MEETING OF THE STATES PARTIES TO THE CONVENTION ON THE PROHIBITION OF THE DEVELOPMENT, PRODUCTION AND STOCKPILING OF BACTERIOLOGICAL (BIOLOGICAL) AND TOXIN WEAPONS AND ON THEIR DESTRUCTION

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CBRN Consolidated Risk Assessment
A Structured Approach to Prevention, Preparedness and Response Planning and S&T Investments[1]

Submitted by Canada

Background

1. The terrorism events and anthrax letter attacks in the fall of 2001 brought public safety and security and the need for Chemical, Biological, Radiological and Nuclear (CBRN) counter-terrorism preparedness into sharp focus. Recent Canadian experiences with such pathogens as Severe Acute Respiratory Syndrome (SARS), the Bovine Spongiform Encephalopathy (BSE or "mad cow disease"), and Avian Influenza (AI) can serve as models to understand the emergency preparedness and response capabilities needed to manage a bio-terrorist event.

2. To develop sound biological counter-terrorism prevention, preparedness, and response mechanisms, new models to systematically analyze the risk of bio-terrorism and assess the key knowledge and scientific gaps must be developed and employed. This systematic approach can be both the basis for the development of national programs but equally importantly, given the international dimensions of the problem and the likely requirements for international cooperation to manage the consequence of many BW attacks, the basis for developing international collaborative programs as well. Thus a careful assessment and shared understanding of the risk are the base for the development of strategic science and technology (S&T) investments.

[1] Prepared by Defence Research and Development Canada, Dr. Camille A. Boulet, Director, CBRN Research and Technology Initiative Defence R&D Canada.

3. The Canadian federal science, intelligence, law enforcement, and operational response communities have developed and employed a Consolidated Risk Assessment (CRA)[2] methodology to better understand the technical feasibility, vulnerabilities and probability of CBRN terrorism. The CRA is central to the Canadian CBRN Research and Technology Initiative (CRTI); a five year, $170 million (CA) science and technology program to improve Canada's ability to prepare, prevent, and respond to CBRN terrorism by addressing knowledge, science, and technology gaps.[3]

CBRN Terrorist Scenario Development and Prioritization

4. The CRTI strategic plan requires the development of a CRA to serve as a foundation for program direction and prioritization of S&T investments, projects, or activities. The results of this assessment are used to identify knowledge, S&T or key capability gaps and help operational communities and first responders more effectively prepare, prevent, and respond to CBRN terrorist acts.

5. The basic elements of the CRA methodology include:

(a) Broad consultation with and participation by the S&T, operational and law enforcement, and intelligence communities;

(b) Development of characteristic scenarios that briefly describe the nature of an individual bioterrorism event;

(c) Evaluation of the public safety vulnerabilities reflected in each of these scenarios, using a Vulnerability Matrix that considers *Relative Technical Feasibility* and the *Impact* that such a scenario would have if successful;

(d) Assessment of the degree of Risk associated with each scenario using a Risk Matrix that factors Vulnerability and Intelligence Judgment;

(e) Systematic analysis of the hazards, targets and scenarios to identify Key Mitigating Factors where S&T or knowledge can be applied; and

(f) Systematic analysis of gaps to identify investment priorities that consider the full spectrum of prevention, preparedness and response requirements.

[2] The results of the Canadian Consolidated Risk Assessment, because of the inclusion of intelligence information in the analysis, are classified. However the methodology is not classified and can therefore be presented here as a basis for developing coordinated approaches to the problem of bioterrorism.

[3] For more information on the CBRN Research and Technology Initiative please see www.crti.drdc-rddc.gc.ca

6. The CRA examines representative scenarios that describe how a particular hazard can be employed against a target. These scenarios cover a range of biological terrorism events including[4:

(a) Biological attacks against people in cities and enclosed spaces;
(b) Biological terrorism against agricultural systems (plant and animal);
(c) Biological terrorism using food, water, or consumer products to affect human populations; and
(d) Biological terrorism as it may affect critical infrastructure.

7. The first step of the CRA is to determine the *Vulnerability* by assessing the Relative Technical Feasibility and the Impact that such a scenario could have if successfully executed. Technical Feasibility considers aspects of the availability of the biological material, its deployment and dissemination, any equipment necessary for production, and the technical expertise and knowledge required for planning and executing an attack. This leads to a Technical Feasibility rating of high, medium, low, or very low.

8. Impact is evaluated, considering human losses, intensity of response at the local, provincial or federal levels, overall disruption of capability and capacity, and economic losses. The Vulnerability rating is assigned based on the following matrix which factors Impact and Relative Technical Feasibility. The matrix takes into account disproportionate impacts where, for example, the impact on local health care systems or other unintended consequences such as affects to public confidence can be much greater than anticipated based solely on the number of direct victims.

