For warfare purpose, agents may be in the form of spores, liquid containing active agents, contaminated material (e.g., dust) or freeze-dried powders. Many pathogen agents are normally zoonoses (i.e., animal diseases) that can also infect people. The diseases produced by these pathogens may be difficult for medical personnel not trained in exotic pathology to diagnose since they may not be familiar with these diseases.

##### ***Pathways:***

For warfare purposes, inhalation is the most effective route of entry. If the agent is not naturally transmitted as an aerosol, it may be altered (e.g., freeze-dried) to facilitate an inhalation pathway. For this reason, all incidents involving pathogens should be considered posing an inhalation hazard during the initial evaluation. The primary routes of entry of pathogen aerosols include inhalation and/or contact of the aerosol with the mucous membranes of the eyes, nose or mouth. In addition, although intact skin is an effective barrier against most pathogens, abraded skin (e.g., abrasions, lacerations, or penetration of skin by debris) circumvents this protective barrier and allows entry of the pathogen into the body.

##### ***Incubation Period:***

Varies depending on the pathogen, but is generally on the order of days to weeks. Exposures to extremely high doses of some pathogens may reduce the incubation period to as short as several hours. Others pathogens may have an incubation period extending for years. Some of these pathogens go through alternating dormant and active cycles producing reoccurring disease within the casualty that can last for years.

***Persistency:***

In general, unless a local reservoir (e.g., animal or insect in which a pathogen can live and serve as a source for continued infection) is established, pathogens are easily killed by unfavorable environmental factors such as fluctuations in temperature, humidity, food sources, or ultraviolet light. For this reason, their persistency is generally limited to days. However, some bacteria are capable of entering a dormant state, called a spore, which is highly resistant to impacts from changes in environmental factors. These agents can survive as spores for decades and then become active again when the proper conditions occur. In addition, pathogens can be freeze-dried and remain in a preserved state almost indefinitely. Freeze-dried pathogens are reactivated when exposed to moisture.

**Additional Hazards (See Specific Agent in Agent Index)**

In general, once the initial cloud has settled the risk from re-aerosolization of pathogens is minimal. However, it should not be discounted. In many cases, there is the additional risk of secondary infections due to exposure of personnel to contaminated blood, bodily fluids, or fecal matter from individuals infected during the initial release. In some instances, pathogens are directly transmitted from person to person through aerosols (i.e., sneezing or coughing) or contact. Some pathogens may be absorbed into fomites (e.g., clothing or bedding) and causing these items to become infectious and capable of transmitting the disease.

**Protection*****Evacuation***

Immediately isolate an area around any liquid or solid contamination for at least 100 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible.

***Field Detection/Identification (See Detector Characteristics in General Section):***

Airborne aerosols of pathogens can be detected by the Biological Integrated Detection System (BIDS). The system operates by detecting changes in back-

ground aerosol concentrations as well as the fluorescence and size distribution of particles within the aerosol. The system can identify a limited number of pathogens as well as collect samples from the aerosol for laboratory analysis. Portable immunoassay kits have been developed for a limited number of pathogens. The kits are capable of identifying pathogens within 30 minutes. Kits for additional pathogens are under development. Clinical immunoassays (ELISA) are available as well as traditional techniques to culture and identify the pathogen.

### ***Personal Protective Requirements:***

Wear fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). There is a significant hazard posed by contact of contaminated material with abraded skin or injection of pathogens through contact with debris. Appropriate protection to avoid any potential abrasion, laceration or puncture wound is essential.

**Although latex gloves may normally be adequate protection against disease, some studies have suggested that the protection offered by these gloves may be inadequate for high concentrations of pathogens. The high level of contamination from a deliberate release incident may preclude the use of latex gloves.**

### ***Decontamination:***

*Casualties/personnel:* **Direct exposure to aerosol cloud:** Remove all clothing and double bag in appropriate biological hazard containers. Wash skin with soap and water followed by washing with a solution of one part household bleach in nine parts water. The bleach solution should remain in contact with the contaminated area for 10 to 15 minutes before a second wash with soap and water.

**All other exposures:** Thoroughly wash skin with soap and water. Collect and disinfect all wash and rinse solutions.

*Equipment:* Wash all surfaces with full strength household bleach insuring a minimum contact time of 30 minutes. Follow this with normal cleaning procedures appropriate for the item.

*Small Areas:* Fumigate with disinfectant gas or aerosol (e.g., formaldehyde). Follow fumigation with a wash of all surfaces employing a disinfectant such as household bleach. Rinse with water.

## **First Aid**

### ***Signs & Symptoms (See Specific Agent in Agent Index):***

Vary depending on the specific pathogen. Generally follow flu-like symptoms including such discomforts as headache, fever, chills, cramping, vomiting, diarrhea, malaise, fatigue, cough, and/or chest discomfort.

### ***Patient Management:***

Treated symptomatically. Antibiotics are effective against many bacteria although some strains have developed resistance to these drugs. Some viral pathogens can be treated by anti-viral drugs. Antitoxins are available to treat some pathogen related Toxins (see Class Index 22). Once the pathogen has been identified, then appropriate drugs can be prescribed. Vaccines are available for some pathogens but generally require 4 to 15 weeks for the body to produce antibodies. Passive immunotherapy is effective for some pathogens but must be instituted shortly after exposure.

### ***Fatality Management:***

If fatality was due to direct exposure to an aerosol cloud, remove all clothing and double bag in appropriate biological hazard containers. Wash cadaver with soap and water. Collect and disinfect all wash and rinse solutions. In many cases, there is an additional risk of secondary infections due to exposure of personnel to contaminated blood, bodily fluids, or fecal matter from cadavers. Some pathogens may be absorbed into fomites (e.g., clothing or bedding) causing these items to become infectious and capable of transmitting the disease. If fomites are hazardous, remove all items and double bag in appropriate biological hazard containers. Dispose of contaminated articles at an appropriate medical waste disposal facility.

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## Class Index C25

### Pathogens – Anti-Personnel/Vector

#### Health

##### *Effects:*

Pathogens employed as biological weapons can be used for both lethal and incapacitating purposes. Effects may be due to the production of Toxins (see Class Index C22) by the organism. Anti-personnel pathogens can be either bacteria, virus, rickettsiae or plasmodia. For warfare purpose, agents may be in the form of spores, liquid containing active agents, contaminated material (e.g., dust) or freeze-dried powders. In addition, these pathogen agents are naturally transmitted by vectors (e.g., mosquitoes, ticks, lice). Many pathogen agents are normally zoonoses (i.e., animal diseases) that can also infect people. The diseases produced by these pathogens may be difficult for medical personnel not trained in exotic pathology to diagnose since they may not be familiar with these diseases.

##### *Pathways:*

For warfare purposes, inhalation is the most effective route of entry. If the agent is not naturally transmitted as an aerosol, it may be altered (e.g., freeze-dried) to facilitate an inhalation pathway. For this reason, all incidents involving pathogens should be considered posing an inhalation hazard during the initial evaluation. The primary routes of entry of pathogen aerosols include inhalation and/or contact of the aerosol with the mucous membranes of the eyes, nose, or mouth. In addition, although intact skin is an effective barrier against most pathogens, abraded skin (e.g., abrasions, lacerations, or penetration of skin by debris) circumvents this protective barrier and allows entry of the pathogen into the body.

In addition, these pathogens are also naturally transmitted by vectors and this pathway may also be exploited as a method of delivery of biowarfare agents. Examples of vectors include flies, mosquitoes, ticks, lice, and fleas. Vectors transmit the pathogen when they bite or scratch a new host. In some cases, the pathogen is excreted in the vector's feces as it feeds and forced into the wound by the casualty when scratching the bite. Vectors may be either the reservoir (i.e., animal or insect in which a pathogen normally lives and serves as a source for continued infection) or intermediate host for the pathogen.

***Incubation Period:***

Varies depending on the pathogen, but is generally on the order of days to weeks. Exposures to extremely high doses of some pathogens may reduce the incubation period to as short as several hours. Others pathogens may have an incubation period extending for years. Some of these pathogens go through alternating dormant and active cycles producing reoccurring disease within the casualty that can last for years.

***Persistency:***

In general, unless a local reservoir (e.g., animal or insect in which a pathogen can live and serves as a source for continued infection) is established, pathogens are easily killed by unfavorable environmental factors such as fluctuations in temperature, humidity, food sources, or ultraviolet light. For this reason, their persistency is generally limited to days. However, some bacteria are capable of entering a dormant state, called a spore, which is highly resistant to impacts from changes in environmental factors. These agents can survive as spores for decades and then become active again when the proper conditions occur. In addition, pathogens can be freeze-dried and remain in a preserved state almost indefinitely. Freeze-dried pathogens are reactivated when exposed to moisture.

In many cases, once the vector is infected, it is capable of transmitting the disease throughout its life span. Some pathogens that are carried by vectors are transmitted transovarially to the young of the vector so that the next generation is born infected.

**Additional Hazards (See Specific Agent in Agent Index)**

In general, once the initial cloud has settled the risk from re-aerosolization of pathogens is minimal. However, it should not be discounted. It is possible that infected individuals or some local species of animal that has acquired the pathogen as a result of the release can become a continual source of vector inoculation. The continued reservoir/vector interaction could transmit the disease rapidly throughout an area. There is a minimal risk of secondary infection from such things as bodily fluids and, although there are exceptions, the risk of direct person-to-person transmission is limited.

**Protection*****Evacuation***

Immediately isolate an area around any liquid or solid contamination for at least 100 feet in all directions. If possible, identify the agent and develop a

downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible.

***Field Detection/Identification (See Detector Characteristics in General Section):***

Airborne aerosols of pathogens can be detected by the Biological Integrated Detection System (BIDS). The system operates by detecting changes in background aerosol concentrations as well as the fluorescence and size distribution of particles within the aerosol. The system can identify a limited number of pathogens as well as collect samples from the aerosol for laboratory analysis. Portable immunoassay kits have been developed for a limited number of pathogens. The kits are capable of identifying pathogens within 30 minutes. Kits for additional pathogens are under development. Clinical immunoassays (ELISA) are available as well as traditional techniques to culture and identify the pathogen.

***Personal Protective Requirements:***

Wear clothing that minimizes the amount of exposed skin and apply appropriate insect repellent. If an aerosol has been used to disseminate the pathogen, wear fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). There is a significant hazard posed by contact of contaminated material with abraded skin or injection of pathogens through contact with debris. Appropriate protection to avoid any potential abrasion, laceration or puncture of the skin is essential.

**Although latex gloves may normally be adequate protection against disease, some studies have suggested that the protection offered by these gloves may be inadequate for high concentrations of pathogens. The high level of contamination from a deliberate release incident may preclude the use of latex gloves.**

***Decontamination:***

*Casualties/personnel:* **Direct exposure to aerosol cloud:** Wash skin with soap and water followed by washing with a solution of one part household bleach in nine parts water. The bleach solution should remain in contact with the contaminated area for 10 to 15 minutes

before a second wash with soap and water. For clothing and equipment, wash all surfaces with full strength household bleach insuring a minimum contact time of 30 minutes. Follow this with normal cleaning procedures appropriate for the item. **Release of non-fly-ing vectors** (e.g., fleas, lice): Remove all potentially infested clothing depositing it in a container that will trap and eliminate any remaining vectors. Wash casualty with soap and water and inspect hairy parts of the body for potential vectors. Apply appropriate repellent. **Release of flying vectors** (e.g., mosquitoes, biting flies): No decontamination is required. Apply appropriate repellent.

*Clothing and Equipment:* **Direct exposure to aerosol cloud:** Wash all surfaces with full strength household bleach insuring a minimum contact time of 30 minutes. Follow this with normal cleaning procedures appropriate for the item.

*Small Areas:* **Aerosol:** fumigate with disinfectant gas or aerosol (e.g., formaldehyde). Follow fumigation with a wash of all surfaces employing a disinfectant such as household bleach. Rinse with water. **Vectors:** fumigate with appropriate pesticides.

## **First Aid**

### ***Signs & Symptoms (See Specific Agent in Agent Index):***

Vary depending on the specific pathogen. Generally follow flu-like symptoms including such discomforts as headache, fever, chills, cramping, vomiting, diarrhea, malaise, fatigue, cough and/or chest discomfort.

### ***Patient Management:***

Treated symptomatically. Antibiotics are effective against many bacteria although some strains have developed resistance to these drugs. Some viral pathogens can be treated by anti-viral drugs. Antitoxins are available to treat some pathogen related Toxins (see Class Index 22). Once the pathogen has been identified, then appropriate drugs can be prescribed. Vaccines are available for some pathogens but generally require 4 to 15 weeks for the body to produce antibodies. Passive immunotherapy is effective for some pathogens but must be instituted shortly after exposure.

Contact between infected individuals and potential vectors should be minimized as this may propagate the spread of the disease. Initiate pesticide application to eradicate potential vectors in the area.

### ***Fatality Management:***

Care must be taken to kill any vectors (e.g., lice, ticks) remaining either on the cadaver or residing in fomites. If fatality was due to direct exposure to an

aerosol cloud, remove all clothing and double bag in appropriate biological hazard containers. Wash cadaver with soap and water. Collect and disinfect all wash and rinse solutions. In many cases, there is an additional risk of secondary infections due to exposure of personnel to contaminated blood, bodily fluids, or fecal matter from cadavers. Some pathogens may be absorbed into fomites (e.g., clothing or bedding) causing these items to become infectious and capable of transmitting the disease. If fomites are hazardous, remove all items and double bag in appropriate biological hazard containers. Dispose of contaminated articles at an appropriate medical waste disposal facility.

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## Class Index C26

### Pathogens – Anti-Personnel/Ingestion

#### Health

##### *Effects:*

Pathogens employed as biological weapons can be used for both lethal and incapacitating purposes. Effects may be due to the production of Toxins (see Class Index C22) by the organism. Pathogens that are primarily an ingestion risks can be either bacteria or virus.

##### *Pathways:*

The primary route of entry of these pathogens is ingestion of food or fluids. In addition, although intact skin is an effective barrier against most pathogens, abraded skin (e.g., abrasions, lacerations, or penetration of skin by debris) circumvents this protective barrier and allows entry of the pathogen into the body. Agents may be in the form of spores, liquid containing active agents, contaminated material (e.g., dust), or freeze-dried pathogens (i.e., preserved powders of living agents). For warfare purposes, the most effective route of entry is inhalation (see Class Index C24). Many agents that might otherwise have minimal airborne risk can be modified and dispersed as an aerosol. For this reason, all incidents involving pathogens should be considered an inhalation hazard until determined otherwise.

##### *Incubation Period:*

Varies depending on the pathogen, but is generally on the order of hours to days. Exposures to extremely high doses of some pathogens may reduce the incubation period.

##### *Persistency:*

Many pathogens can survive in food containers for extended periods. Some pathogens can survive in turbid water for long periods. Some bacteria are capable of entering a dormant state, called a spore, which is highly resistant to impacts from changes in environmental factors. These agents can survive as spores for decades and then become active again when the proper conditions occur. In addition, pathogens can be freeze-dried and remain in a preserved state almost indefinitely. Freeze-dried pathogens are reactivated when exposed to moisture.

## **Additional Hazards (See Specific Agent in Agent Index)**

There is a significant risk of secondary infections from the fecal/oral cycle. Some individuals can become asymptomatic carriers and are capable of spreading the disease long after their recovery (e.g., Typhoid Mary). Some pathogens may be absorbed into fomites (e.g., clothing or bedding) and causing these items to become infectious and capable of transmitting the disease. In addition, mechanical vectors, (e.g., flies, roaches) can transmit pathogens and spread the disease to food not directly contaminated by the release. For pathogens dispersed as aerosols, once the initial cloud has settled the risk from re-aerosolization of pathogens is minimal. However, it should not be discounted.

## **Protection**

### ***Evacuation***

Immediately isolate an area around any liquid or solid contamination for at least 100 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible.

### ***Field Detection/Identification (See Detector Characteristics in General Section):***

Portable immunoassay kits have been developed for a limited number of pathogens. The kits are capable of identifying pathogens within 30 minutes. Kits for additional pathogens are under development. Clinical immunoassays (ELISA) are available as well as traditional techniques to culture and identify the pathogen.

### ***Personal Protective Requirements:***

Wear gloves and surgical protective mask. Ensure thorough and frequent washing of hands. If an aerosol has been used to disseminate the pathogen, wear fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA).

Although latex gloves may normally be adequate protection against disease, some studies have suggested that the protection offered by these gloves may be inadequate for high concentrations of pathogens. The high level of contamination from a deliberate release incident may preclude the use of latex gloves.

### ***Decontamination:***

*Casualties/personnel:* **Direct exposure to aerosol cloud:** Wash skin with soap and water followed by washing with a solution of one part household bleach in nine parts water. The bleach solution should remain in contact with the contaminated area for 10 to 15 minutes before a second wash with soap and water. **All other exposures:** Thoroughly wash skin with soap and water. Collect and disinfect all wash and rinse solutions.

*Clothing and Equipment:* **Direct exposure to aerosol cloud:** Wash all surfaces with full strength household bleach insuring a minimum contact time of 30 minutes. Follow this with normal cleaning procedures appropriate for the item.

*Small Areas:* **Aerosol:** Fumigate with disinfectant gas or aerosol (e.g., formaldehyde). Follow fumigation with a wash of all surfaces employing a disinfectant such as household bleach. Rinse with water.

### **First Aid**

#### ***Signs & Symptoms (See Specific Agent in Agent Index):***

Vary depending on the specific pathogen. Generally include nausea, cramping, vomiting, and diarrhea. Other flu-like symptoms (e.g., headache, fever, chills, malaise, fatigue) may be present.

#### ***Patient Management:***

Fluid and electrolyte replacement is critical. Often this can be accomplished by the use of oral rehydration salts or dilute sports-type drinks. Otherwise, treated symptomatically. Antibiotics are effective against many bacteria although some strains have developed resistance to these drugs. Some viral pathogens can be treated by anti-viral drugs. Antitoxins are available to treat some pathogen related toxins. Once the pathogen has been identified, then appropriate drugs can be prescribed. Vaccines are available for some pathogens but generally require 4 to 15 weeks for the body to produce antibodies.

***Fatality Management:***

If fatality was due to direct exposure to an aerosol cloud, remove all clothing and double bag in appropriate biological hazard containers. Wash cadaver with soap and water. Collect and disinfect all wash and rinse solutions. In many cases, there is an additional risk of secondary infections due to exposure of personnel to contaminated blood, bodily fluids, or fecal matter from cadavers. Some pathogens may be absorbed into fomites (e.g., clothing or bedding) causing these items to become infectious and capable of transmitting the disease. If fomites are hazardous, remove all items and double bag in appropriate biological hazard containers. Dispose of contaminated articles at an appropriate medical waste disposal facility.

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## **Class Index C27**

### **Pathogens – Anti-Animal**

#### ***Health***

#### ***Effects:***

Pathogens employed as anti-animal biological weapons are generally used to produce lethal effects in the target animal species. Primarily, targeted species provide food or are of economic value to the area. Pathogens can be bacteria, virus, rickettsiae, fungus, or parasites. Agents may be in the form of spores, liquid containing active agents, contaminated material (e.g., dust), or freeze-dried pathogens (i.e., preserved powders of living agents).

#### ***Pathways:***

Pathogens may be introduced via inhalation, contact, ingestion, injection, or vector.

#### ***Incubation Period:***

Varies depending on the pathogen, but is generally on the order of days to weeks. Exposures to extremely high doses of some pathogens may reduce the incubation period to as short as several hours.

#### ***Persistency:***

In general, unless a local reservoir (e.g., animal or insect in which a pathogen normally lives and serves as a source for continued infection) is established, pathogens are easily killed by unfavorable environmental factors such as fluctuations in temperature or humidity, acidity of the medium, food sources, or ultraviolet light. For this reason, their persistency in their active state is generally limited to days. However, some bacteria are capable of entering a dormant state, called a spore, which is highly resistant to impacts from changes in environmental factors. These agents can survive as spores for decades and then become active again when the proper conditions occur. In addition, pathogens can be freeze-dried and remain in a preserved state almost indefinitely. Freeze-dried pathogens are reactivated when exposed to moisture.

