CBRN WEAPON CHARACTERISTICS

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Commanders should be familiar with the unique characteristics of chemical, biological, radiological, and nuclear (CBRN) threats, since not all attacks will have the same impact on operations. Different CBRN-related materials and agents have varying degrees of lethality, persistence, destructive capability, and potential psychological impacts. Combinations of CBRN agents may present additional challenges for detection, protection, and treatment of casualties. Alternative delivery methods create changes in CBRN agent concentration levels, areas of contamination, and/or physical destruction. Additionally, weather conditions, terrain, and the operational readiness of the force to survive, operate, and recover from weapons of mass destruction (WMD) attacks and CBRN incidents all influence the resulting effects and severity of injuries on personnel and operations. In all cases, use of these weapons may also cause psychological trauma—everything from short term effects on economic venues to widespread post-traumatic stress. These psychological effects may be an adversary objective in choosing to use WMD agents in attacks against military and civilian targets.

CHEMICAL

Joint Publication (JP) 3-40, *Countering Weapons of Mass Destruction*, defines a chemical agent as "a chemical substance that is intended for use in military operations to kill, seriously injure, or incapacitate mainly through its physiological effects."[1] It is important to note that some chemical substances, while not specifically designed for use as weapons in military operations can be used as effective attack agents. Toxic industrial chemicals and materials fall into this category. These materials may also affect installations and personnel as a result of accidental releases during manufacturing, storage, and/or transportation.

Chemical weapons are categorized according to their physiological effects: choking, blister, blood, and nerve agents, as well as their persistence in the operational environment. Large quantities may be needed to cause mass casualties, but even the limited use of chemical warfare agents can have an adverse operational impact due to their psychological effects. While chemical weapons can be made in facilities designed specifically for that purpose, many types of chemical agents can also be manufactured using technologies and facilities commonly available in non-military industries for military purposes (known as "dual-use"). The ubiquity and availability of dual-use technology, coupled with the potentially small quantity of chemical agents needed to generate widespread effects, may make chemical weapons manufacturing difficult to

[1] JP 1-02, Department of Defense Dictionary of Military and Associated Terms, 15 June 2015, using JP 3-11, *Operations in Chemical, Biological, Radiological, and Nuclear Environments*, 4 October 2013, as its source

detect and assess. Some countries no longer stockpile large amounts of CW agents, but appear to have adopted a strategy of just-in-time production.

BIOLOGICAL

Biological agents, both naturally occurring and manufactured for warfare, can cause disease and illness in human populations, livestock, or crops. Different pathogens include bacteria, viruses, and fungi. Various pathogens have different incubation times and lethality. Potentially disease-causing microorganisms can enter the body through the lungs, digestive tract, mucous membranes, and skin abrasions. Once established in the host organism, pathogens can multiply. They eventually overcome the body's natural immune response. Biological pathogens normally have an incubation period before health effects manifest in detectable symptoms. Consequently, adversaries may release biological agents covertly prior to or early in a conflict, escape undetected, and avoid retaliation by plausibly denying having used prohibited weapons.

Biological warfare agents also include toxins, which are poisonous byproducts of microorganisms, plants, and animals. Some toxins can be produced using synthetic processes. Toxins interfere with cell and tissue functions, which in turn have physiological effects such as loss of respiratory control or muscle functions.

Although biological weapons research does not require a large facility to produce pathogens or toxins, dedicated national-level facilities are needed to develop, test, and stockpile agents for military purposes related to major combat operations. Biological warfare agents may be produced in universities, hospitals, industrial-sized pharmaceutical or fermentation facilities. They can also be produced in clandestine laboratories operating in a limited space. Both small-scale and large-scale production can make use of dual-use technologies. Thus, as with chemical weapons, adversary biological weapons production and proliferation present challenges for detection and identification.

RADIOLOGICAL

Radiological hazards with the potential to injure and kill personnel can come from any radioactive source. While the detonations of nuclear weapons produce large amounts of both immediate radiation as well as radioactive fallout, attacks involving radiological materials can leverage other radiological sources and dispersal methods.

