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Development of Nonproliferation and Assessment Scenarios

Melissa Finley and Natalie Barnett

Prepared by
Sandia National Laboratories
Albuquerque, New Mexico 87185 and Livermore, California 94550

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Development of Nonproliferation and Assessment Scenarios

Melissa Finley and Natalie Barnett
Chemical and Biological Nonproliferation Department
Sandia National Laboratories
P. O. Box 5800
Albuquerque, NM 87185-0759

Abstract

The overall objective of the Nonproliferation and Assessments Scenario Development project is to create and analyze potential and plausible scenarios that would lead to an adversary's ability to acquire and use a biological weapon. The initial three months of funding was intended to be used to develop a scenario to demonstrate the efficacy of this analysis methodology; however, it was determined that a substantial amount of preliminary data collection would be needed before a proof of concept scenario could be developed. We have dedicated substantial effort to determine the acquisition pathways for Foot and Mouth Disease Virus, and similar processes will be applied to all pathogens of interest. We have developed a biosecurity assessments database to capture information on adversary skill locales, available skill sets in specific regions, pathogen sources and regulations involved in pathogen acquisition from legitimate facilities. FY06 funding, once released, will be dedicated to data collection on acquisition, production and dissemination requirements on a pathogen basis. Once pathogen data has been collected, scenarios will be developed and scored.

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1. Background

The Department of Homeland Security (DHS) has developed scenarios that explore possible biological terrorism events. These scenarios are intended to form the foundation for biodefense policy and planning by highlighting opportunities for detection and consequence management in the continental United States. However the DHS scenarios do not adequately consider the steps required for adversaries to successfully initiate the bioterrorism events. The United States Government (USG) should address ways to prevent acquisition and use of biological weapons (nonproliferation) as well as to address the results of bioterrorism (biodefense). The development of biological weapon nonproliferation (BWNP) scenarios will help inform the USG on which biodefense scenarios should be given priority based on the acquisition, development, and dissemination requirements associated with the agents incorporated in these scenarios. These scenarios will also provide a means to examine where, along the pathway from acquisition to development to dissemination, risk reduction techniques might be most effective.

2. Introduction

The objective of this project is to develop and analyze those scenarios which would lead to an adversary's ability to acquire and use a biological weapon. Four main factors will be considered in the design of BWNP scenarios: the requirements associated with the acquisition, development and dissemination of a variety of biological agents, and the characteristics of the adversaries who might attempt to utilize these agents as a biological weapon.

This project will focus on the acquisition, production and dissemination requirements for the following pathogens : *Bacillus anthracis*, *Clostridium botulinum*, Variola major virus (small pox), Foot and Mouth Disease Virus (FMDV), *Yersinia pestis*, vesicular stomatitis virus, Highly Pathogenic Avian Influenza (HPAI) virus (i.e. H5N1), Venezuelan Equine Encephalitis (VEE) virus, Eastern Equine Encephalitis (EEE) virus, *Salmonella typhi*, *Staphylococcus sp.*, and ricin.

Many of these dangerous pathogens may be obtained in a number of different locations world wide. Some pathogens can be acquired from nature or by theft from a legitimate research facility, culture collection, diagnostic laboratory, or during transport. Once acquired, the adversary must produce an appropriate quantity in a suitable form. Testing, storage, and quality assurance may also be components of the development stage. Once a biological weapon has been developed, there are a broad range of options for dissemination from traditional state-based weaponry to commercially available crop dusters or envelopes in the mail.

An analysis of adversaries requires consideration of their possible objectives, which may include asymmetric strength (coercive, retaliatory) through terror or genocide, invigoration of a factional support base, assassination, territory denial and incapacitation of opponents on the battlefield, among others. The adversary motivations and capabilities will then be incorporated into the analysis, as will existing control measures, to establish the baseline risk of the adversary successfully utilizing each of these pathogens as a weapon.

The successful completion of this project will result in the identification of those scenarios which pose the greatest risk to national security and highlight appropriate countermeasures to mitigate these risks. Such countermeasures may include intelligence measures, laboratory biosecurity, disease outbreak surveillance, biodetectors, and consequence management tools. By identifying

technologies and policies that can be developed to prevent an event from occurring, BWNP scenarios will not only help focus and prioritize US biological weapons prevention efforts overseas, but also help the US biodefense community prioritize development of countermeasures to respond to bioterrorism in the United States.