Vulnerability Matrix

IMPACT	**RELATIVE TECHNICAL FEASIBILTY**			
	High	**Medium**	**Low**	**Very Low**
Catastrophic	Extreme	Extreme	High	Moderate
Critical	Extreme	High	High	Low
Moderate	High	Moderate	Moderate	Low
Low	Moderate	Low	Low	Low

9. Secondly, to assess the overall probability of a particular scenario, an Intelligence Judgment is provided for each scenario according to the categories of likely, emerging, possible, or unlikely, with the results of the Vulnerability Matrix being brought forward. Intelligence judgment considers parameters such as the amount and reliability of reporting and terrorist intent, and provides an assessment based on available information.

10. Risk is then established, based on the following matrix, as the product of Vulnerability and Intelligence Judgment that in the context of the CRA is considered to be the best measure of

[4]The Consolidated Risk Assessment addresses the three hazard areas of chemical, biological and radiological /nuclear terrorism however for the purposes of this discussion paper, the examples are limited to biological terrorism.

probability for a given scenario. Each scenario is then assigned a Risk from immediate through high, emerging and finally discretionary.

Risk Assessment Matrix

VULNERABILITY	INTELLIGENCE JUDGEMENT			
	Likely	**Emerging**	**Possible**	**Unlikely**
Extreme	Immediate	Immediate	High	Emerging
High	Immediate	High	High	Discretionary
Moderate	High	Emerging	Emerging	Discretionary
Low	Emerging	Discretionary	Discretionary	Discretionary

11. The assessment of each scenario provides guidance for S&T projects and for evaluating and testing federal response measures. Analysis of key mitigating factors and of S&T targets for research and development, as well as other activities that can mitigate the effects of an attack, have been described as investment priorities. These investment priority areas consider the full spectrum of response requirements as well as broader issues of communication, coordination, and information. Such S&T investment priorities can for example include:

(a) Collective command, control, communications, coordination and information (C4I) capabilities for CBRN planning and response;
(b) S&T for equipping and training first responders;
(c) Prevention, surveillance, and alert capabilities;
(d) Immediate reaction and near-term consequence management capabilities;
(e) Long-term consequence management capabilities;
(f) Criminal and forensic investigation capabilities;
(g) S&T dimensions of risk assessment; and
(h) Public confidence and psychosocial factors.

12. The CRA methodology and the identification of investment priority areas highlight the need for a broad and balanced S&T program to address gaps. This includes an emphasis on collective command, control, and communications as well issues of public confidence and psychosocial factors. In particular, there is a greater need to undertake quantitative assessment of the feasibility, impact and consequences of biological terrorism scenarios as opposed to traditional hazard assessment that examines large scale, militarily significant attacks (S&T dimensions of risk assessment).

13. As an example, the increasing number of letters alleged to contain anthrax being sent to health clinics, government offices and other locations in the US and an alleged “anthrax letter” incident at a government office in Canada prompted a study of the hazard that such letters could produce. At that time, the “passive” form of dissemination of anthrax from opening a contaminated envelope was thought to pose a direct hazard to the person opening the letter, some hazard to others in the immediate vicinity, and a minimal risk outside the area.

14. In reality, a quantitative hazard assessment for anthrax letters had never been conducted. A study, examining the hazard from a small quantity of a biological simulant, showed that the passive dissemination was considerably more dangerous and would have far more serious consequences than previously considered.[5] Opening an anthrax letter would readily produce a respirable aerosol and cause rapid and extensive contamination at hazardous levels. The impact of, and vulnerability to, BW terrorism is considerably different than that of BW warfare. As was demonstrated with the aerosol hazard from anthrax, there is a requirement to develop new knowledge with respect to the BW hazard when used in terrorism scenarios.

Immediate and High Risk Scenarios

15. The CRA identifies several scenarios that are of immediate or high risk to public safety or security. Of these scenarios, most are chemical or biological attacks directly against human targets or the use of biological agents in agro-terrorism. A covert biological aerosol attack employing an anthrax spore-containing letter can be used to illustrate how the risk assessment for such a scenario can be validated using actual terrorism or public heath data.

16. The anthrax letters attack is represented in the CRA as a " covert aerosol attack using a non-contagious biological material". The risk for this anthrax scenario is assessed as a *medium* level of technical feasibility, with *critical* impact, and constitutes a *high* vulnerability. The risk prioritization is assessed as *immediate*. An analysis of the capabilities and capacities needed to manage such a scenario, validated by actual events, allows for identification and prioritization of S&T areas.

