New Concepts in CBRN Warfare in the Light of the Gulf War Experience and Current Reality of Global Terrorism

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New Concepts in CBRN Warfare

The current reality of the use of modern biotechnology, new chemical agents, and the recent relatively easier accessibility for fissile materials and technology for making tactical nuclear weapons, presents mass casualty medicine with a new reality and a changed CBRN scenario, significantly different from the conflicts previous to the Gulf War.

Chemical Weapons

The chemical component of modern CBRN warfare is still classified in four main categories. (1) Choking agents cause pulmonary, morphological, and functional alterations (chlorine and phosgene), (2) blood gases agents (hydrogen cyanide) with the blocking action on oxygen metabolism, (3) vesicants which cause external and internal tissue damage e.g. mustard gas, and (4) nerve agents such as Tabun, Sarin, VX, causing enzyme alterations in the central nervous system. The chemical agents are most effective in densely populated areas resulting in residual persistence in the environment requiring high cost, post-impact recovery of the habitat.

Chemical warfare frequently does not require high technical skills or expense rendering it accessible for various non-military and non-government protagonists, best exemplified by the use of Sarin in the public transportation terrorist action in Japan by the Aum Shinrikoyo cult. A single terrorist act resulted in an instant killing of a dozen and incapacitation of over five thousand people, by the single use of approximately one hundred kilograms of Sarin.

Chemical agents have been successfully produced in many countries not bound by the conventions to destroy their chemical arsenal. The United States, until recently, was bound to destroy all of its chemical weapons by the year 2004. These weapons have been labeled as the atomic bombs of poor countries, which do not necessarily subscribe to the conventions on the prohibition of the development, production, stockpiling, and use of the chemical weapons, and are not bound to collaborate with the organization for prevention of chemical weapons (OPCW) which has been mandated to oversee CWC technical implementation.

Chemical weapons, in general, are considered a tactical warfare arsenal, which can be decisive in the outcome of a battlefield. However, chemical weapons can not destroy the infrastructure of the enemy territories, but can successfully eliminate the enemy forces not prepared for the chemical weapon attack. Chemical weapons can be produced in commercial facilities and in some cases, stored for decades, depending on chemical weapon's shelf-life. New technology of binary weapons utilizes the storage of chemical agents of a low toxicity mixed to highly toxic compounds shortly before their deployment.

Chemical warfare agents could be effectively used as terrorist weapons with a missile attack on densely populated strategic areas, disrupting command posts and infrastructure with potential disaster proportions.

Chemical weapons have been extensively used in the twentieth century from World War One to the Iran-Iraq war. Both the United States and Russia still hold operational large quantities of chemical weapons. Their importance emerging in the areas of current

political, ethnic, and national conflicts together with chemical weapons in organized crime, sabotage, and terrorism warrants a sustained alert and preparedness.

Biological Warfare

The biological component of CBRN warfare has considerably changed in the past three decades, by the introduction of new biotechnologies. This includes genetic modifications of pathogen strains, the use of gene probes, detection of genetic sensors marking the surface of biological agents, increased virulence and lethality of new biological agents. Since the Gulf War, there has been a dramatic increase in the development of the new biological warfare agents, in the production of monoclonal antibodies, genetic engineering of the sequencing of the genomes, advanced diversity of delivery systems, and new horizons in their synchrony with computer equipment. There has also been a dramatic increase in funding of these new biological warfare agents which after the Gulf War exceeded fifty billion dollars in the United States alone. The investments in biotechnology have been even higher in the private sector, mainly in the pharmaceutical industry for diagnostic, prophylactic, and therapeutic agents with the main interest in the advancement of monoclonal antibodies, combination biochemistry of receptor and sensor pharmaceuticals and genetic probe biological agents. The ultimate aim of the military related research in this area has been the production of a super organism with unmatched virulence and pathogenicity. The biological pool of highly virulent agents is exemplified by the Ebola and Hanta viruses. Other agents not as readily available can be obtained in the national collections of most of the industrialized nations. The production and deployment of these recently developed technologies is not entirely beyond the access of various non-government groups, interested in the access to the source organisms and their use for the purpose of biological warfare without investing in the complex technology.

The agents of biological warfare are generally classified in four biosafety levels, ranging from (1) minimal potential hazard, (2) infectious cultures, (3) concentrated cultures, to (4) exceedingly hazardous agents such as Congo hemorrhagic fever, Ebola, Lassa, Omsk and Krimean hemorrhagic fever, Khazakstan and Russian Encephalitis, Anthrax, Brucella, Tullaremia, Plague, Maleus. The basic production techniques do not differ between the military and industrial establishments, except in the areas of purification and containment facilities. The lesson from the Gulf War in the biological warfare was the presence of the Scud missiles with the warheads containing Anthrax and Botulism toxin. The existence of the ongoing development of biological weapons in other countries of the world is well illustrated with the accident in the biological weapons facility in the Sverdlovsk region of Russia in which a release of Anthrax spores left scores of the general public dead in 1979.

Nuclear Warfare

The nuclear component of the future CBRN warfare remains an inevitable concern of future military strategies. The prospective increase in the number of nuclear club countries does not necessarily mean they will be signatories of the non proliferation treaty (NPT). The current stockpile of plutonium-239 in excess of 250 tons at $6,000 per kilogram and much larger quantities of enriched uranium at $1,200 per kilogram require relatively simple technology to make nuclear weapons. This constitutes the basis of a

realistic probability of the expansion of the nuclear arsenal. Currently there are over 35,000 nuclear weapons in the world arsenal, equivalent in the destructive power to over 10,000,000 kilotons of TNT, approximately one million Hiroshimas.