#### **Additional Hazards (See Specific Agent in Agent Index)**

Although pathogens are selected to target a specific animal species, there is the possibility that the disease may migrate to humans.

## Protection

### **Evacuation**

Immediately isolate an area around any liquid or solid contamination for at least 100 feet in all directions. If possible, identify the agent and develop a downwind hazard diagram (see Agent Index). Adjust the initial isolation distance as appropriate. Based on the type of release, amount of material aerosolized and local conditions (e.g., weather, population density, time of day), shelter-in-place until the initial cloud passes may be the most appropriate course of action since timely evacuation of the threatened downwind population may not be possible.

### **Field Detection/Identification:**

Clinical immunoassays (ELISA) are available as well as traditional techniques to culture and identify the pathogen.

### **Personal Protective Requirements:**

Wear fully encapsulating protective gear with positive pressure self-contained breathing apparatus (SCBA). There is a significant hazard posed by contact of contaminated material with abraded skin or injection of pathogens through contact with debris. Appropriate protection to avoid any potential abrasion, laceration or puncture wound is essential.

**Although latex gloves may normally be adequate protection against disease, some studies have suggested that the protection offered by these gloves may be inadequate for high concentrations of pathogens. The high level of contamination from a deliberate release incident may preclude the use of latex gloves.**

### **Decontamination:**

*Personnel:* **Direct exposure to aerosol cloud:** Wash skin with soap and water followed by washing with a solution of one part household bleach in nine parts water. The bleach solution should remain in contact with the contaminated area for 10 to 15 minutes before a second wash with soap and water. **All other exposures:** Thoroughly wash skin with soap and water. Collect and disinfect all wash and rinse solutions.

*Clothing and Equipment:* **Direct exposure to aerosol cloud:** Wash all surfaces with full strength household bleach insuring a minimum contact time of 30 minutes. Follow this with normal cleaning procedures appropriate for the item.

*Small Areas: Aerosol:* Fumigate with disinfectant gas or aerosol (e.g., formaldehyde). Follow fumigation with a wash of all surfaces employing a disinfectant such as household bleach. Rinse with water.

## **First Aid**

### ***Signs & Symptoms:***

*Personnel:* Vary depending on the specific pathogen. Generally follow flu-like symptoms including such discomforts as headache, fever, chills, cramping, vomiting, diarrhea, malaise, fatigue, cough and/or chest discomfort.

*Animals:* Varies depending on the specific pathogen and infected species. Consult veterinarian familiar with exotic diseases.

### ***Patient Management:***

*Personnel:* Treated symptomatically. Antibiotics are effective against many bacteria although some strains have developed resistance to these drugs. Some viral pathogens can be treated by anti-viral drugs. Antitoxins are available to treat some pathogen related Toxins (see Class Index 22). Once the pathogen has been identified, then appropriate drugs can be prescribed. Vaccines are available for some pathogens but generally require 4 to 15 weeks for the body to produce antibodies. Passive immunotherapy is effective for some pathogens but must be instituted shortly after exposure.

*Animals:* Isolate infected animals. Limit vector access to animals through application of pesticides. Ensure adequate personal hygiene of anyone coming into contact with the animals. Consult veterinarian familiar with possible exotic diseases.

### ***Fatality Management:***

*Animals:* Consult veterinarian familiar with exotic diseases. Incineration of carcasses may be appropriate.

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## **Class Index C28**

### **Pathogens – Anti-Plant**

#### **Health**

##### ***Effects:***

Pathogens employed as anti-plant biological weapons are generally employed to produce lethal effects in the target plant species. Primarily target species provide food or other economic value to the area. Pathogens can be bacteria, virus, fungus, or insects. Agents may be in the form of spores, liquid containing active agents, contaminated material (e.g., dust), freeze-dried pathogens (i.e., preserved powders of living agents), eggs, or containers of pests.

##### ***Pathways:***

Pathogens may be administered via aerosol, direct application, or general release. In addition, pathogens may be applied to soil and become active when crops are planted.

##### ***Incubation Period:***

Varies depending on the pathogen.

##### ***Persistency:***

Varies according to the specific species. Some bacteria are capable of entering a dormant state, called a spore, which is highly resistant to impacts from changes in environmental factors. These agents can survive as spores for decades and then become active again when the proper conditions occur. In addition, pathogens can be freeze-dried and remain in a preserved state almost indefinitely. Freeze-dried pathogens are reactivated when exposed to moisture.

#### **Additional Hazards**

There is minimal potential for migration of pathogens to humans or animals.

## **Protection**

### ***Evacuation***

In order to avoid track out of material, immediately isolate an area around any liquid or solid contamination for at least 50 feet in all directions. Down-wind evacuation may not be necessary.

### ***Field Detection/Identification:***

Clinical immunoassays (ELISA) are available as well as traditional techniques to culture and identify the pathogen.

### ***Personal Protective Requirements:***

Efforts should be made to avoid possible off-site transport of the pathogen by personnel through the use of gloves, disposable foot covers and disposable coveralls.

### ***Decontamination:***

*Personnel:* Wash skin with soap and water. Collect and disinfect all wash and rinse solutions. For clothing and equipment, consult local agriculture assistance offices. If unavailable, wash all surfaces with full strength household bleach insuring a minimum contact time of 30 minutes. Follow this with normal appropriate cleaning procedures for the item.

*Small Areas:* Consult local agricultural assistance office. If unavailable fumigate with disinfectant gas or aerosol (e.g., formaldehyde). Follow fumigation with a wash of all surfaces employing a disinfectant such as household bleach. Apply appropriate pesticide if insects have been released.

## **First Aid**

### ***Signs & Symptoms:***

Varies depending on the specific pathogen. Consult local agricultural assistance office.

### ***Patient Management:***

*Personnel:* Should have minimal impact on personnel.

*Crops:* Removal and destruction of infected species. Consult local agricultural assistance office.

***Fatality Management:***

*Crops:* Consult local agricultural assistance office. Incineration of impacted fields may be appropriate.

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## **Class Index C29**

### **Pathogens – Used as Simulants**

#### **Health**

##### ***Effects:***

Pathogens employed as biological warfare simulants do not generally pose a significant risk to personnel. However, individuals with respiratory illness or suppressed immune systems may be at risk. Agents may be in the form of spores, liquid containing active agents, contaminated material (e.g., dust), or freeze-dried pathogens (i.e., preserved powders of living agents).

##### ***Pathways:***

Simulant Pathogens are generally released as aerosols and the primary routes of exposure include inhalation and/or contact of the aerosol with the mucous membranes of the eyes, nose, or mouth. In addition, although intact skin is an effective barrier against most pathogens, abraded skin (e.g., abrasions, lacerations, or penetration of skin by debris) circumvents this protective barrier and allows entry of the pathogen into the body.

##### ***Incubation period:***

Varies depending on the pathogen.

##### ***Persistency:***

Varies according to the specific species. Some bacteria are capable of entering a dormant state, called a spore, which is highly resistant to impacts from changes in environmental factors. These agents can survive as spores for decades and then become active again when the proper conditions occur. In addition, pathogens can be freeze-dried and remain in a preserved state almost indefinitely. Freeze-dried pathogens are reactivated when exposed to moisture.

#### **Additional Hazards**

There is minimal potential for these pathogens to cause significant infection in humans.

## **Protection**

### ***Evacuation***

In order to avoid track out of material, immediately isolate an area around any liquid or solid contamination for at least 50 feet in all directions. Down-wind evacuation may not be necessary.

### ***Field Detection/Identification:***

Clinical immunoassays (ELISA) are available as well as traditional techniques to culture and identify the pathogen.

### ***Personal Protective Requirements:***

Efforts should be made to avoid possible off-site transport of the pathogen by personnel through the use of disposable gloves, booties, and coveralls.

### ***Decontamination:***

*Personnel:* Decontamination may not be required. If deemed appropriate, wash skin with soap and water. For clothing and equipment, follow normal cleaning procedures appropriate for the item.

*Small Areas:* Decontamination may not be required. If deemed appropriate, wash all exposed surfaces with soap and water. If more extensive decontamination is desired, fumigate with disinfectant gas or aerosol (e.g., formaldehyde). Follow fumigation with a wash of all surfaces employing a disinfectant such as household bleach. Rinse with water.

## **First Aid**

### ***Signs & Symptoms:***

Should have minimal impact on personnel.

**Section IV**

**NAERG Guides**

# 4

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## *NAERG Guides*

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### **NAERG Guide 117**

#### **Gases: Toxic/Flammable (Extreme Hazard)**

##### **Potential Hazards**

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###### ***Health***

- Toxic; extremely hazardous.
- May be fatal if inhaled or absorbed through skin.
- Initial odor may be irritating or foul and may deaden your sense of smell.
- Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.
- Fire will produce irritating, corrosive and/or toxic gases.
- Runoff from fire control may cause pollution.

###### ***Fire or Explosion***

- These materials are extremely flammable.
- May form explosive mixtures with air.
- May be ignited by heat, sparks or flames.
- Vapors from liquefied gas are initially heavier than air and spread along ground.
- Vapors may travel to source of ignition and flash back.
- Runoff may create fire or explosion hazard.
- Containers may explode when heated.
- Ruptured cylinders may rocket.

## Public Safety

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- Isolate spill or leak area immediately for at least 100 to 200 meters (330 to 660 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Keep out of low areas.
- Ventilate closed spaces before entering.

## Protective Clothing

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing which is specifically recommended by the manufacture. It may provide little or no thermal protection.
- Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations.

## Evacuation

### *Spill*

- See the Table of Initial Isolation and Protective Action Distances in the *North American Emergency Response Guidebook* for highlighted substances. For non-highlighted substances, increase, in the downwind direction, as necessary, the isolation distance shown in the "Public Safety" section above.

### *Fire*

- If tank, rail car or tank truck is involved in a fire, isolate for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions.

## Emergency Response

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### *Fire*

- Do not extinguish a leaking gas fire unless leak can be stopped.

### *Small Fires*

- Dry chemical, CO<sub>2</sub>, water spray or regular foam.

### *Large Fires*

- Water spray, fog, or regular foam.
- Move containers from fire area if you can do it without risk.
- Damaged cylinders should be handled only by specialists.

### *Fire Involving Tanks*

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Do not direct water at source of leak or safety devices; icing may occur.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.

### ***Spill or Leak***

- Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area).
- All equipment used when handling the product must be grounded.
- Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire.
- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- Use water spray to reduce vapors or divert vapor cloud drift.
- Do not direct water at spill or source of leak.
- If possible, turn leaking containers so that gas escapes rather than liquid.
- Prevent entry into waterways, sewers, basements, or confined areas.
- Isolate area until gas has dispersed.
- Consider igniting spill or leak to eliminate toxic gas concerns.

## ***First Aid***

- Move victim to fresh air.
  - Call emergency medical care.
  - Apply artificial respiration if victim is not breathing.
  - Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
  - Administer oxygen if breathing is difficult.
  - Remove and isolate contaminated clothing and shoes.
  - In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
  - In case of contact with liquefied gas, thaw frosted parts with luke-warm water.
  - Keep victim warm and quiet. Keep victim under observation.
  - Effects of contact or inhalation may be delayed.
  - Ensure that medical personnel are aware of the materials involved, and take precautions to protect themselves.
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## NAERG Guide 118

### Gases: Flammable/Corrosive

#### Potential Hazards

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##### *Fire or Explosion*

- Extremely flammable.
- May be ignited by heat, sparks, or flames.
- May form explosive mixtures with air.
- Vapors from liquefied gas are initially heavier than air and spread along ground.
- Vapors may travel to source of ignition and flash back.
- Some of these materials may react violently with water.
- Containers may explode when heated.
- Ruptured cylinders may rocket.

##### *Health*

- May cause toxic effects if inhaled.
- Vapors are extremely irritating.
- Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.
- Fire will produce irritating, corrosive and/or toxic gases.
- Runoff from fire control may cause pollution.

##### *Public Safety*

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- Isolate spill or leak area immediately for at least 100 to 200 meters (330 to 660 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Keep out of low areas.
- Ventilate closed spaces before entering.

## ***Protective Clothing***

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing which is specifically recommended by the manufacturer.
- Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations.

## ***Evacuation***

### *Large Spill*

- Consider initial down wind evacuation for at least 800 meters (1/2 mile).

### *Fire*

- If tank, rail car or tank truck is involved in a fire, isolate for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions.

## **Emergency Response**

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### ***Fire***

- Do not extinguish a leaking gas fire unless leak can be stopped.

### *Small Fires*

- Dry chemical or CO<sub>2</sub>.

### *Large Fires*

- Water spray, fog, or regular foam.
- Move containers from fire area if you can do it without risk.
- Damaged cylinders should be handled only by specialists.

### *Fire Involving Tanks*

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.

- Do not direct water at source of leak or safety devices; icing may occur.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.

### ***Spill or Leak***

- Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area).
- All equipment used when handling the product must be grounded.
- Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire.
- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- If possible, turn leaking containers so that gas escapes rather than liquid.
- Use water spray to reduce vapors or divert vapor cloud drift.
- Do not direct water at spill or source of leak.

### ***First Aid***

- Move victim to fresh air.
- Call emergency medical care.
- Apply artificial respiration if victim is not breathing.
- Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with liquefied gas, thaw frosted parts with luke-warm water.
- Keep victim warm and quiet.
- Keep victim under observation.
- Effects of contact or inhalation may be delayed.
- Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

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## **NAERG Guide 119**

### **Gases: Toxic/Flammable**

#### **Potential Hazards**

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##### ***Health***

- Toxic; may be fatal if inhaled or absorbed through skin.
- Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.
- Fire will produce irritating, corrosive and/or toxic gases.
- Runoff from fire control may cause pollution.

##### ***Fire or Explosion***

- Flammable; may be ignited by heat, sparks or flames.
- May form explosive mixtures with air.
- Some may polymerize (P) explosively when heated or involved in a fire.
- Vapors from liquefied gas are initially heavier than air and spread along ground.
- Vapors may travel to source of ignition and flash back.
- Some of these materials may react violently with water.
- Containers may explode when heated.
- Ruptured cylinders may rocket.
- Runoff may create fire or explosion hazard.

##### **Public Safety**

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- Isolate spill or leak area immediately for at least 100 to 200 meters (330 to 660 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks).

- Keep out of low areas.
- Ventilate closed spaces before entering.

### ***Protective Clothing***

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing which is specifically recommended by the manufacturer. It may provide little or no thermal protection.
- Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations.

### ***Evacuation***

#### *Spill*

- See the Table of Initial Isolation and Protective Action Distances in the *North American Emergency Response Guidebook* for highlighted substances. For non-highlighted substances, increase, in the downwind direction, as necessary, the isolation distance shown in the "Public Safety" section above.

#### *Fire*

- If tank, rail car or tank truck is involved in a fire, isolate for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions.

### **Emergency Response**

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#### ***Fire***

- Do not extinguish a leaking gas fire unless leak can be stopped.

#### *Small Fires*

- Dry chemical, CO<sub>2</sub> water spray or alcohol-resistant foam.

#### *Large Fires*

- Water spray, fog, or alcohol-resistant foam.
- For chlorosilanes, do not use water; use AFFF alcohol-resistant medium expansion foam.

- Move containers from fire area if you can do it without risk.
- Damaged cylinders should be handled only by specialists.

### *Fire Involving Tanks*

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Do not direct water at source of leak or safety devices; icing may occur.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.

### *Spill or Leak*

- Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area).
- All equipment used when handling the product must be grounded.
  
- Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire.
- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- Do not direct water at spill or source of leak.
- Use water spray to reduce vapors or divert vapor cloud drift.
- For chlorosilanes, use AFFF alcohol-resistant medium expansion foam to reduce vapors.
- If possible, turn leaking containers so that gas escapes rather than liquid.
- Prevent entry into waterways, sewers, basements, or confined areas.
- Isolate area until gas has dispersed.

### *First Aid*

- Move victim to fresh air.
- Call emergency medical care.

- Apply artificial respiration if victim is not breathing.
  - Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
  - Administer oxygen if breathing is difficult.
  - Remove and isolate contaminated clothing and shoes.
  - In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
  - In case of contact with liquefied gas, thaw frosted parts with luke-warm water.
  - Keep victim warm and quiet.
  - Keep victim under observation.
  - Effects of contact or inhalation may be delayed.
  - Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.
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## **NAERG Guide 123**

### **Gases: Toxic and/or Corrosive**

#### **Potential Hazards**

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##### ***Health***

- Toxic; may be fatal if inhaled or absorbed through skin.
- Vapors may be irritating.
- Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.
- Fire will produce irritating, corrosive and/or toxic gases.
- Runoff from fire control may cause pollution.

##### ***Fire or Explosion***

- Some may burn, but none ignite readily.
- Vapors from liquefied gas are initially heavier than air and spread along ground.
- Containers may explode when heated.
- Ruptured cylinders may rocket.

##### **Public Safety**

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- Isolate spill or leak area immediately for at least 100 to 200 meters (330 to 660 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Keep out of low areas.
- Ventilate closed spaces before entering.

##### ***Protective Clothing***

- Wear positive pressure self-contained breathing apparatus (SCBA).

- Wear chemical protective clothing which is specifically recommended by the manufacturer. It may provide little or no thermal protection.
- Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations.

## **Evacuation**

### *Spill*

- See the Table of Initial Isolation and Protective Action Distances in the *North American Emergency Response Guidebook* for highlighted substances. For non-highlighted substances, increase, in the downwind direction, as necessary, the isolation distance shown in the "Public Safety" section above.

### *Fire*

- If tank, rail car or tank truck is involved in a fire, isolate for 800 meters ( $\frac{1}{2}$  mile) in all directions; also, consider initial evacuation for 800 meters ( $\frac{1}{2}$  mile) in all directions.

## **Emergency Response**

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### **Fire**

#### *Small Fires*

- Dry chemical or CO<sub>2</sub>.

#### *Large Fires*

- Water spray, fog or regular foam.
- Do not get water inside containers.
- Move containers from fire area if you can do it without risk.
- Damaged cylinders should be handled only by specialists.

#### *Fire Involving Tanks*

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.

- Do not direct water at source of leak or safety devices; icing may occur.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.

### ***Spill or Leak***

- Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire.
- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- If possible, turn leaking containers so that gas escapes rather than liquid.
- Prevent entry into waterways, sewers, basements, or confined areas.
- Use water spray to reduce vapors or divert vapor cloud drift.
- Do not direct water at spill or source of leak.
- Isolate area until gas has dispersed.

### ***First Aid***

- Move victim to fresh air.
- Call emergency medical care.
- Apply artificial respiration if victim is not breathing.
- Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with liquefied gas, thaw frosted parts with luke-warm water.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- Keep victim warm and quiet.
- Keep victim under observation.
- Effects of contact or inhalation may be delayed.
- Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

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## NAERG Guide 124

### Gases: Toxic and/or Corrosive/Oxidizing

#### Potential Hazards

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##### *Health*

- Toxic, may be fatal if inhaled or absorbed through skin.
- Fire will produce irritating, corrosive and/or toxic gases.
- Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.
- Runoff from fire control may cause pollution.

##### *Fire or Explosion*

- Substance does not burn but will support combustion.
- Vapors from liquefied gas are initially heavier than air and spread along ground.
- These are strong oxidizers and will react vigorously or explosively with many materials including fuels.
- May ignite combustibles (wood, paper, oil, clothing, etc.).
- Some will react violently with air, moist air and/or water.
- Containers may explode when heated.
- Ruptured cylinders may rocket.

##### *Public Safety*

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- Isolate spill or leak area immediately for at least 100 to 200 meters (330 to 660 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Keep out of low areas.
- Ventilate closed spaces before entering.

## ***Protective Clothing***

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing which is specifically recommended by the manufacturer.
- It may provide little or no thermal protection.
- Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations.

## ***Evacuation***

### *Spill*

- See the Table of Initial Isolation and Protective Action Distances in the *North American Emergency Response Guidebook* for highlighted substances. For non-highlighted substances, increase, in the downwind direction, as necessary, the isolation distance shown in the "Public Safety" section above.

### *Fire*

- If tank, rail car or tank truck is involved in a fire, isolate for 800 meters (1/2 mile) in all directions, also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

## **Emergency Response**

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### ***Fire***

#### *Small Fires*

- Water only; no dry chemical, CO<sub>2</sub> or Halon.
- Contain fire and let burn. If fire must be fought, water spray, or fog is recommended.
- Do not get water inside containers.
- Move containers from fire area if you can do it without risk.
- Damaged cylinders should be handled only by specialists.