In addition to nuclear power and nuclear weapons-related facilities, sources of radiological material include medical, security, and industrial equipment and waste. The potential for adversary acquisition of these materials is greatest in states with lower levels of control, leading to a variety of possible proliferation pathways.

Radiological dispersal devices (RDDs), which combine radioactive substances with some type of dispersal mechanism, have the potential to contaminate wide areas and may be deployed either clandestinely or overtly. One example of an RDD, commonly referred to as a "dirty bomb," combines a radioactive substance with a conventional explosive in order to spread radiation. Contamination resulting from the use of a dirty bomb is the result of the amount and type of radioactive substance used in combination with the explosive power of the device. In such a weapon, the majority of casualties will be from the blast effects, rather than from exposure to radiological materials. However, dirty bombs are not the only means to weaponize radiological materials.

Other dispersal devices may include aerosolization and contamination of water and food supplies. Non-dispersal weapons, or radiological exposure devices, use a highly radioactive source placed in a location designed to expose a nearby target population. Depending on the variables of type, amount, and size of the dispersal device and the radiological material, radiation-based injuries may result from exposure to the hazard. The expected health effects are determined by type of exposure (inhalation, contact, exposure to gamma rays), the duration of exposure, the distance from the radioactive source, and the level of man-made and/or natural shielding between the radioactive source and the individual.

Accidents at nuclear power plants may also result in the unintentional release of radiation which may affect Air Force installations or operations. Installations should include this threat in their contingency plans.

Radiological threats differ from chemical and biological threats in several ways. Since radiation is transmitted through waves of energy, personnel may be harmed even if not in direct physical contact with a radiological source. There are four types of radiation, listed in order of increasing penetrating power: alpha, beta, gamma, and neutron. Radiation cannot be “neutralized” or “sterilized” and many radiological materials have half-lives measured in years. Respiratory protection will protect against the inhalation of airborne radiological contaminants. Individual protective equipment or personal protective equipment can provide the wearer with protection against alpha radiation and some protection against the contact and penetration effects of beta radiation. They do not, however, provide significant protection against gamma and neutron radiation.

A radiological device is unlikely to cause large numbers of casualties, but known employment of these devices may lead to mass panic or economic damages. Although the direct effects on military assets may be minimal, the political and psychological effects could disrupt combat forces, adversely impact civilian populations, and stress international partnerships.

NUCLEAR

Nuclear weapons derive their explosive power from the energy released during either nuclear fission, or a combination of nuclear fission and fusion reactions, also known as thermonuclear weapons. The technologies involved with the development, production, and physical effects of nuclear weapons are well known. However, the greatest challenge in creating a functioning weapon is acquiring enough weapons-grade fissile material: either highly enriched weapons grade uranium or plutonium (neither of which occur naturally in amounts concentrated enough to produce a fission bomb or thermonuclear weapon).

Weapons effects include blast, heat, transient radiation, and fallout, causing massive destruction to physical structures and equipment in addition to lethal effects against personnel. Electromagnetic pulse may cause catastrophic effects to unprotected electronic systems within a wide area. The long-term effects of radioactive fallout and significant blast effects make nuclear weapons use a top concern in any military operation against actors possessing nuclear weapons.

DELIVERY METHODS

WMD delivery methods vary widely depending on CBRN agent type, having historically included manned aircraft, ballistic missiles, as well as artillery. Newer delivery platforms, including cruise missiles and remotely-piloted aircraft, pose complex challenges resulting from their speed, stealth, and persistence. Clandestine means of delivery for CBRN may include person-to-person contact, aerosol sprayers, land vehicles, watercraft, manned aircraft, or remotely-piloted aircraft. Covert dispersive techniques are only limited to the imagination of the adversary and can include improvised explosive devices, aerial or ground sprays, or simply leaking containers.

Viable chemical agent delivery systems include artillery shells, rockets, vehicle bombs, theater ballistic missiles, and other small-scale improvised explosive dispersal devices. Aerosolized chemical agents can also be sprayed from aircraft, land vehicles, and ships. Biological agents can be spread through the use of spray, fomite, vector, and person-to-person contact, and can also be used covertly to contaminate food and water supplies. Radiological materials may be spread using dispersal devices or point sources, surface vehicles, or, potentially, from person-to-person contact.