17. In October 2001, a series of anthrax attacks occurred in the United States of America. After an initial report of inhalational anthrax in Florida, several cases of inhalational and cutaneous anthrax occurred in 6 other states. These cases resulted from letters in which an anthrax powder was mailed to various media and government offices. A total of 22 cases of anthrax were identified, 11 cutaneous and 11 inhalational with 5 fatalities resulting from inhalational anthrax.[6]

18. The U.S. anthrax attacks represented a further escalation in the illicit use of CBRN materials. An unknown person and/or group were able to acquire the necessary knowledge and capability to launch an attack using a BW agent. These attacks identified new consequences, intended or unintended, from a BW agent that had not been identified as a result of previous chemical terrorism. The attacks demonstrated the tremendous impacts on both persons and infrastructure. 32,000 people were placed on an initial course of antimicrobial therapy of which over 10,000 were recommended to take a 60-day course of therapy because of factors indicating possible exposure. The anthrax

[5] Kournikakis, B., Armour, S.J., Boulet, C.A., Spence, M., Parsons, B., Risk Assessment of Anthrax Threat Letters, DRES Technical report 2001-048, Defence R&D Canada, September 2001.
[6] Jernigan, D.B., Raghunathan, P.L., Bell, B.P., Brechner, R., Bresnitz, E.A., Butler, J.C. *et al*, Investigation of Bioterrorism-Related Anthrax, United States, 2001: Epidemiologic Findings, Emerging Infectious Diseases, Vol. 8, pp 1019-1028, 2002.

letters further caused extensive contamination of facilities and infrastructure.[7,8] Consequence management of the anthrax attacks extended for months and even years unlike the immediacy of a CW event.[9]

19. In particular, the requirement for rapid diagnostics placed a tremendous burden on the public health system. There was a need to identify exposed persons to ensure that timely and appropriate medical treatment measures were provided.[10] Medical diagnostics, prophylaxis, and therapy emphasized the need for an immediate surge capacity not previously demonstrated in chemical terrorist attacks. The gap analysis and review of key mitigating factors for several biological scenarios in the CRA shows that the requirement for rapid diagnostics with high throughput capacity is a broad lesson and priority for new S&T investments.

20. The demonstrated impacts of the anthrax letters attacks can be measured in terms of the numbers of casualties, the gaps in the technical capabilities of first responders, the response capacity and capability burden it placed on all levels of government, and the clear demonstration of the value of using biological agents to achieve terrorist objectives. While not terrorism acts, the requirements for rapid diagnostics, surge capacity amongst response organizations, and non-linear consequences of an event were reinforced in recent Canadian experiences with SARS and AI.

Conclusion

21. The Consolidated Risk Assessment methodology facilitates interaction and consensus building between scientists and the operational enforcement and intelligence communities. In Canada, this interaction has resulted in a framework that prioritizes S&T investments for CBRN counter terrorism. Emergency preparedness planning and public health responses also benefit from this risk assessment based approach. The knowledge gained can be used to provide information to first responders and establish measures to address the risks through response planning, projects, partnerships and exercises.

22. To address the full dimensions of prevention, preparedness, and response to bioterrorism events will require coordinated national and international programs. Many scenarios can have international dimensions and thus highlight the likely requirements for cooperation to manage the consequence of many BW attacks. Thus a systematic approach to understanding the risk and

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[7] Dull, P.M., Wilson, K.E., Kournikakis, B., Whitney, E.A.S., Boulet, C.A., Ho, J.Y.W., *et al*, *Bacillus anthracis* Aerosolization Associated with a contaminated Mail Sorting Machine, Emerging Infectious Diseases, Vol. 8, pp 1044-1047, 2002.
[8] Dewan, P.K., Fry, A.M., Laserson, K., Tierney, B.C., Quinn, C.P., Hayslett, J.A., *et al*, Inhalational Anthrax Outbreak among Postal Workers, Washington, D.C., 2002, Emerging Infectious Diseases, Vol. 8, pp 1066-1072, 2002.
[9] Public health response to biological and chemical weapons: WHO Guidance – 2nd. Ed, World Health Organization, Geneva, 2004.
[10] Perkins, B.A., Popovic, T., Yeskey, K., Public Health in the Time of Terrorism, Emerging Infectious Diseases, Vol. 8, pp 1015-1018, 2002.

identifying capability gaps is an important basis for the development of international strategic science and technology investments.

23. The Consolidated Risk Assessment is presented as a concrete example of how risk assessment provides the foundation of S&T investment decisions in Canada, but also as a model that can serve as the basis for expanded international collaboration to deal with bioterrorism.