#### *Fire Involving Tanks*

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.

- Cool containers with flooding quantities of water until well after fire is out.
- Do not direct water at source of leak or safety devices, icing may occur.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.
- For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

### ***Spill or Leak***

- Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire.
- Do not touch or walk through spilled material.
- Keep combustibles (wood, paper, oil, etc.) away from spilled material.
- Stop leak if you can do it without risk.
- Use water spray to reduce vapors or divert vapor cloud drift.
- Do not direct water at spill or source of leak.
- If possible, turn leaking containers so that gas escapes rather than liquid.
- Prevent entry into waterways, sewers, basements, or confined areas.
- Isolate area until gas has dispersed.
- Ventilate the area.

### ***First Aid***

- Move victim to fresh air.
- Call emergency medical care.
- Apply artificial respiration if victim is not breathing.
- Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
- Administer oxygen if breathing is difficult.
- Clothing frozen to the skin should be thawed before being removed.

- Remove and isolate contaminated clothing and shoes.
  - In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
  - Keep victim warm and quiet.
  - Keep victim under observation.
  - Effects of contact or inhalation may be delayed.
  - Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.
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## **NAERG Guide 125**

### **Gases: Corrosive**

#### **Potential Hazards**

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##### ***Health***

- Toxic; may be fatal if inhaled.
- Vapors are extremely irritating and corrosive.
- Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.
- Fire will produce irritating, corrosive and/or toxic gases.
- Runoff from fire control may cause pollution.

##### ***Fire or Explosion***

- Some may burn, but none ignite readily.
- Vapors from liquefied gas are initially heavier than air and spread along ground.
- Some of these materials may react violently with water.
- Containers may explode when heated.
- Ruptured cylinders may rocket.

##### **Public Safety**

---

- Isolated spill or leak area immediately for at least 100 to 200 meters (300 to 660 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Keep out of low areas.
- Ventilate closed spaces before entering.

## ***Protective Clothing***

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing which is specifically recommended by the manufacturer. It may provide little or no thermal protection.
- Structural firefighters' protective clothing is recommended for fire situation only; it is not effective in spill situations.

## ***Evacuation***

### *Spill*

- See the Table of Initial Isolation and Protective Action Distances in the *North American Emergency Response Guidebook* for highlighted substances. For non-highlighted substances, increase, in the down-wind direction, as necessary, the isolation distance shown in the "Public Safety" section above.

### *Fire*

- If tank, rail car or tank truck is involved in a fire, isolate for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions.

## **Emergency Response**

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### ***Fire***

#### *Small Fires*

- Dry chemical or CO<sub>2</sub>.

#### *Large Fires*

- Water spray, fog, or regular foam.
- Move containers from fire area if you can do it without risk.
- Do not get water inside containers.
- Damaged cylinders should be handled only by specialists.

### *Fire Involving Tanks*

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Do not direct water at source of leak or safety devices; icing may occur.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.

### *Spill or Leak*

- Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire.
- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- If possible, turn leaking containers so that gas escapes rather than liquid.
- Prevent entry into waterways, sewers, basements or confined areas.
- Do not direct water at spill or source of leak.
- Use water spray to reduce vapors or divert vapor cloud drift.
- Isolate area until gas has dispersed.

### *First Aid*

- Move victim to fresh air.
- Call emergency medical care.
- Apply artificial respiration if victim is not breathing.
- Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
- Administer oxygen if breathing is difficult.

- Clothing frozen to the skin should be thawed before being removed.
  - Remove and isolate contaminated clothing and shoes.
  - In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
  - Keep victim warm and quiet.
  - Keep victim under observation.
  - Effects of contact or inhalation may be delayed.
  - Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.
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## NAERG Guide 127

### Flammable Liquids (Polar/Water Miscible)

#### Potential Hazards

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##### *Fire or Explosion*

- Highly flammable: Will be easily ignited by heat, sparks, or flames.
- Vapors may form explosive mixtures with air.
- Vapors may travel to source of ignition and flash back.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Vapor explosion hazard indoors, outdoors or in sewers.
- Some may polymerize (P) explosively when heated or involved in a fire.
- Runoff to sewer may create fire or explosion hazard.
- Containers may explode when heated.
- Many liquids are lighter than water.

##### *Health*

- Inhalation or contact with material may irritate or burn skin and eyes.
- Fire may produce irritating, corrosive and/or toxic gases.
- Vapors may cause dizziness or suffocation.
- Runoff from fire control may cause pollution.

##### *Public Safety*

---

- Isolate spill or leak area immediately for at least 25 to 50 meters (80 to 160 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Keep out of low areas.
- Ventilate closed spaces before entering.

## ***Protective Clothing***

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Structural firefighters' protective clothing will only provide limited protection.

## ***Evacuation***

### *Large Spill*

- Consider initial downwind evacuation for at least 300 meters (1000 feet).

### *Fire*

- If tank, rail car or tank truck is involved in a fire, isolate for 800 meters ( $\frac{1}{2}$  mile) in all directions; also, consider initial evacuation for 800 meters ( $\frac{1}{2}$  mile) in all directions.

## **Emergency Response**

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### ***Fire***

CAUTION: All these products have a very low flash point: Use of water spray when fighting fire may be inefficient.

### *Small Fires*

- Dry chemical, CO<sub>2</sub>, water spray or alcohol-resistant foam.

### *Large Fires*

- Water spray, fog, or alcohol-resistant foam.
- Do not use straight streams.
- Move containers from fire area if you can do it without risk.

### *Fire Involving Tanks or Car/Trailer Loads*

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.

- For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

### ***Spill or Leak***

- Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area).
- All equipment used when handling the product must be grounded.
- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- Prevent entry into waterways, sewers, basements, or confined areas.
- A vapor suppressing foam may be used to reduce vapors.
- Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.
- Use clean non-sparking tools to collect absorbed material.

### ***Large Spills***

- Dike far ahead of liquid spill for later disposal.
- Water spray may reduce vapor, but may not prevent ignition in closed spaces.

### ***First Aid***

- Move victim to fresh air.
  - Call emergency medical care.
  - Apply artificial respiration if victim is not breathing.
  - Administer oxygen if breathing is difficult.
  - Remove and isolate contaminated clothing and shoes.
  - In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
  - Wash skin with soap and water.
  - Keep victim warm and quiet.
  - Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.
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## NAERG Guide 128

### Flammable Liquids (Non-Polar/Water Immiscible)

#### Potential Hazards

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##### *Fire or Explosion*

- Highly flammable: Will be easily ignited by heat, sparks, or flames.
- Vapors may form explosive mixtures with air.
- Vapors may travel to source of ignition and flash back.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Vapor explosion hazard indoors, outdoors or in sewers.
- Some may polymerize (P) explosively when heated or involved in a fire.
- Runoff to sewer may create fire or explosion hazard.
- Containers may explode when heated.
- Many liquids are lighter than water.
- Substance may be transported hot.

##### *Health*

- Inhalation or contact with material may irritate or burn skin and eyes.
- Fire may produce irritating, corrosive and/or toxic gases.
- Vapors may cause dizziness or suffocation.
- Runoff from fire control or dilution water may cause pollution.

##### *Public Safety*

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- Isolate spill or leak area immediately for at least 25 to 50 meters (80 to 160 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Keep out of low areas.
- Ventilate closed spaces before entering.

## ***Protective Clothing***

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Structural firefighters' protective clothing will only provide limited protection.

## ***Evacuation***

### *Large Spill*

- Consider initial downwind evacuation for at least 300 meters (1000 feet).

### *Fire*

- If tank, rail car, or tank truck is involved in a fire, isolate for 800 meters ( $\frac{1}{2}$  mile) in all directions; also, consider initial evacuation for 800 meters ( $\frac{1}{2}$  mile) in all directions.

## **Emergency Response**

---

### ***Fire***

CAUTION: All these products have a very low flash point. Use of water spray when fighting fire may be inefficient.

### *Small Fires*

- Dry chemical, CO<sub>2</sub>, water spray or regular foam.

### *Large Fires*

- Water spray, fog, or regular foam.
- Do not use straight streams.
- Move containers from fire area if you can do it without risk.

### *Fire Involving Tanks or Car/Trailer Loads*

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.

- Always stay away from the ends of tanks.
- For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

### ***Spill or Leak***

- Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area).
- All equipment used when handling the product must be grounded.
- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- Prevent entry into waterways, sewers, basements, or confined areas.
- A vapor suppressing foam maybe used to reduce vapors.
- Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.
- Use clean non-sparking tools to collect absorbed material.

### ***Large Spills***

- Dike far ahead of liquid spill for later disposal.
- Water spray may reduce vapor, but may not prevent ignition in closed spaces.

### ***First Aid***

- Move victim to fresh air.
  - Call emergency medical care.
  - Apply artificial respiration if victim is not breathing.
  - Administer oxygen if breathing is difficult.
  - Remove and isolate contaminated clothing and shoes.
  - In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
  - Wash skin with soap and water.
  - Keep victim warm and quiet.
  - Ensure that medical personnel are aware of the materials(s) involved, and take precautions to protect themselves.
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## NAERG Guide 129

### Flammable Liquids (Polar/Water Miscible/Noxious)

#### Potential Hazards

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##### *Fire or Explosion*

- Highly flammable: Will be easily ignited by heat, sparks, or flames.
- Vapors may form explosive mixtures with air.
- Vapors may travel to source of ignition and flash back.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Vapor explosion hazard indoors, outdoors or in sewers.
- Some may polymerize (P) explosively when heated or involved in a fire.
- Runoff to sewer may create fire or explosion hazard.
- Containers may explode when heated.
- Many liquids are lighter than water.

##### *Health*

- May cause toxic effects if inhaled or absorbed through skin.
- Inhalation or contact with material may irritate or burn skin and eyes.
- Fire will produce irritating, corrosive and/or toxic gases.
- Vapors may cause dizziness or suffocation.
- Runoff from fire control or dilution water may cause pollution.

#### Public Safety

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- Isolate spill or leak area immediately for at least 50 to 100 meters (160 to 330 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Keep out of low areas.
- Ventilate closed spaces before entering.

## ***Protective Clothing***

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Structural firefighters' protective clothing will only provide limited protection.

## ***Evacuation***

### *Large Spill*

- Consider initial downwind evacuation for at least 300 meters (1000 feet).

### *Fire*

- If tank, rail car, or tank truck is involved in a fire, isolate for 800 meters ( $\frac{1}{2}$  mile) in all directions; also, consider initial evacuation for 800 meters ( $\frac{1}{2}$  mile) in all directions.

## **Emergency Response**

---

### ***Fire***

CAUTION: All these products have a very low flash point: Use of water spray when fighting fire may be inefficient.

### *Small Fires*

- Dry chemical, CO<sub>2</sub>, water spray or alcohol-resistant foam.
- Do not use dry chemical extinguishers to control fires involving nitromethane or nitroethane.

### *Large Fires*

- Water spray, fog, or alcohol-resistant foam.
- Do not use straight streams.
- Move containers from fire area if you can do it without risk.

### *Fire Involving Tanks or Car/Trailer Loads*

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.

- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.
- For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

### ***Spill or Leak***

- Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area).
- All equipment used when handling the product must be grounded.
- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- Prevent entry into waterways, sewers, basements, or confined areas.
- A vapor suppressing foam may be used to reduce vapors.
- Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.
- Use clean non-sparking tools to collect absorbed material.

### ***Large Spills***

- Dike far ahead of liquid spill for later disposal.
- Water spray may reduce vapor; but may not prevent ignition in closed spaces.

### ***First Aid***

- Move victim to fresh air.
- Call emergency medical care.
- Apply artificial respiration if victim is not breathing.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.

- Wash skin with soap and water.
  - Keep victim warm and quiet.
  - Effects of exposure (inhalation, ingestion, or skin contact) to substance may be delayed.
  - Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.
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## NAERG Guide 131

### Flammable Liquids – Toxic

#### Potential Hazards

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##### *Health*

- Toxic; may be fatal if inhaled, ingested, or absorbed through skin.
- Inhalation or contact with some of these materials will irritate or burn skin and eyes.
- Fire will produce irritating, corrosive and/or toxic gases.
- Vapors may cause dizziness or suffocation.
- Runoff from fire control or dilution water may cause pollution.

##### *Fire or Explosion*

- Highly flammable: Will be easily ignited by heat, sparks or flames.
- Vapors may form explosive mixtures with air.
- Vapors may travel to source of ignition and flash back.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Vapor explosion and poison hazard indoors, outdoors or in sewers.
- Some may polymerize (P) explosively when heated or involved in a fire.
- Runoff to sewer may create fire or explosion hazard.
- Containers may explode when heated.
- Many liquids are lighter than water.

##### **Public Safety**

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- Isolate spill or leak area immediately for at least 100 to 200 meters (330 to 660 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Keep out of low areas.
- Ventilate closed spaces before entering.

## ***Protective Clothing***

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing which is specifically recommended by the manufacturer. It may provide little or no thermal protection.
- Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations.

## ***Evacuation***

### *Spill*

- See the Table of Initial Isolation and Protective Action Distances in the *North American Emergency Response Guidebook* for highlighted substances. For non-highlighted substances, increase, in the downwind direction, as necessary, the isolation distance shown in the "Public Safety" section above.

### *Fire*

- If tank, rail car, or tank truck is involved in a fire, isolate for 800 meters ( $\frac{1}{2}$  mile) in all directions; also, consider initial evacuation for 800 meters ( $\frac{1}{2}$  mile) in all directions.

## **Emergency Response**

---

### ***Fire***

CAUTION: All these products have a very low flash point; use of water spray when fighting fire may be inefficient.

### *Small Fires*

- Dry chemical, CO<sub>2</sub>, water spray or alcohol-resistant foam.

### *Large Fires*

- Water spray, fog, or alcohol-resistant foam.
- Move containers from fire area if you can do it without risk.
- Dike fire control water for later disposal; do not scatter the material.
- Do not use straight streams.

### *Fire Involving Tanks or Car/Trailer Loads*

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.
- For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

### ***Spill or Leak***

- Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire.
- Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediately area).
- All equipment used when handling the product must be grounded.
- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- Prevent entry into waterways, sewers, basements, or confined areas.
- A vapor suppressing foam may be used to reduce vapors.

### *Small Spills*

- Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal.
- Use clean non-sparking tools to collect absorbed material.

### *Large Spills*

- Dike far ahead of liquid spill for later disposal.
- Water spray may reduce vapor; but may not prevent ignition in closed spaces.

### ***First Aid***

- Move victim to fresh air.
- Call emergency medical care.

- Apply artificial respiration if victim is not breathing.
  - Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiration medical device.
  - Administer oxygen if breathing is difficult.
  - Remove and isolate contaminated clothing and shoes.
  - In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
  - Wash skin with soap and water.
  - Keep victim warm and quiet.
  - Effects of exposure (inhalation, ingestion, or skin contact) to substance may be delayed.
  - Ensure that medical personnel are aware of the materials(s) involved, and take precautions to protect themselves.
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## NAERG Guide 132

### Flammable Liquids – Corrosive

#### Potential Hazards

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##### *Fire or Explosion*

- Flammable/combustible materials.
- May be ignited by heat, sparks or flames.
- Vapors may form explosive mixtures with air.
- Vapors may travel to source of ignition and flash back.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Vapor explosion hazard indoors, outdoors, or in sewers.
- Some may polymerize (P) explosively when heated or involved in a fire.
- Runoff to sewer may create fire or explosion hazard.
- Containers may explode when heated.
- Many liquids are lighter than water.

##### *Health*

- May cause toxic effects if inhaled or ingested/swallowed.
- Contact with substance may cause severe burns to skin and eyes.
- Fire will produce irritating, corrosive and/or toxic gases.
- Vapors may cause dizziness or suffocation.
- Runoff from fire control or dilution water may cause pollution.

##### *Public Safety*

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- Isolate spill or leak area immediately for at least 50 to 100 meters (160 to 330 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Keep out of low areas.
- Ventilate closed spaces before entering.

## ***Protective Clothing***

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing which is specifically recommended by the manufacturer. It may provide little or no thermal protection.
- Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations.

## ***Evacuation***

### *Large Spill*

- See the Table of Initial Isolation and Protective Action Distances in the *North American Emergency Response Guidebook* for highlighted substances. For non-highlighted substances, increase in the downwind direction, as necessary, the isolation distance shown in the "Public Safety" section above.

### *Fire*

- If tank, rail car or tank truck is involved fire, isolate for 800 meters ( $\frac{1}{2}$  mile) in all directions; also, consider initial evacuation for 800 meters ( $\frac{1}{2}$  mile) in all directions.

## **Emergency Response**

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### ***Fire***

- Some of these materials may react violently with water.

### *Small Fires*

- Dry chemical, CO<sub>2</sub>, water spray or alcohol-resistant foam.

### *Large Fires*

- Water spray, fog, or alcohol-resistant foam.
- Move containers from fire area if you can do it without risk.
- Dike fire control water for later disposal; do not scatter the material.
- Do not get water inside containers.

### *Fire Involving Tanks or Car/Trailer Loads*

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.
- For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

### *Spill or Leak*

- Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire.
- Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area).
- All equipment used when handling the product must be grounded.
- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- Prevent entry into waterways, sewers, basements, or confined areas.
- A vapor suppressing foam may be used to reduce vapors.
- Absorb with earth, sand or other non-combustible material and transfer to containers (except for Hydrazine).
- Use clean non-sparking tools to collect absorbed material.

### *Large Spills*

- Dike far ahead of liquid spill for later disposal.
- Water spray may reduce vapor; but may not prevent ignition in closed spaces.

### *First Aid*

- Move victim to fresh air.
- Call emergency medical care.
- Apply artificial respiration if victim is not breathing.
- Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket

mask equipped with a one-way valve or other proper respiratory medical device.

- Administer oxygen if breathing is difficult.
  - Remove and isolate contaminated clothing and shoes.
  - In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
  - Keep victim warm and quiet.
  - Effects of exposure (inhalation, ingestion, or skin contact) to substance may be delayed.
  - Ensure that medical personnel are aware of the materials involved, and take precautions to protect themselves.
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## **NAERG Guide 133**

### **Flammable Solids**

#### **Potential Hazards**

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##### ***Fire or Explosion***

- Flammable/combustible material.
- May be ignited by friction, heat, sparks, or flames.
- Some may burn rapidly with flare burning effect.
- Powders, dusts, shavings, borings, turnings, or cuttings may explode or burn with explosive violence.
- Substance may be transported in a molten form.
- May re-ignite after fire is extinguished.

##### ***Health***

- Fire may produce irritating and/or toxic gases.
- Contact may cause burns to skin and eyes.
- Contact with molten substance may cause severe burns to skin and eyes.
- Runoff from fire control may cause pollution.

#### **Public Safety**

---

- Isolate spill or leak area immediately for at least 10 to 25 meters (30 to 80 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Keep out of low areas.

##### ***Protective Clothing***

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Structural firefighters' protective clothing will only provide limited protection.

## **Evacuation**

### *Large Spill*

- Consider initial downwind evacuation for at least 100 meters (330 feet).

### *Fire*

- If tank, rail car or tank truck is involved in a fire, isolate for 800 meters ( $\frac{1}{2}$  mile) in all directions; also, consider initial evacuation for 800 meters ( $\frac{1}{2}$  mile) in all directions.

## **Emergency Response**

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### **Fire**

#### *Small Fires*

- Dry chemical, CO<sub>2</sub>, sand, earth, water spray or regular foam.

#### *Large Fires*

- Water spray, fog, or regular foam.
- Move containers from fire area if you can do it without risk.

#### *Fire Involving Tanks or Car/Trailer Loads*

- Cool containers with flooding quantities of water until well after fire is out.
- For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.

### **Spill or Leak**

- Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area).
- Do not touch or walk through spilled material.

### *Small Dry Spills*

- With clean shovel place material into clean, dry container and cover loosely; move containers from spill area.

### *Large Spills*

- Wet down with water and dike for later disposal.
- Prevent entry into waterways, sewers, basements, or confined areas.

