Industrial Chemicals

Although countries generally focus on traditional agents (choking, blood, blister and nerve), terrorist groups may use readily available toxic industrial chemicals as well. In fact, several compounds initially developed for military use in wartime, such as phosgene and chlorine, are commonly used in industry today. There are a wide variety of potential chemicals that could be used for malicious purposes including:

- Organophosphate pesticides—such as malathion and parathion. Chemically related to nerve agents but are not nearly as toxic. These compounds disrupt the acetyl cholinesterase enzyme just like nerve agents.
- Carbamates—produce the same effects as nerve agents and organophosphate pesticides, but are not structurally related. An example is Sevin R.
- Metallic poisons—affect a person in a variety of ways and are usually inhalation or ingestion hazards. Arsenic trioxide is a metallic poison.

Biological Agents

Biological agents are live microorganisms or toxins that can incapacitate or kill humans and animals, and damage crops. Biological warfare is the most economical and easily concealed of the weapons of mass destruction (biological, chemical and nuclear). Members of the Japanese Aum Shinrikyo cult admitted to using biological agents in Japan during the mid-1990s, further highlighting the increased danger of biological warfare by terrorist organizations.

One of the most insidious aspects of biological agents is their extraordinary potential for covert use. Biological agents are undetectable by the human senses and can be readily released from stand off distances. Clinical symptoms usually do not appear for days to a week or more after an attack. Since the biological agent attack may not be detected, initial cases of exposure may not be attributed to it. This would make it extremely difficult to adequately respond to exposure of a large number of people and to identify the culprits. One disadvantage to the use of biological agents is that many are rapidly degraded upon exposure to certain conditions in the environment, such as ultraviolet and visible radiation, heat, drying or humidity.

Pathogens are living organisms that can cause diseases in humans. Pathogens include bacteria, viruses and fungi and vary considerably in their lethality and physiological effects. Toxins are also classified as biological agents even though they are non-living sub-stances. The table below provides characteristics for several common biological agents.

Bacteria are single-cell organisms that can be grown and developed by terrorists. Examples include *Francisella tularensis* and *Bacillus anthracis* (see table below), the cause of tularemia and anthrax.

Viruses are submicroscopic organisms that require living cells to produce and multiply. *Variola major*, the causative agent of smallpox, is a virus that could be used as a biological agent.

Fungi usually do not affect healthy individuals but they can pose a significant hazard to plants such as crops. Cereal rust is an example of a fungal agent.

Toxins are metabolic by-products of living organisms, such as microbes, insects, snakes and plants. They can also be artificially produced. Ricin, for example, is a toxin extracted from castor beans.

The characteristics and effects of biological agents vary; *Yersinia pestis*, the causative agent of the plague, has the potential to inflict epidemics while *Bacillus anthracis* (anthrax) spores can contaminate soil for decades. Toxins can take effect within hours and most are more deadly than the synthesized chemical nerve agents. Biological agents can be spread through the contamination of food and water supplies or via aerosol dissemination. An example of food contamination would be the use of *Salmonella typhii* which produces symptoms similar to that of food poisoning.

Disease (Common Name)	Causative Agent	Physiological Effects	Time to Effect[1]
Anthrax	*Bacillus anthracis*	Mild fever and fatigue, worsening to severe respiratory disorders, high fever and excessively rapid pulse rate. Death can occur within 5–12 days of exposure if left untreated. Pulmonary anthrax is fatal more than 90% of the time.	1-5 days
Plague	*Yersinia pestis*	Fever, headache and rapid heart rate, followed by pneumonia and hemorrhaging of the skin and mucous membranes. Untreated plague pneumonia fatalities approach 100% but early treatment can reduce mortality to as low as 5%.	2-3 days
Smallpox	*Variola major*	Sudden onset of fever, malaise, headache, severe backache and prostration; after 2–4 days fever falls and rash appears; scabs form and fall off at the end of the fourth week.	10-14 days
Ricin	*Ricinus communis* (castor bean plant)	Initial symptoms include high fever, pain, cough and shortness of breath; after several days severe dehydration and a decrease in urine/blood pressure. If death has not occurred in 3–5 days the victim usually recovers.	Several hours

[1] Time to initial effect is highly variable, depending upon the dosage received.

Dissemination Devices

Terrorist groups can acquire common devices to disseminate CB agents and readily adapt them for ill-conceived purposes. Agents can be distributed using simple containers such as glass bottles or modified aerosol generators. Ease of dissemination is highlighted by the Japanese cult Aum Shinrikyo, in which ordinary plastic bags were used to release the nerve agent sarin in the Tokyo subway system.