Tactical CBRN warfare has to consider the medical consequences of mass casualty management as well as post impact management of the population and the environment. In the nuclear component of the CBRN warfare, medical management includes thermal, blast, and acute radiation illness after the initial impact, and chronic radiation illness as well as contamination with 440 organotropic radionuclides as a chronic impact. This long-term global hazard includes both somatic and genetic alterations. Current reassessment of the risk of the nuclear weapons confirms the increased incidence of immune system pathology, increased cancer risk, and genetic effects manifested in increased heritable mutations. The future risks of nuclear weapons in the tactical conflict or the terrorist bomb scenario is enhanced by the reality of the new aspects of nuclear technology and access to plutonium and enriched uranium. Mixed oxide rods (MOX), pyroprocessing, and the production of more plutonium than is needed for the reactor operations open a realistic possibility of such materials being available on the international clandestine market.

The concepts of nuclear deterrence do not apply to clandestine nuclear terrorist networks. To deter a terrorist attack, a weapon of precise and selective destructive capability would need to be available for use against any target, anywhere in the world. The hidden arsenals of target nations and the command posts are not easily identifiable or accessible by conventional weapons since they are buried in mountains and deep underground facilities. The current nuclear arsenal of ground penetrating weapons consists almost exclusively of B-61-11 gravity bombs, not able to penetrate deeper than 20ft of rock. Currently work is being conducted at Los Alamos and Sandia laboratories, New Mexico, as a joint research project for the production of the next generation bunker buster bomb. The initial plans of using small nuclear warheads deploying a nuclear device at pre-determined target depths were hindered by the Atomic Energy Commission (AEC) experience of four decades ago, wherein the performance of small nuclear warheads proved unreliable. In 1994, by an act of Congress, the Department of Energy (DOE) research and development of low yield nuclear weapons was discontinued because of both physical properties and legal restrictions.

The current planning of the Department of Defense (DOD) Threat Reduction Agency proposes the concept of delivering a nuclear warhead with the capacity of melting the rock, which would result in contained nuclear fallout. This concept has been challenged by the Program on Global Security and Science, which postulates the opposite effect, i.e. the release of a radioactive gas plume, with adverse consequences for both the human population and the biosphere. The Global security program scientists have estimated that a nuclear warhead two hundred times smaller than the Hiroshima bomb would have to penetrate 230 feet to contain the radioactivity. The use of a 0.1kiloton weapon at a site such as Baghdad would result in hundreds of thousands of casualties.

The experience from the recently declassified AEC test on December 18, 1964 in the Nevada desert reveals “a radioactive gas plume escaping from an 89 ft deep underground explosion. Similar reports of radioactive gases escaping underground nuclear blasts have been reassessing the underground blasts conducted by AEC test sites in Arizona, California, Colorado, Utah, Wyoming, and New Mexico.

The mass production of small yield nuclear weapons may have adverse consequences. Any unexploded nuclear weapons may be used by the enemy for counter attacks. Furthermore the simplified technology could lead to easier accessibility and its use by terrorists in the production of "suitcase nuclear weapons."

Radiological Weapons

The important lesson learned from the Gulf War in regard to CBRN warfare is the serious radioactive hazard of uranium isotopes that were released for the first time in large quantities during operation desert storm. The concept of radioactive warfare goes back to the final phase of WW II with the Japanese air attacks against the continental United States. The utilization of uranium oxide in the form of aerosols was considered a realistic threat.

Current and future scenarios deploying 1500 kg hard target uranium warheads would exceed by several hundred times the contamination levels caused by the DU anti-tank penetrators in the Gulf War. In the Balkan conflict of 1999, uranium dust was detected in Hungary and Greece. Our current data of biological samples from Kandahar, Kabul, and Jalalabad obtained by state of the art mass spectrometry analysis confirm over 100 times higher concentration of uranium isotopes in the biological specimens as compared with the control group. The several thousand hard target guided weapons used in Afghanistan and in the Iraq "no fly zones" should be addressed by the UN general assembly before any further use in future military conflicts.

In the Gulf War between 350 and 800 metric tons of depleted uranium was used in the armor penetrating artillery shells. This released a conservatively estimated of 3-6 million grams of DU in the atmosphere. This was recently recalculated as a much higher quantity (in the range of tens of millions of grams) being released into the atmosphere. This contamination caused primarily by the inhalation of radioactive dust initially described as Al-Eskan disease has been the focus of a sustained controversy in the scientific literature. The current data confirm the findings of the presence of at least four isotopes of uranium in the body fluids and autopsy samples of contaminated British, Canadian, and United States Gulf War veterans. The relationship of this component of the CBRN environment and the complex symptomatology of Gulf War diseases has not yet been resolved with certainty. Nevertheless numerous scientific reports suggest mutagenic, oncogenic, and organ specific somatic affects of uranium isotopes, by both in vitro and in vivo evidence. Quantitative analysis has unequivocally proved the presence of uranium isotopes in Gulf War veterans ten years after exposure by different detection modalities including ICP-MS, alpha spectrometry, kinetic phosphorimetric studies and surface, thermal and plasma ionization mass spectrometry.

The current global CBRN reality is both a high probability and high consequence threat with potentially catastrophic consequences of mass casualties and massive destruction of both the human habitat and the biosphere. This hazard is augmented by the new elements of biological and nuclear arsenals and may well extend far beyond the present generation. Easier accessibility and more complex detection of clandestine CBRN stockpiles warrant a sustained state of alert and training to face the consequences in both tactical warfare and CBRN terrorism.