### ***First Aid***

- Move victim to fresh air.
  - Call emergency medical care.
  - Apply artificial respiration if victim is not breathing.
  - Administer oxygen if breathing is difficult.
  - Remove and isolate contaminated clothing and shoes.
  - In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
  - Removal of solidified molten material from skin requires medical assistance.
  - Keep victim warm and quiet.
  - Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.
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## NAERG Guide 135

### Substances: Spontaneously Combustible

#### Potential Hazards

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##### *Fire or Explosion*

- Flammable/combustible material.
- May ignite on contact with air or moist air.
- May burn rapidly with flare-burning effect.
- Some react vigorously or explosively on contact with water.
- Some may decompose explosively when heated or involved in a fire.
- May re-ignite after fire is extinguished.
- Runoff may create fire or explosion hazard.

##### *Health*

- Fire will produce irritating, corrosive and/or toxic gases.
- Inhalation of decomposition products may cause severe injury or death.
- Contact with substance may cause severe burns to skin and eyes.
- Runoff from fire control may cause pollution.

##### *Public Safety*

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- Isolate spill or leak area immediately for at least 100 to 150 meters (330 to 490 feet) in all directions.
- Stay upwind.
- Keep unauthorized personnel away.
- Keep out of low areas.

##### *Protective Clothing*

- Wear positive pressure self-contained breathing apparatus (SCBA).

- Wear chemical protective clothing which is specifically recommended by the manufacturer.
- Structural firefighters' protective clothing will only provide limited protection.

## **Evacuation**

### *Spill*

- See the Table of Initial Isolation and Protective Action Distances in the *North American Emergency Response Guidebook* for highlighted substances. For non-highlighted substances, increase, in the downwind direction, as necessary, the isolation distance shown in the "Public Safety" section above.

### *Fire*

- If tank, rail car, or tank truck is involved in a fire, isolate for 800 meters ( $\frac{1}{2}$  mile) in all directions; also, consider initial evacuation for 800 meters ( $\frac{1}{2}$  mile) in all directions.

## **Emergency Response**

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### **Fire**

- Do not use water, CO<sub>2</sub> or foam on material itself.
- Some of these materials may react violently with water.

### *Small Fires*

- Dry chemical, soda ash, lime, or dry sand.

### *Large Fires*

- Dry sand, dry chemical, soda ash, or lime or withdraw from area and let fire burn. CAUTION: Dithionite (Hydrosulfite/Hydrosulphite) fires may require flooding with water in order to eliminate hazardous reaction since the materials generate their own oxygen.
- Move containers from fire area if you can do it without risk.

### *Fire Involving Tanks or Car/Trailer Loads*

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.

- Do not get water inside containers or in contact with substance.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.

### ***Spill or Leak***

- Fully encapsulating, vapor protective clothing should be worn for spills and leak with no fire.
- Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area).
- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.

### ***Small Spills***

- Cover with dry earth, dry sand, or other non-combustible material followed with plastic sheet to minimize spreading or contact with rain.
- Use clean non-sparking tools to collect material and place it into loosely covered plastic containers for later disposal.
- Prevent entry into waterways, sewers, basements, or confined areas.

### ***First Aid***

- Move victim to fresh air.
- Call emergency medical care.
- Apply artificial respiration if victim is not breathing.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- Keep victim warm and quiet.
- Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

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## NAERG Guide 136

### Substances: Spontaneously Combustible/Toxic (Air Reactive)

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#### Potential Hazards

##### *Fire or Explosions*

- Extremely flammable; will ignite itself if exposed to air.
- Burns rapidly, releasing dense, white, irritating fumes.
- Substance may be transported in a molten form.
- May re-ignite after fire is extinguished.

##### *Health*

- Fire will produce irritating, corrosive and/or toxic gases.
- Toxic; ingestion of substance or inhalation of decomposition products will cause severe injury or death.
- Contact with substance may cause severe burns to skin and eyes.
- Some effects may be experienced due to skin absorption.
- Runoff from fire control maybe corrosive and/or toxic and cause pollution.

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#### Public Safety

- Isolate spill or leak area immediately for at least 100 to 150 meters (330 to 490 feet) in all directions.
- Stay upwind.
- Keep unauthorized personnel away.
- Keep out of low areas.

##### *Protective Clothing*

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing which is specifically recommended by the manufacturer.

- Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations.

## **Evacuation**

### *Spill*

- Consider initial downwind evacuation for at least 300 meters (1000 feet).

### *Fire*

- If tank, rail car or tank truck is involved in a fire, isolate for 800 meters ( $\frac{1}{2}$  mile) in all directions; also, consider initial evacuation for 800 meters ( $\frac{1}{2}$  mile) in all directions.

## **Emergency Response**

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### **Fire**

#### *Small Fires*

- Water spray, wet sand, or wet earth.

#### *Large Fires*

- Water spray or fog.
- Do not scatter spilled material with high pressure water streams.
- Move containers from fire area if you can do it without risk.

#### *Fire Involving Tanks or Car/Trailer Loads*

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.

### **Spill or Leak**

- Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire.

- Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area).
- Do not touch or walk through spilled material.
- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- Stop leak if you can do it without risk.

### *Small Spills*

- Cover with water, sand, or earth. Shovel into metal container and keep material under water.

### *Large Spills*

- Dike for later disposal and cover with wet sand or earth.
- Prevent entry into waterways, sewers, basements, or confined areas.

### ***First Aid***

- Move victim to fresh air.
  - Call emergency medical care.
  - Apply artificial respiration if victim is not breathing.
  - Administer oxygen if breathing is difficult.
  - In case of contact with substance, keep exposed skin areas immersed in water or covered with wet bandages until medical attention is received.
  - Removal of solidified molten material from skin requires medical assistance.
  - Remove and isolate contaminated clothing and shoes at the site and place in metal container filled with water. Fire hazard if allowed to dry.
  - Effects of exposure (inhalation, ingestion, or skin contact) to substance may be delayed.
  - Keep victim warm and quiet.
  - Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.
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## NAERG Guide 137

### Substances: Water-Reactive/Corrosive

#### Potential Hazards

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##### *Health*

- TOXIC; inhalation, ingestion or contact (skin, eyes) with vapors, dusts or substance may cause severe injury, burns, or death.
- Fire will produce irritating, corrosive and/or toxic gases.
- Reaction with water may generate much heat which will increase the concentration of fumes in the air.
- Contact with molten substance may cause severe burns to skin and eyes.
- Runoff from fire control or dilution water may cause pollution.

##### *Fire or Explosion*

- Some of these materials may burn, but none ignite readily.
- May ignite combustibles (wood, paper, oil, clothing, etc.).
- Substance will react with water (some violently), releasing corrosive and/or toxic gases.
- Flammable/toxic gases may accumulate in confined areas (basement, tanks, hopper/tank cars, etc.).
- Contact with metals may evolve flammable hydrogen gas.
- Containers may explode when heated or if contaminated with water.
- Substance may be transported in a molten form.

##### **Public Safety**

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- Isolate spill or leak area immediately for at least 50 to 100 meters (160 to 330 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.

## ***Protective Clothing***

- Keep out of low areas.
- Ventilate enclosed areas.
- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing which is specifically recommended by the manufacturer. Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations.

## ***Evacuation***

### *Spill*

- See the Table of Initial Isolation and Protective Action Distances in the *North American Emergency Response Guidebook* for highlighted substances. For non-highlighted substances, increase, in the downwind direction, as necessary, the isolation distance shown in the "Public Safety" section above.

### *Fire*

- If tank, rail car, or tank truck is involved in a fire, isolate for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

## **Emergency Response**

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### ***Fire***

- When material is not involved in fire, do not use water on material itself.

### *Small Fires*

- Dry chemical or CO<sub>2</sub>.
- Move containers from fire area if you can do it without risk.

### *Large Fires*

- Flood fire area with large quantities of water, while knocking down vapors with water fog. If insufficient water supply, knock down vapors only.

### *Fire Involving Tanks or Car/Trailer Loads*

- Cool containers with flooding quantities of water until well after fire is out.
- Do not get water inside containers.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.

### ***Spill or Leak***

- Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire.
- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- Stop leak if you can do it without risk.
- Use water spray to reduce vapors; do not put water directly on leak, spill area or inside container.
- Keep combustibles (wood, paper, oil, etc.) away from spilled material.

### *Small Spills*

- Cover with dry earth, dry sand, or other non-combustible material followed with plastic sheet to minimize spreading or contact with rain.
- Use clean non-sparking tools to collect material and place it into loosely covered plastic containers for later disposal.
- Prevent entry into waterways, sewers, basements or confined areas.

### ***First Aid***

- Move victim to fresh air.
- Call emergency medical care.
- Apply artificial respiration if victim is not breathing.
- Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.

- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
  - For minor skin contact, avoid spreading material on unaffected skin.
  - Removal of solidified molten material from skin requires medical assistance.
  - Keep victim warm and quiet.
  - Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed.
  - Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.
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**NAERG Guide 139**  
**Substances: Water-Reactive**  
**(Emitting Flammable and Toxic Gases)**

**Potential Hazards**

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***Fire or Explosion***

- Produce flammable and toxic gases on contact with water.
- May ignite on contact with water or moist air.
- Some react vigorously or explosively on contact with water.
- May be ignited by heat, sparks, or flames.
- May re-ignite after fire is extinguished.
- Some are transported in highly flammable liquids.
- Runoff may create fire or explosion hazard.

***Health***

- Highly toxic: contact with water produces toxic gas, may be fatal if inhaled.
- Inhalation or contact with vapors, substance, or decomposition products may cause severe injury or death.
- May produce corrosive solutions on contact with water.
- Fire will produce irritating, corrosive and/or toxic gases. Runoff from fire control may cause pollution.

**Public Safety**

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- Isolate spill or leak area immediately for at least 100 to 150 meters (330 to 490 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Keep out of low areas.
- Ventilate the area before entry.

## ***Protective Clothing***

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing which is specifically recommended by the manufacturer.
- Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations.

## ***Evacuation***

### *Large Spill*

- See the Table of Initial Isolation and Protective Action Distances in the *North American Emergency Response Guidebook* for highlighted substances. For non-highlighted substances, increase, in the downwind direction, as necessary, the isolation distance shown in the "Public Safety" section above.

### *Fire*

- If tank, rail car, or tank truck is involved in a fire, isolate for 800 meters ( $\frac{1}{2}$  mile) in all directions; also, consider initial evacuation for 800 meters ( $\frac{1}{2}$  mile) in all directions.

## **Emergency Response**

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### ***Fire***

- Do not use water or foam.

### *Small Fires*

- Dry chemical, soda ash, lime, or sand.

### *Large Fires*

- Dry sand, dry chemical, soda ash, or lime or withdraw from area and let fire burn.
- For chlorosilanes, use AFFF alcohol-resistant medium expansion foam; do not use dry chemicals, soda ash, or lime on chlorosilane fires as they may release large quantities of hydrogen gas which may explode.
- Move containers from fire area if you can do it without risk.

### *Fire Involving Tanks or Car/Trailer Loads*

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Do not get water inside containers.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.

### ***Spill or Leak***

- Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire.
- Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area).
- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- Do not get water on spilled substance or inside containers.
- Use water spray to reduce vapors or divert vapor cloud drift.
- For chlorosilanes, use AFFF alcohol-resistant medium expansion foam to reduce vapors.

### *Small Spills*

- Cover with dry earth, dry sand, or other non-combustible material followed with plastic sheet to minimize spreading or contact with rain.
- Dike for later disposal; do not apply water unless directed to do so.

### *Powder Spills*

- Cover powder spill with plastic sheet or tarp to minimize spreading and keep powder dry.
- Do not clean-up or dispose of, except under supervision of a specialist.

### ***First Aid***

- Move victim to fresh air.

- Call emergency medical care.
  - Apply artificial respiration if victim is not breathing.
  - Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
  - Administer oxygen if breathing is difficult.
  - Remove and isolate contaminated clothing and shoes.
  - In case of contact with substance, wipe from skin immediately; flush skin or eyes with running water for at least 20 minutes.
  - Keep victim warm and quiet.
  - Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.
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## **NAERG Guide 144**

### **Oxidizers (Water-Reactive)**

#### **Potential Hazards**

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##### ***Fire or Explosion***

- May ignite combustibles (wood, paper, oil, clothing, etc.).
- Reacts vigorously and/or explosively with water.
- Produces toxic and/or corrosive substances on contact with water.
- Flammable/toxic gases may accumulate in tanks and hopper cars.
- Containers may explode when heated.
- Runoff may create fire or explosion hazard.

##### ***Health***

- Toxic; inhalation or contact with vapor, substance, or decomposition products may cause severe injury or death.
- Fire will produce irritating, corrosive and/or toxic gases.
- Runoff from fire control or dilution water may cause pollution.

#### **Public Safety**

---

- Isolate spill or leak area immediately for at least 50 to 100 meters (160 to 330 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Keep out of low areas.
- Ventilate closed spaces before entering.

##### ***Protective Clothing***

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing which is specifically recommended by the manufacturer.
- Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations.

## **Evacuation**

### *Spill*

- See the Table of Initial Isolation and Protective Action Distances in the *North American Emergency Response Guidebook* for highlighted substances. For non-highlighted substances, increase, in the down-wind direction, as necessary, the isolation distance shown in the “Public Safety” section above.

### *Fire*

- If tank, rail car or tank truck is involved in a fire, isolate for 800 meters ( $\frac{1}{2}$  mile) in all directions; also, consider initial evacuation for 800 meters ( $\frac{1}{2}$  mile) in all directions.

## **Emergency Response**

---

### **Fire**

- Do not use water or foam.

### *Small Fires*

- Dry chemical, soda ash, or lime.

### *Large Fires*

- Dry sand, dry chemical, soda ash, or lime or withdraw from area and let fire burn.
- Move containers from fire area if you can do it without risk.

### *Fire Involving Tanks or Car/Trailer Loads*

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.

## ***Spill or Leak***

- Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area).
- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- Stop leak if you can do it without risk.
- Use water spray to reduce vapors or divert vapor cloud drift.
- Do not get water on spilled substance or inside containers.

### *Small Spills*

- Cover with dry earth, dry sand, or other non-combustible material followed with plastic sheet to minimize spreading or contact with rain.

### *Large Spills*

- Do not clean-up or dispose of, except under supervision of a specialist.

## ***First Aid***

- Move victim to fresh air.
- Call emergency medical care.
- Apply artificial respiration if victim is not breathing.
- Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- Keep victim warm and quiet.
- Keep victim under observation.
- Effects of contact or inhalation may be delayed.
- Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

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## **NAERG Guide 151**

### **Substances: Toxic (Non-Combustible)**

#### **Potential Hazards**

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##### ***Health***

- Highly toxic, may be fatal if inhaled, swallowed or absorbed through skin.
- Avoid any skin contact.
- Effects of contact or inhalation may be delayed.
- Fire may produce irritating, corrosive and/or toxic gases.
- Runoff from fire control or dilution water may be corrosive and/or toxic and cause pollution.

##### ***Fire or Explosion***

- Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes.
- Containers may explode when heated.
- Runoff may pollute waterways.

##### **Public Safety**

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- Isolate spill or leak area immediately for at least 25 to 50 meters (80 to 160 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Keep out of low areas.

##### ***Protective Clothing***

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing which is specifically recommended by the manufacturer.
- Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations.

## **Evacuation**

### *Spill*

- See the Table of Initial Isolation and Protective Action Distances in the *North American Emergency Response Guidebook* for highlighted substances. For non-highlighted substances, increase, in the down-wind direction, as necessary, the isolation distance shown in the “Public Safety” section above.

### *Fire*

- If tank, rail car, or tank truck is involved in a fire, isolate for 800 meters ( $\frac{1}{2}$  mile) in all directions; also, consider initial evacuation for 800 meters ( $\frac{1}{2}$  mile) in all directions.

## **Emergency Response**

---

### **Fire**

#### *Small Fires*

- Dry chemical, CO<sub>2</sub> or water spray.

#### *Large Fires*

- Water spray, fog, or regular foam.
- Move containers from fire area if you can do it without risk.
- Dike fire control water for later disposal; do not scatter the material.
- Do not use straight streams.

#### *Fire Involving Tanks or Car/Trailer Loads*

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Do not get water inside containers.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.
- For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

## ***Spill or Leak***

- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- Stop leak if you can do it without risk.
- Prevent entry into waterways, sewers, basements, or confined areas.
- Cover with plastic sheet to prevent spreading.
- Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.
- Do not get water inside containers.

## ***First Aid***

- Move victim to fresh air.
  - Call emergency medical care.
  - Apply artificial respiration if victim is not breathing.
  - Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
  - Administer oxygen if breathing is difficult.
  - Remove and isolate contaminated clothing and shoes.
  - In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
  - For minor skin contact, avoid spreading material on unaffected skin.
  - Keep victim warm and quiet.
  - Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed.
  - Ensure that medical personnel are aware of the materials involved, and take precautions to protect themselves.
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## **NAERG Guide 152**

### **Substances: Toxic (Combustible)**

#### **Potential Hazards**

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##### ***Health***

- Highly toxic, may be fatal if inhaled, swallowed, or absorbed through skin.
- Contact with molten substance may cause severe burns to skin and eyes.
- Avoid any skin contact.
- Effects of contact or inhalation may be delayed.
- Fire may produce irritating, corrosive and/or toxic gases.
- Runoff from fire control or dilution water may be corrosive and/or toxic and cause pollution.

##### ***Fire or Explosion***

- Combustible material: may burn but does not ignite readily.
- Containers may explode when heated.
- Runoff may pollute waterways.
- Substance may be transported in a molten form.

##### **Public Safety**

---

- Isolate spill or leak area immediately for at least 25 to 50 meters (80 to 160 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Keep out of low areas.

##### ***Protective Clothing***

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing which is specifically recommended by the manufacturer.

- Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations.

## **Evacuation**

### *Spill*

- See the Table of Initial Isolation and Protective Action Distances in the *North American Emergency Response Guidebook* for highlighted substances. For non-highlighted substances, increase, in the downwind direction, as necessary, the isolation distance shown in the "Public Safety" section above.

### *Fire*

- If tank, rail car, or tank truck is involved in a fire, isolate for 800 meters ( $\frac{1}{2}$  mile) in all directions; also, consider initial evacuation for 800 meters ( $\frac{1}{2}$  mile) in all directions.

## **Emergency Response**

---

### **Fire**

#### *Small Fires*

- Dry chemical, CO<sub>2</sub>, or water spray.

#### *Large Fires*

- Water spray, fog, or regular foam.
- Move containers from fire area if you can do it without risk.
- Dike fire control water for later disposal; do not scatter the material.
- Do not use straight streams.

#### *Fire Involving Tanks or Car/Trailer Loads*

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Do not get water inside containers.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.

- For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.

### ***Spill or Leak***

- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- Stop leak if you can do it without risk.
- Prevent entry into waterways, sewers, basements, or confined areas.
- Cover with plastic sheet to prevent spreading.
- Absorb or cover with dry earth, sand, or other non-combustible material and transfer to containers.
- Do not get water inside containers.

### ***First Aid***

- Move victim to fresh air.
  - Call emergency medical care.
  - Apply artificial respiration if victim is not breathing.
  - Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
  - Administer oxygen if breathing is difficult.
  - Remove and isolate contaminated clothing and shoes.
  - In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
  - For minor skin contact, avoid spreading material on unaffected skin.
  - Keep victim warm and quiet.
  - Effects of exposure (inhalation, ingestion, or skin contact) to substance may be delayed.
  - Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.
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## NAERG Guide 153

### Substances: Toxic and/or Corrosive (Combustible)

#### Potential Hazards

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##### *Health*

- Toxic; inhalation, ingestion, or skin contact with material may cause severe injury or death.
- Contact with molten substance may cause severe burns to skin and eyes.
- Avoid any skin contact.
- Effects of contact or inhalation may be delayed.
- Fire may produce irritating, corrosive and/or toxic gases.
- Runoff from fire control or dilution water may be corrosive and/or toxic and cause pollution.

##### *Fire or Explosion*

- Combustible material: may burn but does not ignite readily.
- When heated, vapors may form explosive mixtures with air: indoors, outdoors, and sewers explosion hazards.
- Some may polymerize (P) explosively when heated or involved in a fire.
- Contact with metals may evolve flammable hydrogen gas.
- Containers may explode when heated.
- Runoff may pollute waterways.

##### **Public Safety**

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- Substance may be transported in a molten form.
- Isolate spill or leak area immediately for at least 25 to 50 meters (80 to 160 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.

- Keep out of low areas.
- Ventilate enclosed areas.

### ***Protective Clothing***

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing which is specifically recommended by the manufacturer. Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations.

### ***Evacuation***

#### *Spill*

- See the Table of Initial Isolation and Protective Action Distances in the *North American Emergency Response Guidebook* for highlighted substances. For non-highlighted substances, increase, in the downwind direction, as necessary, the isolation distance shown in the "Public Safety" section above.

#### *Fire*

- If tank, rail car, or tank truck is involved in a fire, isolate for 800 meters ( $\frac{1}{2}$  mile) in all directions; also, consider initial evacuation for 800 meters ( $\frac{1}{2}$  mile) in all directions.

### **Emergency Response**

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#### ***Fire***

##### *Small Fires*

- Dry chemical, CO<sub>2</sub> or water spray.

##### *Large Fires*

- Dry chemical, CO<sub>2</sub>, alcohol-resistant foam or water spray.
- Move containers from fire area if you can do it without risk.
- Dike fire control water for later disposal; do not scatter the material.

### *Fire Involving Tanks or Car/Trailer Loads*

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Do not get water inside containers.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.

### *Spill or Leak*

- Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area).
- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- Stop leak if you can do it without risk.
- Prevent entry into waterways, sewers, basements, or confined areas.
- Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.
- Do not get water inside containers.

### *First Aid*

- Move victim to fresh air.
- Call emergency medical care.
- Apply artificial respiration if victim is not breathing.
- Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- For minor skin contact, avoid spreading material on unaffected skin.

- Keep victim warm and quiet.
  - Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed.
  - Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.
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## NAERG Guide 154

### Substances: Toxic and/or Corrosive (Non-Combustible)

#### Potential Hazards

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##### *Health*

- Toxic: inhalation, ingestion, or skin contact with material may cause severe injury or death.
- Contact with molten substance may cause severe burns to skin and eyes.
- Avoid any skin contact.
- Effects of contact or inhalation may be delayed.
- Fire may produce irritating, corrosive and/or toxic gases.
- Runoff from fire control or dilution water may be corrosive and/or toxic and cause pollution.

##### *Fire or Explosion*

- Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes.
- Some are oxidizers and may ignite combustibles (wood, paper, oil, clothing, etc.).
- Contact with metals may evolve flammable hydrogen gas.
- Containers may explode when heated.

##### **Public Safety**

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- Isolate spill or leak area immediately for at least 25 to 50 meters (80 to 160 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Keep out of low areas.
- Ventilate enclosed areas.

## ***Protective Clothing***

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing which is specifically recommended by the manufacturer.
- Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations.

## ***Evacuation***

### *Spill*

- See the Table of Initial Isolation and Protective Action Distances in the *North American Emergency Response Guidebook* for highlighted substances. For non-highlighted substances, increase, in the downwind direction, as necessary, the isolation distance shown in the "Public Safety" section above.

### *Fire*

- If tank, rail car, or tank truck is involved in a fire, isolate for 800 meters ( $\frac{1}{2}$  mile) in all directions; also, consider initial evacuation for 800 meters ( $\frac{1}{2}$  mile) in all directions.

## **Emergency Response**

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### ***Fire***

#### *Small Fires*

- Dry chemical, CO<sub>2</sub> or water spray.

#### *Large Fires*

- Dry chemical, CO<sub>2</sub>, alcohol-resistant foam or water spray.
- Move containers from fire area if you can do it without risk.
- Dike fire control water for later disposal; do not scatter the material.

#### *Fire Involving Tanks or Car/Trailer Loads*

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Do not get water inside containers.

- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.

### ***Spill or Leak***

- Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area).
- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- Stop leak if you can do it without risk.
- Prevent entry into waterways, sewers, basements, or confined areas.
- Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers.
- Do not get water inside containers.

### ***First Aid***

- Move victim to fresh air.
- Call emergency medical care.
- Apply artificial respiration if victim is not breathing.
- Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- For minor skin contact, avoid spreading material on unaffected skin.
- Keep victim warm and quiet.
- Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed.
- Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

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**NAERG Guide 155**  
**Substances: Toxic and/or Corrosive**  
**(Flammable/Water-Reactive)**

**Potential Hazards**

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***Fire or Explosion***

- Highly Flammable: will be easily ignited by heat, sparks or flames.
- Vapors form explosive mixtures with air: indoors, outdoors, and sewers explosion hazards.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Vapors may travel to source of ignition and flash back.
- Substance will react with water (some violently) releasing flammable, toxic, or corrosive gases and runoff.
- Contact with metals may evolve flammable hydrogen gas.
- Containers may explode when heated or if contaminated with water.

***Health***

- Toxic: inhalation, ingestion or contact (skin, eyes) with vapors, dusts or substance may cause severe injury, burns, or death.
- Bromoacetates and chloroacetates are extremely irritating/lachrymators.
- Reaction with water or moist air will release toxic, corrosive, or flammable gases.
- Reaction with water may generate much heat which will increase the concentration of fumes in the air.
- Fire will produce irritating, corrosive and/or toxic gases.
- Runoff from fire control or dilution water may be corrosive and/or toxic and cause pollution.

**Public Safety**

---

- Isolate spill or leak area immediately for at least 50 to 100 meters (160 to 330 feet) in all directions.

- Keep unauthorized personnel away.
- Stay upwind.
- Keep out of low areas.
- Ventilate enclosed areas.

### ***Protective Clothing***

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing which is specifically recommended by the manufacturer.
- Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations.

### ***Evacuation***

#### *Spill*

- See the Table of Initial Isolation and Protective Action Distances in the *North American Emergency Response Guidebook* for highlighted substances. For non-highlighted substances, increase, in the downwind direction, as necessary, the isolation distance shown in the "Public Safety" section above.

#### *Fire*

- If tank, rail car, or tank truck is involved in a fire, isolate for 800 meters ( $\frac{1}{2}$  mile) in all directions; also, consider initial evacuation for 800 meters ( $\frac{1}{2}$  mile) in all directions.

### **Emergency Response**

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#### ***Fire***

- Note: Most foams will react with the material and release corrosive/toxic gases.

#### *Small Fires*

- CO<sub>2</sub>, dry chemical, dry sand, alcohol-resistant foam.

#### *Large Fires*

- Water spray, fog or alcohol-resistant foam.

- For chlorosilanes, do not use water; use AFFF alcohol-resistant medium expansion foam.
- Move containers from fire area if you can do it without risk.
- Do not use straight streams.

#### *Fire Involving Tanks or Car/Trailer Loads*

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Do not get water inside containers.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.

#### ***Spill or Leak***

- Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area).
- All equipment used when handling the product must be grounded.
- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- Stop leak if you can do it without risk.
- A vapor suppressing foam may be used to reduce vapors.
- For chlorosilanes, use AFFF alcohol-resistant medium expansion foam to reduce vapors.
- Do not get water on spilled substance or inside containers.
- Use water spray to reduce vapors or divert vapor cloud drift.
- Prevent entry into waterways, sewers, basements, or confined areas.

#### *Small Spills*

- Cover with dry earth, dry sand, or other non-combustible material followed with plastic sheet to minimize spreading or contact with rain.
- Use clean non-sparking tools to collect material and place it into loosely covered plastic containers for later disposal.

## ***First Aid***

- Move victim to fresh air.
  - Call emergency medical care.
  - Apply artificial respiration if victim is not breathing.
  - Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
  - Administer oxygen if breathing is difficult.
  - Remove and isolate contaminated clothing and shoes.
  - In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
  - For minor skin contact, avoid spreading material on unaffected skin.
  - Keep victim warm and quiet.
  - Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed.
  - Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.
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## **NAERG Guide 156**

### **Substances: Toxic and/or Corrosive (Combustible/Water-Sensitive)**

#### **Potential Hazards**

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##### ***Fire or Explosive***

- Combustible material: may burn but does not ignite readily.
- Substance will react with water (some violently) releasing flammable, toxic or corrosive gases and runoff.
- When heated, vapors may form explosive mixtures with air: indoors, outdoors, and sewers explosion hazards.
- Most vapors are heavier than air. They will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Vapors may travel to source of ignition and flash back.
- Contact with metals may evolve flammable hydrogen gas.
- Containers may explode when heated or if contaminated with water.

##### ***Health***

- Toxic: inhalation, ingestion or contact (skin, eyes) with vapors, dusts or substance may cause severe injury, burns, or death.
- Reaction with water or moist air will release toxic, corrosive, or flammable gases.
- Reaction with water may generate much heat which will increase the concentration of fumes in the air.
- Fire will produce irritating, corrosive and/or toxic gases.
- Runoff from fire control or dilution water may be corrosive and/or toxic and cause pollution.

##### **Public Safety**

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- Isolate spill or leak area immediately for at least 50 to 100 meters (160 to 330 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.

- Keep out of low areas.
- Ventilate enclosed areas.

### ***Protective Clothing***

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing which is specifically recommended by the manufacturer.
- Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations.

### ***Evacuation***

#### *Spill*

- See the Table of Initial Isolation and Protective Action Distances in the *North American Emergency Response Guidebook* for highlighted substances. For non-highlighted substances, increase, in the downwind direction, as necessary, the isolation distance shown in the "Public Safety" section above.

#### *Fire*

- If tank, rail car, or tank truck is involved in a fire, isolate for 800 meters ( $\frac{1}{2}$  mile) in all directions; also, consider initial evacuation for 800 meters ( $\frac{1}{2}$  mile) in all directions.

### **Emergency Response**

---

#### ***Fire***

- Note: Most foams will react with the material and release corrosive/toxic gases.

#### *Small Fires*

- CO<sub>2</sub>, dry chemical, dry sand, alcohol-resistant foam.

#### *Large Fires*

- Water spray, fog or alcohol-resistant foam.
- For chlorosilanes, do not use water; use AFFF alcohol-resistant medium expansion foam.

- Move containers from fire area if you can do it without risk.
- Do not use straight streams.

### *Fire Involving Tanks or Car/Trailer Loads*

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Do not get water inside containers.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.

### ***Spill or Leak***

- Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area).
- All equipment used when handling the product must be grounded.
- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- Stop leak if you can do it without risk.
- A vapor suppressing foam may be used to reduce vapors.
- For chlorosilanes, use AFFF alcohol-resistant medium expansion foam to reduce vapors.
- Do not get water on spilled substance or inside containers.
- Use water spray to reduce vapors or divert vapor cloud drift.
- Prevent entry into waterways, sewers, basements, or confined areas.

### *Small Spills*

- Cover with dry earth, dry sand, or other non-combustible material followed with plastic sheet to minimize spreading or contact with rain.
- Use clean non-sparking tools to collect material and place it into loosely covered plastic containers for later disposal.

### ***First Aid***

- Move victim to fresh air.

- Call emergency medical care.
  - Apply artificial respiration if victim is not breathing.
  - Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
  - Administer oxygen if breathing is difficult.
  - Remove and isolate contaminated clothing and shoes.
  - In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
  - For minor skin contact, avoid spreading material on unaffected skin.
  - Keep victim warm and quiet.
  - Effects of exposure (inhalation, ingestion, or skin contact) to substance may be delayed.
  - Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.
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**NAERG Guide 157**  
**Substances: Toxic and/or Corrosive**  
**(Non-Combustible/Water-Sensitive)**

**Potential Hazards**

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***Health***

- Toxic; inhalation, ingestion or contact (skin, eyes) with vapors, dusts, or substance may cause severe injury, burns, or death.
- Reaction with water or moist air will release toxic, corrosive, or flammable gases.
- Reaction with water may generate much heat which will increase the concentration of fumes in the air.
- Fire will produce irritating, corrosive and/or toxic gases.
- Runoff from fire control or dilution water may be corrosive and/or toxic and cause pollution.

***Fire or Explosion***

- Non-combustible, substance itself does not burn but may decompose upon heating to produce corrosive and/or toxic fumes.
- Vapors may accumulate in confined areas (basement, tanks, hopper/tank cars etc.).
- Substance will react with water (some violently), releasing corrosive and/or toxic gases.
- Reaction with water may generate much heat which will increase the concentration of fumes in the air.
- Contact with metals may evolve flammable hydrogen gas.
- Containers may explode when heated or if contaminated with water.

**Public Safety**

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- Isolate spill or leak area immediately for at least 50 to 100 meters (160 to 330 feet) in all directions.
- Keep unauthorized personnel away.

- Stay upwind.
- Keep out of low areas.
- Ventilate enclosed areas.

### ***Protective Clothing***

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing which is specifically recommended by the manufacturer.
- Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations.

### ***Evacuation***

#### *Spill*

- See the Table of Initial Isolation and Protective Action Distances in the *North American Emergency Response Guidebook* for highlighted substances. For non-highlighted substances, increase, in the downwind direction, as necessary, the isolation distance shown in the "Public Safety" section above.

#### *Fire*

- If tank, rail car, or tank truck is involved in a fire, isolate for 800 meters ( $\frac{1}{2}$  mile) in all directions; also, consider initial evacuation for 800 meters ( $\frac{1}{2}$  mile) in all directions.

### **Emergency Response**

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#### ***Fire***

- Note: Most foams will react with the material and release corrosive/toxic gases.

#### *Small Fires*

- CO<sub>2</sub> (except for Cyanides), dry chemical, dry sand, alcohol-resistant foam.

#### *Large Fires*

- Water spray, fog or alcohol-resistant foam.

- Move containers from fire area if you can do it without risk.
- Do not use straight streams.
- Dike fire control water for later disposal; do not scatter the material.

#### *Fire Involving Tanks or Car/Trailer Loads*

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Do not get water inside containers.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.

#### ***Spill or Leak***

- Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area).
- All equipment used when handling the product must be grounded.
- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- Stop leak if you can do it without risk.
- A vapor suppressing foam may be used to reduce vapors.
- Do not get water inside containers.
- Use water spray to reduce vapors or divert vapor cloud drift.
- Prevent entry into waterways, sewers, basements or confined areas.

#### *Small Spills*

- Cover with dry earth, dry sand, or other non-combustible material followed with plastic sheet to minimize spreading or contact with rain.
- Use clean non-sparking tools to collect material and place it into loosely covered plastic containers for later disposal.

#### ***First Aid***

- Move victim to fresh air.
- Call emergency medical care.
- Apply artificial respiration if victim is not breathing.

- Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
  - Administer oxygen if breathing is difficult.
  - Remove and isolate contaminated clothing and shoes.
  - In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
  - For minor skin contact, avoid spreading material on unaffected skin.
  - Keep victim warm and quiet.
  - Effects of exposure (inhalation, ingestion or skin contact) to substance may be delayed.
  - Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.
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## **NAERG Guide 158**

### **Infectious Substances**

#### **Potential Hazards**

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##### ***Health***

- Inhalation or contact with substance may cause infection, disease, or death.
- Runoff from fire control may cause pollution.
- Note: Damage packages containing solid CO<sub>2</sub> as a refrigerant may produce water or frost from condensation of air. Do not touch this liquid as it could be contaminated by the contents of the parcel.

##### ***Fire or Explosion***

- Some of these materials may burn, but none ignite readily.
- Some may be transported in flammable liquids.

#### **Public Safety**

---

- Isolate spill or leak area immediately for at least 10 to 25 meters (30 to 80 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Obtain identity of substance involved.

##### ***Protective Clothing***

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Structural firefighters' protective clothing will only provide limited protection.

## Emergency Response

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### **Fire**

#### *Small Fires*

- Dry chemical, soda ash, lime, or sand.

#### *Large Fires*

- Use extinguishing agent suitable for type of surrounding fire.
- Move containers from fire area if you can do it without risk.
- Do not scatter spilled material with high-pressure water streams.

### **Spill or Leak**

- Do not touch or walk through spilled material.
- Do not touch damaged containers or spilled material unless wearing appropriate protective clothing.
- Absorb with earth, sand, or other non-combustible material.
- Cover damaged package or spilled material with damp towel or rag and keep wet with liquid bleach or other disinfectant.
- Do not clean-up or dispose of except under supervision of a specialist.

### **First Aid**

- Move victim to safe isolate area. CAUTION: Victim may be a source of contamination.
- Call emergency medical care.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- Effects of exposure (inhalation, ingestion, or skin contact) to substance may be delayed.
- For further assistance, contact your local Poison Control Center.
- Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

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## **NAERG Guide 159 Substances (Irritating)**

### **Potential Hazards**

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#### ***Health***

- Inhalation of vapors or dust is extremely irritating.
- May cause coughing, difficult breathing, and nausea.
- Brief exposure effects last only a few minutes.
- Exposure in an enclosed area may be very harmful.
- Fire will produce irritating, corrosive and/or toxic gases.
- Runoff from fire control or dilution water may cause pollution.

#### ***Fire or Explosion***

- Some of these materials may burn, but none ignite readily.
- Containers may explode when heated.

### **Public Safety**

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- Isolate spill or leak area immediately for at least 25 to 50 meters (80 to 160 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Keep out of low areas.
- Ventilate closed spaces before entering.

#### ***Protective Clothing***

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Wear chemical protective clothing which is specifically recommended by the manufacturer.
- Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations.

## **Evacuation**

### *Large Spill*

- Consider initial downwind evacuation for at least 100 meters (330 feet).

### *Fire*

- If tank, rail car, or tank truck is involved in a fire, isolate for 800 meters ( $\frac{1}{2}$  mile) in all directions; also, consider initial evacuation for 800 meters ( $\frac{1}{2}$  mile) in all directions.

## **Emergency Response**

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### **Fire**

#### *Small Fires*

- Dry chemical, CO<sub>2</sub>, water spray or regular foam.

#### *Large Fires*

- Water spray, fog, or regular foam.
- Move containers from fire area if you can do it without risk.
- Dike fire control water for later disposal; do not scatter the material.

#### *Fire Involving Tanks or Car/Trailer Loads*

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Do not get water inside containers.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.
- For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn.
- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire.

## ***Spill or Leak***

### *Small Spills*

- Take up with sand or other non-combustible absorbent material and place into containers for later disposal.

### *Large Spills*

- Dike far ahead of liquid spill for later disposal.
- Prevent entry into waterways, sewers, basements, or confined areas.

## ***First Aid***

- Move victim to fresh air.
  - Call emergency medical care.
  - Apply artificial respiration if victim is not breathing.
  - Do not use mouth-to-mouth method if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
  - Administer oxygen if breathing is difficult.
  - Remove and isolate contaminated clothing and shoes.
  - In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
  - For minor skin contact, avoid spreading material on unaffected skin.
  - Keep victim warm and quiet.
  - Effects should disappear after individual has been exposed to fresh air for approximately 10 minutes.
  - Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.
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## **NAERG Guide 160**

### **Halogenated Solvents**

#### **Potential Hazards**

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##### ***Health***

- Vapors may cause dizziness or suffocation.
- Exposure in an enclosed area may be very harmful.
- Contact may irritate or burn skin and eyes.
- Fire may produce irritating and/or toxic gases.
- Runoff from fire control or dilution water may cause pollution.

##### ***Fire or Explosion***

- Some of these materials may burn, but none ignite readily.
- Most vapors are heavier than air.
- Air/vapor mixtures may explode when ignited.
- Container may explode in heat of fire.

#### **Public Safety**

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- Isolate spill or leak area immediately for at least 25 to 50 meters (80 to 160 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks).
- Keep out of low areas.
- Ventilate closed spaces before entering.

##### ***Protective Clothing***

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Structural firefighters' protective clothing will only provide limited protection.

## **Evacuation**

### *Large Spill*

- Consider initial downwind evacuation for at least 100 meters (330 feet).

### *Fire*

- If tank, rail car or tank truck is involved in a fire, isolate for 800 meters ( $\frac{1}{2}$  mile) in all directions; also, consider initial evacuation for 800 meters ( $\frac{1}{2}$  mile) in all directions.

## **Emergency Response**

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### **Fire**

#### *Small Fires*

- Dry chemical, CO<sub>2</sub>, or water spray.

#### *Large Fires*

- Dry chemical, CO<sub>2</sub>, alcohol-resistant foam or water spray.
- Move containers from fire area if you can do it without risk.
- Dike fire control water for later disposal; do not scatter the material.

#### *Fire Involving Tanks or Car/Trailer Loads*

- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.

### **Spill or Leak**

- Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area).
- Stop leak if you can do it without risk.

### *Small Liquid Spills*

- Take up with sand, earth, or other noncombustible absorbent material.

### *Large Spills*

- Dike far ahead of liquid spill for later disposal.
- Prevent entry into waterways, sewers, basements, or confined areas.

### ***First Aid***

- Move victim to fresh air.
  - Call emergency medical care.
  - Apply artificial respiration if victim is not breathing.
  - Administer oxygen if breathing is difficult.
  - Remove and isolate contaminated clothing and shoes.
  - In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
  - For minor skin contact, avoid spreading material on unaffected skin.
  - Wash skin with soap and water.
  - Keep victim warm and quiet.
  - Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.
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## **NAERG Guide 171**

### **Substances (Low To Moderate Hazard)**

#### **Potential Hazards**

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##### ***Fire or Explosion***

- Some may burn but none ignite readily.
- Some may polymerize (P) explosively when heated or involved in a fire.
- Containers may explode when heated.
- Some may be transported hot.

##### ***Health***

- Inhalation of material may be harmful.
- Contact may cause burns to skin and eyes.
- Inhalation of asbestos dust may have a damaging effect on the lungs.
- Fire may produce irritating, corrosive and/or toxic gases.
- Runoff from fire control may cause pollution.

##### **Public Safety**

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- Isolate spill or leak area immediately for at least 10 to 25 meters (30 to 80 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.

##### ***Protective Clothing***

- Wear positive pressure self-contained breathing apparatus (SCBA).
- Structural firefighters' protective clothing will only provide limited protection.

## *Fire*

- If tank, rail car, or tank truck is involved in a fire, isolate for 800 meters ( $\frac{1}{2}$  mile) in all directions; also, consider initial evacuation for 800 meters ( $\frac{1}{2}$  mile) in all directions.

## **Emergency Response**

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### ***Fire***

#### *Small Fires*

- Dry chemical, CO<sub>2</sub>, water spray or regular foam.

#### *Large Fires*

- Water spray, fog, or regular foam.
- Move containers from fire area if you can do it without risk.
- Do not scatter spilled material with high pressure water streams.
- Dike fire-control water for later disposal.

#### *Fire Involving Tanks*

- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- Always stay away from the ends of tanks.

### ***Spill or Leak***

- Do not touch or walk through spilled material.
- Stop leak if you can do it without risk.
- Prevent dust cloud.
- Avoid inhalation of asbestos dust.

#### *Small Dry Spills*

- With clean shovel place material into clean, dry container and cover loosely; move containers from spill area.

### *Small Spills*

- Take up with sand or other non-combustible absorbent material and place into containers for later disposal.

### *Large Spills*

- Dike far ahead of liquid spill for later disposal.
- Cover powder spill with plastic sheet or tarp to minimize spreading.
- Prevent entry into waterways, sewers, basements, or confined areas.

### ***First Aid***

- Move victim to fresh air.
- Call emergency medical care.
- Apply artificial respiration if victim is not breathing.
- Administer oxygen if breathing is difficult.
- Remove and isolate contaminated clothing and shoes.
- In case of contact with substance, immediately flush skin or eyes with running water for at least 20 minutes.
- Ensure that medical personnel are aware of the materials involved, and take precautions to protect themselves.

**Section V**

**General Section**

# 5

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## *Agent Detector Characteristics*

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Initial detection and identification of the nature of materials used in a deliberate release situation are much more difficult than at the scene of a “normal” hazardous materials incident. Responders to a “normal” incident can usually uncover some form of posted warning (e.g., 704M diamond, transportation placards) or documentation (e.g., manifests, MSDSs) on the material. At a deliberate release, however, it is highly unlikely that there will be any precautionary information upon which responders can base their actions.

Chemical warfare agents, as with other hazardous materials, can be detected through the use of a number of different types of instruments. Some instruments provide only a yes/no indication that some chemical is present. Others also make a qualitative to semi-quantitative evaluation of amount of agents present. However, military battlefield detection systems are only designed to alert personnel to agent concentrations that will inhibit the performance of their mission, that is, concentrations of agents that will cause death or acute symptoms. These systems are not sensitive to lesser concentrations that may lead to chronic symptoms or latent problems such as cancer. Additionally, several detectors have a high rate of false alarms due to cross-sensitivity to common interferents such as diesel fuel, vehicle exhaust, or smoke. Because of the prevalence of these interferents in cities, a significant number of detector false alarms can be expected. Some common interferents for various detectors are listed in the table.

In addition to these specialty systems, some fire departments, and the majority of HazMat teams, have access to some form of commercial systems for detection of hazardous chemicals. These systems may include instruments for general surveys of organic vapors (e.g., photo ionization detectors, flame ionization detectors), instrumentation capable of detecting and identifying specific gases (e.g., MonoTox, Snapshot), colorimetric tube systems (e.g., Drager, Sensidyne, MSA), and instruments capable of determining the acidity of liquids (e.g., pH paper, pH meter).

Other than phosgene and the cyanide agents, most chemical warfare agents are thought to have ionization potentials of less than 10.6 eV. Therefore screening with photo ionization detectors (PIDs) and flame ionization detectors (FIDs) is possible. However, because these systems will not differentiate

between hazardous materials and any other ionizable chemical vapor, interpretation of the screening results is necessary.

Tubes for colorimetric systems are available that are capable of qualitatively identifying nerve agents, blister agents, and vomiting agents. Tubes are also available that can identify as well as provide semi-quantitative indication of vapor concentration for blood and choking agents. Many of these tubes have cross sensitivities and, again, care must be taken to correctly interpret the results. These tubes are listed in the table.

Chemical warfare agents in their pure states will generally have a neutral pH. However, impure agents, especially those that have been manufactured by the terrorists, may be slightly acidic and indicate a low pH.

Table 5.1 lists some of the systems available to detect, and in some cases identify, various chemical and biological agents. The  $\geq$  symbol indicates that the listed value is the minimal concentration detectable by the detector system. If a range of concentrations is listed, then the manufacturer has specified that the detector works optimally within that range. Results from analysis of agent concentrations outside of the specified levels (either greater or lesser values) may not be accurate. A designation of "Qualitative" indicates that the system will only identify the given agent.

**TABLE 5.1**

## Agent Detector Characteristics

Detector System	Agents Detected	Sensitivity	Response Time
<i>Chemical Agent Vapors</i>			
MM-1 (in FOX NBC Reconnaissance Vehicle) <sup>a</sup>	Phosgene (CG)	≥ 28 ppm	≤ 45 sec
	Sarin (GB)	≥ 11 ppm	≤ 45 sec
	Cyanogen chloride (CK)	≥ 19 ppm	≤ 45 sec
M8A1 Alarm <sup>b</sup>	G and V series nerve agents	≥ 0.2 ppm	≤ 2 min
M256A1 Kit <sup>c</sup>	G-series nerve agents	≥ 0.00009 ppm	15 min
	V-series nerve agents	≥ 0.002 ppm	15 min
	Sulfur mustard (HD)	≥ 0.03 ppm	15 min
	Lewisite (L)	≥ 1 ppm	15 min
	Phosgene Oxime (CX)	≥ 0.6 ppm	15 min
	Cyanogen chloride (CK)	≥ 3 ppm	15 min
	Hydrogen cyanide (AC)	≥ 8 ppm	15 min
	Common interferences include high temperatures, petroleum products, some pesticides, and burning brush and military decontaminating solution DS2. Kit will not function at temperatures below 25°F.		
CAM/ICAM <sup>d</sup>	Tabun (GA), sarin (GB), VX, sulfur mustard (HD), and nitrogen mustard (HN)	≥ 0.02 ppm	≤ 1 min
	Common interferences include ammonia, burning gasoline, burning grass, gasoline vapor, breath mints, burning kerosene, brake fluid, insect repellent, military decontaminating solution DS2, and the M258 military decontamination kit		
ICAD <sup>e</sup>	Sulfur mustard (HD)	≥ 2 ppm	< 120 sec
	Sarin (GB)	≥ 0.9 ppm	< 30 sec
	Phosgene (CG)	≥ 6 ppm	< 15 sec
	Hydrogen cyanide (AC)	≥ 45 ppm	< 120 sec
	Screening mode for sulfur mustard (HD) and lewisite (L)	≥ 7 ppm	< 30 sec
	Screening mode for G-series nerve agents	≥ 0.08 ppm	< 120 sec
M18A2 Kit <sup>f</sup>	Sarin (GB)	≥ 0.2 ppm	2 min
	Phosgene (CG)	≥ 3 ppm	1 min
	Sulfur mustard (HD)	≥ 0.08 ppm	3 min
	Lewisite (L)	≥ 1 ppm	1 min

**TABLE 5.1 (CONTINUED)**

Agent Detector Characteristics

Detector System	Agents Detected	Sensitivity	Response Time
	Hydrogen cyanide (AC)	≥ 7 ppm	1 min
	Sarin (GB) and V series agents	≥ 0.02 ppm	4 min

*Colorimetric Tubes<sup>g</sup>*

Phosphoric Acid esters	Nerve agents	Qualitative	300 sec
Thioethers	Sulfur mustards	Qualitative	80 sec
Organic Basic Nitrogen Compounds	Nitrogen mustards and some nerve agents	Qualitative	80 sec
Organic Arsenic Compounds	Arsenical mustards, arsine (SA), and vomiting agents	Qualitative	80–160 sec
Hydrocyanic Acid	Hydrogen cyanide (AC)	2 – 30 ppm	48 sec
Cyanogen Chloride	Cyanogen chloride (CK)	0.25 – 5 ppm	12-210 sec
Phosgene	Phosgene (CG)	0.25 – 15 ppm	53 sec
Carbon Tetrachloride	Phosgene (CG), and chloropicrin (PS)	1 – 15 ppm	300 sec
Chlorine	Halogens (Cl <sub>2</sub> , Br <sub>2</sub> )	50 – 500 ppm	15 sec
Chloroformates	Diphosgene (DP)	0.2 – 10 ppm	150 sec
APD 2000 <sup>h</sup>	G-series nerve agents	≥ 0.015 ppm	30 sec
	VX	≥ 0.004 ppm	30 sec
	Sulfur mustard (HD)	≥ 0.3 ppm	15 sec
	Nitrogen mustard (HN)	≥ 0.3 ppm	15 sec
	Lewisite (L)	≥ 0.2 ppm	15 sec
	Mace		
	Pepper Spray		

*Chemical Agent Liquids*

M8 Paper <sup>i</sup>	G and V series nerve agents, sulfur mustard (HD), lewisite (L), nitrogen mustard (HN), and phosgene oxime (CX)	0.02 ml drops	≤ 30 sec
	Common interferences include high temperatures, certain cleaning solvents, insect repellent, petroleum products, and military decontaminating solution DS2.		
M9 Paper <sup>i</sup>	All liquid agents	0.1 ml drops	≤ 20 sec
	Common interferences include high temperatures (≥ 125°F) abrasion, brake fluid, large droplets of gasoline, grease, petroleum based hydraulic fluids, insect repellent and sprays, gear lubricating oil, ethylene glycol [antifreeze], and military decontaminating solution DS2. M9 paper will not respond to chemical agents when wet.		

**TABLE 5.1 (CONTINUED)**

Agent Detector Characteristics

Detector System	Agents Detected	Sensitivity	Response Time
MM-1 (in FOX NBC Reconnaissance Vehicle) <sup>a</sup>	Multiple	0.1 – 100 µg	≤ 45 sec
M272 Kit <sup>j</sup>	G and V series nerve agents Sulfur mustard (HD), and lewisite (L) Hydrogen cyanide (AC)	≥ 0.02 mg/l ≥ 2.0 mg/l ≥ 20 mg/l	7 min 7 min 6 min

Detector System	Agents Detected
<i>Toxin Agents</i>	
Rapid diagnostic assays fielded in support of Operation Desert Storm/Shield <sup>k</sup>	Botulinum Toxin Clostridium Perfringens Toxin Staphylococcal Enterotoxin B (SEB) Staphylococcal Enterotoxins A/C1,2,3/D
Commercially available SMART Tickets	Botulinum Toxin Staphylococcus Enterotoxin B (SEB)

<i>Pathogen Agents</i>	
Rapid diagnostic assays fielded in support of Operation Desert Storm/Shield <sup>l</sup>	Anthrax Crimean-Congo Hemorrhagic Fever Dengue (DF, DHF, DSS) Mediterranean Spotted Fever Q Fever Plague Relapsing Fever Rift Valley Fever Sandfly Fever, Naples Sandfly Fever, Sicilian Sindbis Fever Tularemia Typhus, Murine (Endemic) West Nile Fever/Encephalitis
Commercially available SMART Tickets	Anthrax Plague

**TABLE 5.1 (CONTINUED)**

## Agent Detector Characteristics

- <sup>a</sup> The FOX Nuclear, Biological and Chemical Reconnaissance System is a wheeled, armored vehicle equipped with an on board mass spectrometer (MM-1) for the identification of chemical contamination. The FOX was designed to locate the presence of, and mark the extent of, ground contamination caused by liquid chemical agents. Two sampling wheels are located on the rear of the vehicle. These wheels are lowered and roll on the ground during reconnaissance operations. At various intervals, these wheels are lifted and “sniffed” by a sampling probe. The probe is attached to the mass spectrometer. Although extremely sensitive, the mass spectrometer system is not optimized for sampling generalized airborne chemical vapors. When operating in the air sampling mode, very high concentrations of chemical agents must be present in order for the FOX to provide suitable warning to unprotected individuals in the vicinity.
- <sup>b</sup> The M8Al Automatic Chemical Agent Alarm electronically monitors for hazardous levels of nerve agent vapor. While sensitive, it is also prone to false positive responses due to high concentrations of various organic compounds including some pesticides and vehicle exhausts. Operators must be trained to use care in emplacing the device to minimize the chance of false alarms.
- <sup>c</sup> The most widely available U.S. military detector for chemical agent vapors is the M256Al Chemical Agent Detector Kit. These kits contain cards with vials of liquid chemical reagents attached that are combined and exposed to the air in a specific sequence. The kits must be manually manipulated, and the full sequence of tests takes 20 to 25 minutes. These kits are the most sensitive detector of nerve agent vapor and are not subject to the same type of interferents that can cause false alarms in some of the electronic detector systems.
- <sup>d</sup> Although the Chemical Agent Monitor (CAM) and the Improved Chemical Agent Monitor (ICAM) detect chemical agent vapors, they are not designed to function as a survey instrument. In practice they serve as post-attack devices for determining the presence of vapors emanating from residual liquid contamination. In general, the probe of the monitor must be within one inch of any liquid contamination in order to identify the suspected material. This hand-held air sampler detects and identifies nerve and blister agent vapors. The degree of contamination is depicted in a rough quantitative form on a bar-graph display.
- <sup>e</sup> The ICAD simultaneously detects nerve, blood, blister, and choking agents at the “gross” levels. However, it alarms above the initial effective dose for nerve agents.
- <sup>f</sup> Is a colorimetric-tube system designed specifically to detect and identify military agents. To complete the series of tests requires approximately 24 minutes. It is about 20 times less sensitive than the M256 kit and is no longer employed by the U.S. military.
- <sup>g</sup> Tubes for colorimetric systems are available that are capable of qualitatively identifying nerve agents, blister agents, vomiting agents. Tubes are also available that can identify as well as provide semi-quantitative indication of vapor concentration for blood and choking agents. Many of these tubes have cross sensitivities and care must be taken to correctly interpret the results.
- <sup>h</sup> Civilian equivalent of the CAM. In addition to the agents detected by the CAM, the ADP 2000 will also detect pepper spray and Mace.

**TABLE 5.1 (CONTINUED)**Agent Detector Characteristics

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- <sup>i</sup> The most widely available U.S. military detectors for evaluation of liquid contamination are the M8 and M9 papers. These chemically treated papers are sensitive to droplets of liquid chemical agents. They are intended only to provide indication of the presence of a liquid chemical agent hazard. M9 paper merely indicates that presence of a potential liquid chemical agent whereas M8 paper provides a qualitative identification of both nerve and blister agent liquids. However, both paper systems can respond to other organic substances (e.g. brake fluid), and provide false positives. Users must be trained to avoid placing the paper in contact with such substances and to consider other possible indicators of chemical agent presence when assessing a positive indication from the paper.
- <sup>j</sup> The M272 is a specialized kit that can detect the presence of chemical agents in water and is normally employed by military units responsible for handling fresh water.
- <sup>k</sup> Since toxins are not volatile, detection of toxins is limited to analysis of liquid or solid agents, residue, or by employing air samplers that collect and concentrate aerosol particles into a liquid sample. Portable immunoassay kits have been developed for a limited number of toxins. While the kits are capable of identifying toxins within 30 minutes, the overall sampling procedure (i.e., air-sampling in conjunction with the immunoassay analysis) can take several hours to produce a result. [In addition, clinical immunoassays (ELISA), as well as laboratory analytical methods for detection and identification of toxins are available. These methods can take from 2 to 4 hours to identify individual toxins even under ideal conditions.]
- <sup>l</sup> Pathogens are very difficult to detect in the environment. Laboratory techniques to culture and identify pathogens as well as clinical immunoassays (ELISA) are available but may require extended periods to provide results. Although prototypes are in development, there are currently no fielded systems capable of real time detection and identification of biological agents either military or civilian. During the Gulf War, Britain, Canada, France, and the United States all deployed air samplers that collected and concentrated aerosol particles into a liquid sample suitable for testing with a small antibody based enzymatic test kit. These portable immunoassay kits have been developed for a limited number of pathogens. While the kits themselves are capable of identifying pathogens within 30 minutes, the overall sampling procedure (i.e., air-sampling in conjunction with the immunoassay analysis) took several hours to produce a result and could only determine retrospectively if a biological attack had taken place.

# 6

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## *Personal Protective Equipment*

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Civilian equipment providing personal protection (PPE) against biological and chemical agents consists of an impermeable overgarment used in conjunction with either an air-purifying respirator, or a self-contained breathing apparatus (SCBA). Military battlefield chemical/biological protective garments are referred to as Mission Oriented Protective Posture (MOPP) gear. Unlike civilian PPE, these garments absorb agents before they can penetrate the skin. Military inhalation protection is provided by an air purifying respirator. MOPP 4, the highest level of protection, consists of an air-purifying respirator with hood, adsorbent charcoal overgarment, butyl rubber gloves and overboots. These overgarments are designed to withstand the rigors of battlefield conditions, something civilian suits could not. OSHA has never approved either military respirators or MOPP overgarments for use by civilian responders.

Although numerous manufacturers of fabrics used to make personal protective ensembles have tested their materials against chemical warfare agents, it is the ensemble as a whole that is important. This is due to the extreme hazard posed by agent vapors, especially those from nerve and blister agents. Because of the limited availability of data concerning the effectiveness of commercial Level A suits as protection against chemical warfare agents, the U.S. Army Chemical and Biological Defense Command established a program to test various suit designs.<sup>24</sup> A summary of the test results is shown in [Table 6.1](#). Testing was conducted using chemical warfare agents, agent simulants, and test procedures developed for assessment of military-issue chemical warfare protective equipment. All suits and suit materials were tested in “off-the-shelf” new, as-received condition. The effects of aging, temperature extremes, laundering, and other factors were not evaluated.

Each suit was evaluated for the permeation of agents through suit material and the level of protection afforded by the suit ensemble against agent vapors. Breakthrough for the permeation test was set at 200 ng/cm<sup>2</sup> for sulfur mustard and 800 ng/cm<sup>2</sup> for sarin.

**TABLE 6.1**

Summary of Effectiveness of Commercial Personal Protective Ensembles

Suit	Permeation Breakthrough Time (Minutes)		Median Overall PF	Percentage of Suits with PF*	
	Sarin	Mustard		≥ 1,000	≥ 2,000
Kappler Suit Model 42483 Responder CSMLimited Use Suit	350	150	1582	46%	26%
TYCHEM 10,000, PKG Style 12645	> 480	330	804	11%	0%
Trellchem HPS reusable suit	> 480	> 480	1533	100%	97%
Ready 1 Limited Use Suit: Model 91	> 480	125	1988	100%	100%
First Team XE HazMat suit	> 480	385	1502	85%	83%
Commander Ultrapro Reusable Suit, Style 79102	> 480	280	1110	100%	96%
Kappler Responder Suit Model 50660	> 480	435	NE**	74%	50%
TYCHEM Limited Use Style No. 11645	> 480	> 480	NE	36%	16%
Trellchem TLU Limited Use suit	> 480	> 480	NE	100%	98%
Chemturiion Reusable Suit Model 13	> 480	110	NE	77%	75%
Chempruf II BETEX Suit	225	125	NE	75%	66%
Commander Brigade F91 Limited Use TYCHEM 10,000	> 480	> 480	NE	93%	89%

\* Percentage of test runs where the suit Protection Factor met a hypothetical threshold value of 1,000 or 2,000 during operational testing.

\*\* Not Established

# 7

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## *Sample Collection of Contaminated Materials*

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Samples of materials suspected of being chemical or biological warfare agents, or of being contaminated with chemical or biological warfare agents, should be collected in the same manner as other hazards material samples. Vapor samples can be obtained using standard absorbent collection systems, or by employing pre-evacuated canisters. One to five grams (1 to 5 milliliters) of pure liquid/solid agent is generally sufficient for laboratory analysis. [Table 7.1](#) provides a general list of standard sample collection sizes for materials suspected of being contaminated with chemical or biological agents.<sup>148</sup>

Extreme care should be exercised to insure that the outside of the sample container has been decontaminated. After sealing and decontaminating the sample container, it should be packaged in a slightly larger container that has been filled with an absorbent material such as absorbent clay (e.g., kitty litter) or vermiculite. The principle hazard during transportation from a leaking sample would be exposure to agent vapor. If the sample is to be transported within an occupied vehicle, it may be advisable to further package the sample in an ice-filled cooler. Cooling the sample will reduce the vapor pressure of the agent and further minimize any potential exposure to agent vapor.

**TABLE 7.1**

## Analytical Sample Sizes

Media	Size
<i>Chemical Agent Samples</i>	
Concentrated agent	1 – 5 grams (1 – 5 milliliters)
Dilute agent	Approximately 10 milliliters
Soil	10 centimeters long × 5 centimeters wide × 1 centimeters deep. Greater depth not as useful.
Water	Maximum of 500 milliliters
Vegetation	Equivalent to 3 tree leaves or 3 hands full of grass depending on amount of contamination.
<i>Biological Agent Samples</i>	
Soil	10 centimeters long × 5 centimeters wide × 1 centimeters deep. Greater depth not as useful.
Vegetation	Enough to fill soft-drink can (12 ounces).

# 8

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## *Summary of U.S. Military Chemical Munition Markings*

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For over 70 years the U.S. has produced and stored chemical weapons. In addition to the military arsenal, there are also “non-stockpile” materials. Non-stockpile material includes buried chemical warfare material, binary chemical weapons, recovered chemical weapons, and former production facilities. Some of these materials date back to World War I development and production efforts. Not all of these sites are still under military control. For example, in 1993, a large number of World War I chemical shells were removed from a residential neighborhood in Washington, D.C. The burial site was discovered by construction crews while excavating the basement of a new home. In addition to non-stockpile materials, there have also been several situations where individuals have claimed to possess chemical munitions and threatened to release their contents. For these reasons, it would be beneficial to be able to rapidly identify suspect munitions.

Most countries label their chemical munitions with special markings, colors and/or bands in order to facilitate their identification on the battlefield. Although similar in some cases, no two countries employ an identical system. In order to assist in the identification of potential U.S. chemical munitions, a summary of U.S. markings is listed below. The U.S. has introduced major changes to the marking system on three different occasions. For this reason, some knowledge of the date of manufacture is required to accurately identify the munition contents. However, all munitions with a lethal chemical agent filling, and only lethal munitions, no matter in what period the munition was manufactured, have green bands and markings on a gray background.

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## Munitions *with* Bands (Stripes)

### **Green Bands and Green Markings on a Gray Background**

- *One band* on munitions manufactured prior to 1960 indicates a munition with a nonpersistent toxic agent (nerve, blood, or choking) filling.
- *One band* on munitions manufactured between 1960 and 1976 indicates a munition with nonpersistent toxic agent (blood or choking only) filling.
- All munitions, both persistent and nonpersistent toxic agent fillings of all categories (nerve, blister, blood, and choking), manufactured after 1976 have only *one band*.
- *Two bands* on munitions manufactured prior to 1960 indicate a munition with a persistent toxic agent (nerve or blister) filling.
- *Two bands* on munitions manufactured between 1960 and 1976 indicate a munition with a persistent toxic agent (blister) filling.
- *Three bands* indicate a munition manufactured between 1960 and 1976 with a nerve agent filling (both persistent and nonpersistent).
- *A dashed band* indicates a munition with a binary nerve agent filling manufactured after 1976.
- Markings include the agent name or military agent symbol and may include the general descriptive word "GAS."

### **Red Bands and Red Markings on a Gray Background**

- *One band* on munitions manufactured prior to 1976 indicates a munition with a nonpersistent riot control agent filling. Markings include the military agent symbol and the general descriptive word "GAS" (manufactured prior to 1960) or "RIOT" (manufactured between 1960 and 1976).
- All munitions, both persistent and nonpersistent riot control agent fillings, manufactured after 1976 have only *one band*. Markings include the agent name or military agent symbol.
- *Two bands* on munitions manufactured between 1960 and 1976 can indicate that the munition is filled with either a persistent riot control agent or with an incapacitating agent. Markings include the agent name or military agent symbol. Munitions with a persistent riot control agent filling have the general descriptive word

“RIOT,” while munitions with an incapacitating agent filling have no general descriptive wording.

### ***Purple (Violet) Band and Purple (Violet) Markings on a Gray Background***

- On munitions manufactured prior to 1960 indicate a munition with an incendiary agent filling. Markings include the military agent symbol and the general descriptive word “INCENDIARY.”
- Not used on any munitions between 1960 and 1976.
- On munitions manufactured after 1976 indicate a munition with an incapacitating agent filling. Markings include the agent name or military agent symbol. No general descriptive wording is indicated on the munition.

### ***Yellow Band and Yellow Markings on a Gray Background***

- Indicates a screening and signaling smoke munition manufactured prior to 1960. Markings include the military agent symbol and the general descriptive word “SMOKE.”
- Hand Grenade with *Light-Green* Band and *Light-Green* Markings on an Olive-Drab Green Background indicate an M-18 colored smoke grenade.

### ***Additional Yellow or Red Band***

- On munitions manufactured after 1960 indicates the type of burster or expelling charge.
- Yellow indicates high explosive.
- Red indicates low explosive.

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## ***Munitions without Bands (Stripes)***

### ***Black Markings on a Red Background***

- Indicate a munition with an incendiary agent filling. Markings include the agent name or military agent symbol. No general descriptive wording is indicated on the munition.

### ***Black Markings on a Light-Green Background***

- Indicate a screening or signaling smoke munitions. Markings include the agent name or military agent symbol. No general descriptive wording is indicated on the munition.

### ***Black Markings on a Light-Red Background***

- Indicate a Dual-Purpose (Incendiary/Smoke) munition with a white phosphorous or plasticized white phosphorous filling. Markings include the agent name or military agent symbol. No general descriptive wording is indicated on the munition.

### ***White Markings on a Blue Background***

- Indicates a practice round.

# 9

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## *International and Domestic U.S. Lists of Agents*

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Table 9.1 contains a listing of the agents identified in various treaties, lists of controlled materials, and threat assessments.

The Chemical Weapons Convention divides chemical agents and critical precursors into three schedules, (*CWC Schedules*). Schedule 1 lists chemicals that are deemed to pose a high risk to the purposes of the CWC, but have very limited, if any, commercial applications. Schedule 2 lists chemicals that are deemed to pose a significant risk to the purposes of the CWC. It also includes toxic chemicals that could be used as chemical warfare agents as well as key precursors to the chemicals in Schedule 1. Schedule 3 lists other chemicals that are considered to pose a risk to the purposes of the CWC including “dual-use” chemicals such as phosgene and all other regulated precursors for chemical warfare agents. Chemicals can be added or deleted from the various schedules as deemed appropriate.

The *Australia Group* is an informal forum of states whose goal is to discourage and impede chemical/biological weapons proliferation by harmonizing national export controls on pathogen cultures, toxins, and precursor chemicals. The Australia Group has established common export controls for chemical and biological weapons nonproliferation purposes. The Group has also issued an informal “warning list” of dual-use precursors and bulk chemicals.

As part of regulations governing hazardous biological agents, The United States Centers for Disease Control has developed a list, (*CDC List*) of infectious agents and toxins that it believes pose a significant risk to public health. Agents may be added or deleted as deemed necessary to protect the public.

The United States Department of Agriculture, (*USDA List*) regulates all diseases that may impact crops or animals within the United States.

**TABLE 9.1**

International and Domestic Lists of Agents

Agent	CWC Schedules	Australia Group	CDC List	USDA List
<i>Chemical Agents</i>				
1,3-Bis(2-chloroethylthio)-n-propane [CAS# 63905-10-2]	Schedule 1			
1,4-Bis(2-chloroethylthio)-n-butane [CAS# 142868-93-7]	Schedule 1			
1,5-Bis(2-chloroethylthio)-n-pentane [CAS# 142868-94-8]	Schedule 1			
2-Chloroethylchloromethylsulfide [CAS# 2625-76-5]	Schedule 1			
Amiton [CAS# 78-53-5]	Schedule 2			
Bis(2-chloroethylthio)methane [CAS# 63869-13-6]	Schedule 1			
Bis(2-chloroethylthiomethyl)ether [CAS# 63918-90-1]	Schedule 1			
BZ [CAS# 13004-56-3]	Schedule 2			
Chloropicrin [CAS# 76-06-2]	Schedule 3			
Cyanogen Chloride [CAS# 506-77-4]	Schedule 3			
HL	Schedule 1			
HQ	Schedule 1			
HT	Schedule 1			
Hydrogen Cyanide [CAS# 74-90-8]	Schedule 3			
Lewisite [CAS# 541-25-3]	Schedule 1			
Lewisite 2 [CAS# 40334-69-8]	Schedule 1			
Lewisite 3 [CAS# 40334-70-1]	Schedule 1			
Mustard [CAS# 505-60-2]	Schedule 1			
Nitrogen Mustard 1 [CAS# 538-07-8]	Schedule 1			
Nitrogen Mustard 2 [CAS# 51-75-2]	Schedule 1			
Nitrogen Mustard 3 [CAS# 555-77-1]	Schedule 1			
O-Alkyl (H or less than or equal to C10, including cycloalkyl) S-2-dialkyl (Me, Et, n-Pr or i-Pr)-aminoethyl alkyl (Me, Et, n-Pr or i-Pr) phosphonothiolate and corresponding alkylated or protonated salts	Schedule 1			
O-Alkyl (less than or equal to C10, including cycloalkyl) alkyl (Me, Et, n-Pr or i-Pr)-phosphonofluoridates	Schedule 1			
O-Alkyl (less than or equal to C10, including cycloalkyl) N, N-dialkyl (Me, Et, n-Pr or i-Pr) phosphoramidocyanidates	Schedule 1			
O-Mustard [CAS# 63918-89-8]	Schedule 1			
Perfluoroisobutylene [CAS# 382-21-8]	Schedule 2			
Phosgene [CAS# 75-44-5]	Schedule 3			
Sesquimustard [CAS# 3563-36-8]	Schedule 1			
Thickened Mustard	Schedule 1			
V-sub-x [CAS# 20820-80-8]	Schedule 1			

**TABLE 9.1 (CONTINUED)**

International and Domestic Lists of Agents

Agent	CWC Schedules	Australia Group	CDC List	USDA List
VX [CAS# 50782-69-9]	Schedule 1			
<i>Precursors/Dual Use Chemicals</i>				
Alkyl (Me, Et, n-Pr or i-Pr) phosphoryldifluorides	Schedule 1			
Ammonium Bifluoride [CAS# 1341-49-7]		Control List		
Arsenic Trichloride [CAS# 7784-34-1]		Control List		
Benzilic Acid [CAS# 76-93-7]		Control List		
Chemicals, except for those listed in Schedule 1, containing a phosphorus atom to which is bonded one methyl, ethyl or propyl (normal or iso) group but not further carbon atoms	Schedule 2			
2-Chloroethanol [CAS# 107-07-3]		Control List		
Chlorosarin [CAS# 1445-76-7]	Schedule 1			
Chlorosoman [CAS# 7040-57-5]	Schedule 1			
Dialkyl (Me, Et, n-Pr or i-Pr) N,N-dialkyl (Me, Et, n-Pr or i-Pr)-phosphoramidates	Schedule 2			
Diethyl Ethylphosphonate [CAS# 78-38-6]		Control List		
Diethyl Methylphosphonate [CAS# 683-08-9]	Schedule 2			
Diethyl Methylphosphonite [CAS# 15715-41-0]		Control List		
Diethyl N,N-Dimethylphosphoramidate		Control List		
Diethyl Phosphite [CAS# 762-04-9]		Control List		
Diethylaminoethanol [CAS# 100-37-8]		Control List		
Diisopropylamine [CAS# 100-18-9]		Control List		
Dimethyl Ethylphosphonate [CAS# 6163-75-3]		Control List		
Dimethyl Methylphosphonate [CAS# 756-79-6]		Control List		
Dimethylamine [CAS# 124-40-3]		Control List		
Dimethylamine Hydrochloride [CAS# 506-59-2]		Control List		
Diphenyl Methylphosphonate [CAS# 7526-26-3]	Schedule 2			
Ethyl Phosphinyl Dichloride [CAS# 1498-40-4]	Schedule 2	Control List		
Ethyl Phosphinyl Difluoride [CAS# 430-78-4]		Control List		
Ethyl Phosphonothioic Dichloride [CAS# 993-43-1]	Schedule 2			
Ethyl Phosphonyl Dichloride [CAS# 1066-50-8]	Schedule 2	Control List		
Ethyl Phosphonyl Difluoride		Control List		
Ethyldiethanolamine [CAS# 139-87-7]	Schedule 3			
Hydrogen Fluoride [CAS# 7664-39-3]		Control List		

**TABLE 9.1 (CONTINUED)**

International and Domestic Lists of Agents

Agent	CWC Schedules	Australia Group	CDC List	USDA List
3-Hydroxy-1-methylpiperidine [CAS# 3554-74-3]		Control List		
Methyl Benzilate [CAS# 76-89-1]		Control List		
Methyldiethanolamine [CAS# 105-59-9]	Schedule 3			
Methylphosphinyl Dichloride [CAS# 676-83-5]		Control List		
Methylphosphinyl Difluoride [CAS# 753-59-3]		Control List		
Methylphosphonic Acid [CAS# 993-13-5]	Schedule 2			
Methylphosphonic Dichloride [CAS# 676-97-1]	Schedule 1			
Methylphosphonic Difluoride [CAS# 676-99-3]	Schedule 1			
N,N-Dialkyl (Me, Et, n-Pr or i-Pr) aminoethane-2-ols and corresponding protonated salts	Schedule 2			
N,N-Dialkyl (Me, Et, n-Pr or i-Pr) Aminoethane-2-thiols and corresponding protonated salts	Schedule 2			
N,N-Dialkyl (Me, Et, n-Pr or i-Pr) aminoethyl-2-chlorides and corresponding protonated salts	Schedule 2			
N,N-Dialkyl (Me, Et, n-Pr or i-Pr) phosphoramidic dihalides	Schedule 2			
N,N-Diisopropyl-(beta)-aminoethane Thiol [CAS# 5842-07-9]		Control List		
N,N-Diisopropyl-(beta)-aminoethanol [CAS# 96-80-0]		Control List		
N,N-Diisopropyl-(beta)-aminoethyl Chloride		Control List		
N,N-Diisopropyl-2-aminoethyl Chloride Hydrochloride [CAS# 4261-68-1]		Control List		
O-Alkyl (H or less than or equal to C10, including cycloalkyl) O-2-dialkyl (Me, Et, n-Pr or i-Pr)-aminoethyl alkyl (Me, Et, N- Pr or i-Pr) phosphonites and corresponding alkylated or protonated salts	Schedule 1			
O-Ethyl 2-Diisopropylaminoethyl Methylphosphonite [CAS# 57856-11-8]	Schedule 1			
Phosphonic Acid, Methyl-, (5-Ethyl-2- methyl-1,3,2-dioxaphosphorinan-5-yl) Methyl Methyl Ester, P-Oxide [CAS# 41203-81-0]	Schedule 2			
Phosphonic Acid, Methyl-, Bis(3- (Trimethoxysilyl)propyl) Ester [CAS# 67812-18-4]	Schedule 2			
Phosphonic Acid, Methyl-, compounds with (Aminoiminomethyl) Urea (1:1)	Schedule 2			

**TABLE 9.1 (CONTINUED)**

International and Domestic Lists of Agents

Agent	CWC Schedules	Australia Group	CDC List	USDA List
Phosphonic Acid, Methyl-, Methyl 3-(Trimethoxysilyl)-propyl Ester [CAS# 67812-17-3]	Schedule 2			
Phosphonic Acid, Methyl-, Monoammonium Salt [CAS# 34255-87-3]	Schedule 2			
Phosphonic Acid, Methyl-, Monomethyl Ester, Monosodium Salt [CAS# 73750-69-3]	Schedule 2			
Phosphorus Oxychloride [CAS# 10025-87-3]		Control List		
Phosphorus Pentachloride [CAS# 10026-13-8]		Control List		
Phosphorus Pentasulphide [CAS# 1314-80-3]		Control List		
Phosphorus Trichloride [CAS# 7719-12-2]		Control List		
Pinacolone [CAS# 75-97-8]		Control List		
Pinacolyl Alcohol [CAS# 464-07-3]		Control List		
Potassium Bifluoride [CAS# 7789-29-9]		Control List		
Potassium Cyanide [CAS# 151-50-8]		Control List		
Potassium Fluoride [CAS# 7789-23-3]		Control List		
3-Quinuclidinol [CAS# 1619-34-7]		Control List		
3-Quinuclidone		Control List		
Sodium Bifluoride [CAS# 1333-83-1]		Control List		
Sodium Cyanide [CAS# 143-33-9]		Control List		
Sodium Fluoride [CAS# 7681-49-4]		Control List		
Sodium Sulfide [CAS# 1313-82-2]		Control List		
Sulfur Dichloride [CAS# 10545-99-0]		Control List		
Sulfur Monochloride [CAS# 10025-67-9]	Schedule 3	Control List		
Thiodiglycol [CAS# 111-48-8]		Control List		
Thionyl Chloride [CAS# 7719-09-7]	Schedule 3	Control List		
Triethanolamine [CAS# 102-71-6]		Control List		
Triethanolamine Hydrochloride [CAS# 637-39-8]		Control List		
Triethyl Phosphite [CAS# 122-52-1]		Control List		
<i>Toxins</i>				
Abrin [CAS# 1393-62-0]		Warning List	Yes	
Aflatoxin (B1) [CAS# 1162-65-8]			Yes	
alpha-Conotoxin [CAS# 115797-06-3]		Core List	Yes	
Botulinum Toxins [CAS# 93384-43-1]		Core List	Yes	
Cholera toxin		Warning List		
Clostridium Perfringens Toxin		Core List	Yes	
Microcystin [CAS# 101043-37-2]		Core List		
Modeccin		Warning List		
Mycotoxins		Warning List		
Ricin [CAS# 9009-86-3]	Schedule 1		Yes	
Saxitoxin [CAS# 35523-89-8]	Schedule 1		Yes	

**TABLE 9.1 (CONTINUED)**

International and Domestic Lists of Agents

Agent	CWC Schedules	Australia Group	CDC List	USDA List
Staphylococcus Enterotoxin B [CAS# 11100-45-1]		Core List	Yes	
Tetanus Toxin		Warning List		
Tetrodotoxin [CAS# 4368-28-9]		Core List	Yes	
Trichothecene [CAS# 21259-20-1]		Warning List	Yes	
Verotoxin		Core List		
Viscumin		Warning List		
Volkensin		Warning List		
<i>Pathogens</i>				
African Horse Sickness				Yes
African Swine fever		Export Control		Yes
Akabane				Yes
Anthrax		Core List	Yes	
Aujeszký's Disease		Export Control		
Avian Influenza		Export Control		Yes
Banana Bunchy Top		Awareness		
<i>Besnoitia besnoiti</i>				Yes
Bluetongue		Export Control		
Borna Disease				Yes
Bovine Infectious Petechial Fever				Yes
Bovine Spongiform Encephalitis				Yes
Brucellosis		Core List	Yes	Yes
Camelpox				Yes
Chikungunya Virus Disease		Core List		
Cholera		Core List		
<i>Clostridium perfringens</i>		Warning List		
<i>Clostridium tetani</i>		Warning List		
Coccidioidomycosis			Yes	
<i>Colletotrichum kanawae</i>		Export Control		
Congo-Crimean Hemorrhagic Fever		Core List	Yes	
<i>Deuterophoma tracheiphila</i>		Awareness		
<i>Dothidella ulei</i>		Export Control		
<i>E. coli</i> , Serotype 0157H7		Warning List		
Eastern Equine Encephalitis		Core List	Yes	
Ebola Hemorrhagic Fever		Core List	Yes	
Ephemeral Fever				Yes
Equine Morbillivirus			Yes	
Flexal Virus			Yes	
Foot and Mouth Disease		Export Control		Yes
Glanders		Core List	Yes	
Guanarito Hemorrhagic Fever			Yes	
Hantaan		Core List		
<i>Helminthosporium oryzae</i>		Export Control		
Hog Cholera		Export Control		Yes
Junin Hemorrhagic Fever		Core List	Yes	
Kyasanur Forest		Warning List		
Lassa Fever		Core List	Yes	

**TABLE 9.1 (CONTINUED)**

International and Domestic Lists of Agents

Agent	CWC Schedules	Australia Group	CDC List	USDA List
Legionnaire's Disease		Warning List		
Louping Ill		Warning List		Yes
Lumpy Skin Disease				Yes
Lymphocytic Choriomeningitis		Core List		
Lyssa		Export Control		
Machupo Hemorrhagic Fever		Core List	Yes	
Marburg Hemorrhagic Fever		Core List	Yes	
Melioidosis		Core List	Yes	
<i>Monilia rorei</i>		Awareness		
Monkey Pox		Core List		
Murray Valley Encephalitis		Warning List		
<i>Mycoplasma agalactiae</i>				Yes
<i>Mycoplasma mycoides</i>		Export Control		Yes
Nairobi Sheep Disease				Yes
Newcastle Disease		Export Control		Yes
Omsk Hemorrhagic Fever		Warning List		
Oropouche Virus Disease		Warning List		
Peste Des Petits Ruminants		Export Control		Yes
Plague		Core List	Yes	
Powassan Encephalitis		Warning List		
<i>Pseudomonas ruminantium</i>				Yes
Psittacosis		Core List		
<i>Puccinia graminis</i>		Export Control		
<i>Pucciniaglomerum</i>		Export Control		
<i>Pyricularia grisea</i>		Export Control		
Q Fever		Core List	Yes	
Rift Valley Fever		Core List	Yes	Yes
Rinderpest		Export Control		Yes
Rocio Encephalitis		Warning List		
Rocky Mountain Spotted Fever		Core List	Yes	
Russian Spring-Summer Encephalitis		Core List		
Sabia Hemorrhagic Fever			Yes	
Screwworm				Yes
Sheep Ant Goat Pox				Yes
Shigellosis		Core List		
Sin Nombre			Yes	
Smallpox		Core List	Yes	
St. Louis Encephalitis		Warning List		
Swine Vesicular Disease		Export Control		Yes
Teschen Disease		Export Control		Yes
<i>Theileria annulata</i>				Yes
<i>Theileria bovis</i>				Yes
<i>Theileria hirci</i>				Yes
<i>Theileria lawrencei</i>				Yes
Tick-borne Encephalitis Complex			Yes	
Trench Fever		Core List		
<i>Trypanosoma evansi</i>				Yes
<i>Trypanosoma vivax</i>				Yes
Tularemia		Core List	Yes	

**TABLE 9.1 (CONTINUED)**

International and Domestic Lists of Agents

Agent	CWC Schedules	Australia Group	CDC List	USDA List
Typhoid Fever		Core List		
Typhus, Epidemic		Core List	Yes	
Venezuelan Equine Encephalitis		Core List	Yes	
Vesicular Exanthema				Yes
Vesicular Stomatitis Fever		Export Control		
Viral Hemorrhagic Disease of Rabbits				Yes
Wesselsbron Fever				Yes
Western Equine Encephalitis		Core List		
White Pox		Core List		
<i>Xanthomonas albilineans</i>		Export Control		
<i>Xanthomonas campestris pv. citri</i>		Export Control		
<i>Xanthomonas campestris pv. oryzae</i>		Awareness		
<i>Xylella fastidiosa</i>		Awareness		
Yellow Fever		Core List	Yes	
Yersiniosis		Warning List		
Zymonema				Yes

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## *Glossary*

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**Acetylcholine:** a chemical neurotransmitter produced by nerve cells predominantly outside the central nervous system. It is a chemical “messenger,” stimulating the heart, skeletal muscles, and numerous secretory glands.

**Acetylcholinesterase:** an enzyme that normally hydrolyzes acetylcholine, thereby stopping its activity. This enzyme is inhibited by nerve agents.

**Acute Exposure:** single, short-term exposure.

**Aerobe:** a microorganism that can live and grow in the presence of oxygen.

**Aerosol:** a liquid or solid, composed of finely divided particles, suspended in a gaseous medium. Although aerosols are not gases, they are not necessarily visible.

**Anaerobe:** a microorganism that can live without air or oxygen. In some cases, oxygen is toxic to these organisms.

**Arsenical:** a chemical compound containing arsenic.

**As:** is the chemical symbol for arsenic.

**Asymptomatic:** without signs or symptoms of disease or illness.

**Atropine:** an alkaloid obtained from *Atropa belladonna*. It is used as an antidote for nerve agent poisoning. It inhibits the action of acetylcholine at the muscle junction by binding to acetylcholine receptors.

**Autonomic Nervous System:** that part of the nervous system that governs involuntary functions, such as heart rate, reflexes, and breathing. It consists of the sympathetic and parasympathetic nervous system.

**Bacteria:** a one-celled microorganism which has no chlorophyll and reproduces by dividing in one, two, or three directions of space.

**Binary Chemical Agent:** a highly toxic agent produced when two or more chemical substances, which individually have relatively little toxicity, react due to being mixed or combined.

**Biological Agent:** a microorganism, or toxin from a living creature, that causes either disease in man, plants, or animals or deterioration of material.

**Blister Agent:** see Vesicant.

**Blood Agent:** is an agent that affects bodily functions through action on the oxygen-carrying properties of the blood and interfere with normal transfer of oxygen to bodily tissue.

**Br:** is the chemical symbol for bromine.

**C:** is the chemical symbol for carbon.

**Carrier:** is an individual who harbors specific disease organisms, without showing clinical symptoms, and serves as a means of conveying infection.

**Central Nervous System:** consists of the brain and spinal cord.

**Chemical Agent:** a solid, liquid, or gas which, through its chemical properties, produces lethal or damaging effects on man, animals, plants or material, or produces screening or signaling smoke.

**Chemical Agent Symbol:** is the U.S. code designation of any chemical agent. This is a combination of one to three letters or letter-number combinations. It is not the same as, and should not be confused with, the chemical formula.

**Choking Agent:** is an agent that causes irritation and inflammation of bronchial tubes and lungs. Their primary physiological action is limited to the respiratory tract with injury extending to the deepest part of the lungs.

**Cl:** is the chemical symbol for chlorine.

**Contagious Disease:** an infectious disease capable of being directly transmitted from one individual to another. Many infectious diseases are not contagious but require some special method of transmission or inoculation.

**Cumulative Effect:** the building up, within the body, of small ineffective doses of certain chemical agents to a point where eventual effect is similar to a large dose.

**Cutaneous:** pertaining to the skin.

**Cyanosis:** blueness of the skin due to insufficient oxygen in the blood.

**Cytotoxin:** toxin that directly damages and kills the cell with which it makes contact.

**Dermal:** relating to the skin (e.g., dermal exposure).

**Disease:** is the deviation from the normal state or function of a cell, an organ, or an individual.

**Endemic:** native to, or prevalent in, a particular district or region. An endemic disease has a low incidence but is constantly present in a given community.

**Endotoxin:** a toxin produced in an organism and liberated only when the organism disintegrates.

**Enterotoxin:** a toxin of bacterial origin that affect the intestines, causing diarrhea.

**Enzyme:** organic substance capable of causing chemical changes to take place quickly at body temperature by catabolic action. A biological catalyst.

**Epidemic:** an outbreak of a contagious, infectious disease. The disease can be transmitted from an infected individual to a non-infected individual by direct contact, droplet inhalation, or vector.

**Epiphytotic:** an outbreak of disease among plants. It is analogous to an epidemic in man.

**Epizootic:** an outbreak of disease among animals. It is analogous to an epidemic in man.

**Exotoxin:** a toxin excreted by a microorganism into the surrounding medium.

**F:** is the chemical symbol for fluorine.

**Fungus:** any one of a group of thallophytic plants, including molds, mildews, rusts, smuts, and mushrooms. These plants do not contain chlorophyll and reproduce mainly by sporulation.

**Germs:** are disease-producing microorganisms, microbes, or pathogenic bacterium. The term includes bacteria, rickettsiae, viruses, and fungi.

**H:** is the chemical symbol for hydrogen.

**Halogen:** name for the group of elements comprised of fluorine, chlorine, bromine, and iodine. These elements are oxidizers and form acidic solutions in water.

**Hydrolysis:** is the interaction of a material with water to produce a different material. When used as part of a decontamination effort, the intent is to yield a less toxic product or products.

**IC<sub>50</sub>:** is the concentration of a vapor or aerosol necessary to incapacitate or disable 50% of exposed and unprotected individuals through inhalation of the agent.

**IDLH:** Immediately Dangerous to Life or Health levels are vapor, aerosol or dust concentrations likely to cause death, immediate or delayed permanent adverse health effects, or prevent escape from the contaminated environment. IDLH levels are established to ensure that the worker can escape from the contaminated environment in the event of a failure of respiratory protection.

**Immediately Dangerous to Life or Health:** see IDLH.

**Incapacitating Agent:** is an agent that produces temporary physiological or mental effects, or both, which will render individuals incapable of concerted effort. Effects do not terminate when removed from contact with the agent. Compare with Riot Control Agents.

**Incapacitating Concentration:** see IC<sub>50</sub>.

**Incendiary Agent:** is a compound that generates sufficient heat to cause destructive thermal degradation or destructive combustion.

**Incubation Period:** is the time interval between the introduction into the body of an infectious agent and the appearance of the first symptoms of disease.

**Kelvin:** absolute temperature scale and designated by °K. Temperatures in Fahrenheit (°F) can be converted to Kelvin by the following formula

$$^{\circ}\text{K} = 273 + (^{\circ}\text{F} - 32)/1.8$$

where:

°K= the temperature in degrees Kelvin

°F = the temperature in degrees Fahrenheit

**Lacrimator:** an agent that irritates the eyes and produces tears.

**Latent Period:** a period of seeming inactivity. An example would be the 10 to 20 year period between exposure to a cancer causing agent and the development of cancer.

**LC<sub>50</sub>:** is the concentration of a vapor or aerosol which would prove lethal to 50% of exposed and unprotected individuals through inhalation of the agent.

**LD<sub>50</sub>:** is the amount of liquid or solid which would prove lethal to 50% of exposed and unprotected individuals through injection, ingestion, or contact.

**Lethal Concentration:** see LC<sub>50</sub>.

**Lethal Dose:** see LD<sub>50</sub>.

**Lung-Damaging Agent:** see Choking Agent.

**Macular Rash:** rash comprised of small blemishes or discolorations that do not rise above the skin surface. Individual blemishes may resemble freckles.

**Malaise:** a feeling of bodily discomfort.

**Melting Point:** is the temperature at which a solid changes to a liquid. The melting point is the same as the freezing point.

**mg/m<sup>3</sup>:** see ppm.

**Milligrams Per Cubic Meter:** see ppm.

**Miosis:** excessive contraction of the pupil.

**Miscible:** soluble in all proportions.

**Morbidity:** diseased state.

**Mortality Rate:** the ratio of the number of deaths from a given disease to the total number of cases of that disease.

**N:** is the chemical symbol for nitrogen.

**Necrosis:** death of a cell or group of cells.

**Neurotoxin:** a poison affecting nerve tissue.

**Nerve Agent:** is an agent which affects bodily functions by reacting with the enzyme acetylcholinesterase, permitting accumulation of acetylcholine and continual stimulation of the parasympathetic nervous system, as well as affecting other parts of the autonomic nervous system.

**O:** is the chemical symbol for oxygen.

**P:** is the chemical symbol for phosphorous.

**Papular Rash:** rash formed by small, firm, raised skin lesions.

**Parasympathetic Nervous System:** the part of the autonomic nervous system that decreases pupil size, heart rate, and blood pressure, and increases functions such as secretion of saliva, tears, and perspiration.

**Parts Per Million:** see ppm.

**Pathogen:** a disease-producing microorganism.

**PEL:** Permissible Exposure Limit; is a time weighted average concentration that must not be exceeded during any 8-hour work shift of a 40-hour work week. PELs are established by the Occupational, Safety and Health Administration (OSHA) and are designed to protect workers exposed to industrial chemicals on a daily basis as part of their professions. See also TWA.

**Percutaneous:** effected or performed through the skin.

**Permeation:** is essentially the movement of chemicals at the molecular level through intact suit material. It is usually expressed as breakthrough times for a given chemical or chemical class.

**Permissible Exposure Limit:** see PEL.

**Persistence:** is an expression of the duration of effectiveness of a chemical agent. This is dependent on the physical and chemical properties of the agent, weather, methods of dissemination, and conditions of the terrain. Under battlefield conditions, non-persistent agents generally lose their effectiveness approximately 10 to 15 minutes after deployment. See also Relative Persistence.

**Petechia:** red or purple flat spots occurring on the skin as a result of hemorrhage.

**Phytotoxin:** a toxin derived from a plant. An example is ricin from the castor bean.

**ppm:** parts per million. The relative ratio of volume of agent to volume of air. An alternative method of denoting concentration is milligrams of agent per cubic meter of air ( $\text{mg}/\text{m}^3$ ). Parts per million can be converted to milligrams per cubic meter by the following formula

$$\text{mg}/\text{m}^3 = (\text{ppm})(\text{gmw})/\text{RT}$$

where:

$\text{mg}/\text{m}^3$  = the concentration in milligrams per cubic meter  
ppm = the concentration in parts per million  
gmw = the molecular weight of the agent in grams  
RT = theoretical molar volume of agent vapor in liters. The value of RT is determined by multiplying the ambient temperature in Kelvin ( $^{\circ}\text{K}$ ) by 0.08205. For  $77^{\circ}\text{F}$ , this value is 24.45.

**Protection Factor:** The level of protection against agent vapors afforded by a suit ensemble. The Protection Factor is essentially a measure of the reduction in cumulative exposure to an aerosol afforded by the suit. The Protection Factor for an ensemble is affected by the fit of the suit, the design of its seals and closures, and some physical aspects of the individual wearing the suit.

**Pulmonary:** pertaining to the lungs.

**R:** is the generic chemical symbol for an unspecified organic group. The group is generally a hydrocarbon but may contain other functional groups within the chain. Different unspecified groups are designated by a prime (i.e., ' or ").

**Relative Persistency:** is a mathematical comparison of the evaporation rate of water at 68°F (20°C) to the evaporation rate of the agent at ambient temperature. Relative persistency is calculated by the formula

$$\text{RPr} = (4.34/P) (T/M)^{1/2}$$

where:

- RPr = the relative persistency of the agent
- P = the vapor pressure of the agent at the temperature T
- M = the molecular weight of the agent
- T = the ambient temperature of the agent in degrees Kelvin (°K)

**Residual Contamination:** that amount of hazardous material that remains after decontamination.

**Reservoir (pathogen):** refers to any animal, plant, or nonliving material in which pathogens normally live and multiply.

**Rickettsia:** gram-negative, nonmotile, intracellular, parasitic microorganism which is intermediate in size between bacteria and viruses.

**Riot Control Agent:** is an agent that produces only a temporary irritating or incapacitating effect. This class of agents includes both tear and vomiting agents. Effects last minimally longer than contact with the agent. Compare with Incapacitating Agents.

**S:** is the chemical symbol for sulfur.

**Spores:** resistant, dormant cells of some bacteria; primitive reproductive bodies of fungi.

**Sternutator:** an agent that produces sneezing. See also vomiting agents.

**Sympathetic Nervous System:** a network of nerves that trigger certain involuntary and automatic bodily functions, such as constricting blood vessels, widening the pupils, and speeding up the heartbeat.

**Symptoms:** the functional evidence of disease; a change in condition indicative of some mental or bodily state.

**Synapse:** site at which neurons make functional contacts with other neurons or cells.

**Synergistic:** working together, having combined cooperative action that increases the effectiveness of one or more of the components' properties.

**Systemic:** relating to the entire organism instead of a part.

**Tear Agent:** is an agent that causes a copious flow of tears and intense (although temporary) eye pain. In high concentrations, they are irritating to the skin and cause a temporary burning and itching sensation. High concentration can cause burns.

**Time-Weighted Average:** see TWA.

**Toxin:** any poisonous substance from microorganisms, plants, or animals.

**TWA:** Time-Weighted Average; is the average concentration of a chemical that a normal worker can be continuously exposed to during a normal 8-hour work day and a 40-hour week without showing any adverse effects. TWAs are calculated by averaging each exposure, taking into account the concentration of exposure as weighted by the duration of the exposure. See also PEL.

**Ultraviolet Light:** is light waves shorter (and therefore with higher energy) than the visible blue-violet waves, but longer (and therefore with less energy) than X-rays. Ultraviolet light is very effective in killing microorganisms.

**Vapor Density:** is the ratio of the density of any vapor to the density of air (assigned a value of 1). If the vapor density of the vapor is greater than 1, it will tend to settle to the lowest point and hug the earth. If the vapor density of the vapor is less than 1, the vapor will tend to disperse.

**Vapor Pressure:** is the pressure exerted by vapor against the atmosphere and is dependent on temperature. The greater the vapor pressure, the faster a material will evaporate.

**Vector:** a carrier; especially the animal or intermediate host that carries a pathogen from one host to another. Examples of vectors include mosquitoes, fleas, ticks, and lice.

**Vegetative Cells:** are non spore-forming bacteria or spore-forming bacteria in their non-sporing state.

**Venom:** poisonous mixture of toxins and other natural chemical produced by animals. Examples include snakes, spiders, and scorpions.

**Vesicant:** is an agent which causes inflammation, blisters, and general destruction of bodily tissue. In addition, the vapor also attacks the respiratory tract with the most severe impacts on the upper tract. Eyes are very susceptible to this class of agents.

**Virulence:** is the degree of pathogenicity of a microorganism as indicated by its ability to invade the tissue of a host. It is the capacity of a microorganism to produce disease.

**Virus:** is an infectious agent, smaller than bacteria and rickettsiae, capable of living and replicating only within a living susceptible host cell. Viruses cannot survive or be grown on artificial media.

**Volatility:** is the tendency of a chemical to vaporize or give off fumes. The volatility of an agent varies with temperature and is expressed as the weight of vapor present in a given volume of air. Volatility is often confused with relative persistency. The volatility of a material (in ppm) can be calculated by multiplying its vapor pressure in millimeters of mercury (mm Hg) by 1315.

**Vomiting Agent:** is an agent that causes vomiting and may produce coughing, sneezing, nasal discharge, tears, and pain in the nose and throat. Headache often follows exposure to this class of agent.

**X:** is the generic chemical symbol for a halogen (i.e., fluorine, chlorine, bromine, or iodine).

**Zoonosis:** a disease of animals that may be transmitted to man.

**Zootoxin:** a toxin or poison of animal origin such as the venom of snakes, spiders, and scorpions.

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## References

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