3. Accomplishments

The data presented in this report was collected over the period of three months and commenced upon receipt of Late Start LDRD funding. BWNP Scenario development has received approval for funding through FY07 at which time the planned scenarios and risk assessments are slated for completion. Initially, the late start funding was intended to be used to develop a preliminary nonproliferation scenario to demonstrate the utility of NP&A scenarios in prioritizing biological weapons nonproliferation (BWNP) activities worldwide; however, the value of creating a scenario without baseline data serves little purpose. The Late Start funding provided the opportunity to understand more completely that the scenarios will evolve from the data, rather than drive the data collection as initially proposed. Thus, the first three months of funding was used to begin the initial data collection process, with acquisition the main focus. Additionally, database construction is underway to establish country-specific information related to biofacilities, research centers, endemic diseases, biotechnologies, political climate, disease surveillance, and regulations governing the possession, use and transfer of dangerous biological materials. This data is the foundation for understanding where legitimate sources of the target pathogens, the available skill sets in these regions, potential adversary locales and some idea of existing impediments to proliferation in the form of regulations and surveillance capability.

3.1 Acquisition

Dangerous pathogens can be found worldwide, and all of them are found in nature, or derived from organisms found in nature, except for Variola major. Endemic areas and recent outbreak sites are therefore of interest, as are research facilities, culture collections, and diagnostic laboratories throughout the world, where these agents may be procured in a purified, viable form of known virulence.

Much of the emphasis on data collection thus far has been placed on the acquisition of FMDV. The reference material and methods used to locate FMDV in nature and in research facilities are applicable to most pathogens, with the exception of Variola major, which has been eradicated from nature, and ricin, which is derived from castor beans rather than from a pathogenic organism that would be endemic or cause outbreaks. Disease outbreak information for animal pathogens can be obtained from the World Organization for Animal Health (OIE), Food and Agricultural Organization (FAO) and outbreak information regarding human and zoonotic pathogens can be obtained from the World Health Organization (WHO) and the Centers for Disease Control (CDC). Additional outbreak information can be obtained from regional news sources and the National Library of Medicine.

Using the World Reference Laboratory for FMDV, the OIE and the National Library of Medicine, data concerning Foot and Mouth Disease (FMD) outbreak locations, dates and serotypes of FMDV isolated, have been collected on a country wide basis from 1999 to 2005. As a result, we can determine where FMDV is endemic, the strains or serotypes present, and where recent outbreaks have occurred, and thus identify potential sources of FMDV in nature

that might be attractive to potential adversaries. To date, we have identified 113 countries in Asia, Africa, Europe, the Middle East, and South America that have experienced FMDV outbreaks between 1999 and 2005, many of which have had cases reported yearly.

Legitimate research facilities may also study and store FMDV. Therefore, research institutions studying FMDV have been identified using the National Library of Medicine (PubMed). Laboratories in Argentina, Australia, Austria, Belgium, Brazil, Canada, China, Denmark, France, Germany, Israel, Republic of Korea, South Africa, Switzerland, The Netherlands, the United Kingdom (UK), and the US study FMDV and may have live virus stored within their facilities. The United States limits FMDV research to the Plum Island Animal Disease Research Center to minimize the potential for accidental release or theft. It has not yet been determined whether similar restrictions apply in other countries. Additionally, it is not yet known whether these laboratories are government, private or academic institutions; an issue which will be investigated in the future.

Culture collections are facilities that are bioresource centers that store and distribute biological materials such as cell lines, bacteria, animal and plant viruses, and antisera. *Bacillus anthracis*, *Clostridium botulinum*, *Yersinia pestis*, *Salmonella typhi* and *typhimurium*, vesicular stomatitis virus, as well as various *Staphylococcus sp.*, are available through the World Federation for Culture Collections – Microbial Resource Center (WFCC-MIRCEN) World Data Centre for Microorganisms (WDCM). The center is designed to provide a comprehensive directory of culture collections; databases on microbes and cell lines; and the gateway to biodiversity, molecular biology and genome projects.

Investigation into the rules governing acquisition of organisms from legitimate facilities is underway. The effort focuses primarily on possession and acquisition requirements, transfer (interstate), import, export, re-export laws, and international agreements enacted to prevent the illegal acquisition of pathogens and toxins. Current exemptions to regulations and non-participants of international agreements will be determined. National legislation has been identified for the United States, United Kingdom, and Canada and summaries of international legislation on a country-by-country basis are being obtained from external sources who have conducted similar studies.

3.2 Biosecurity Assessments Database

Database development work was conducted to establish country-specific information related to biofacilities, biotechnologies, disease surveillance, endemic diseases, regulations, research centers and the political climate. Facility-specific tables with information on activities, biosafety, pathogens, security, and Sandia's assessments were also developed. A prototype of the database has been created and a demonstration of its functionality has been conducted. The database will contain all of the necessary data for scenario development and will be updated regularly.

4. Conclusions and Future Objectives

The Late Start funding enabled us spend three months becoming familiar with data collection techniques, establishing sound references, and collecting information pertaining to the acquisition of the selected pathogens, particularly FMDV. We have obtained a substantial

amount of information regarding FMDV and have started to evaluate the regulations associated with obtaining pathogens from legitimate facilities. We have initiated development of a biosecurity assessments database where we will store collected data and which will serve as a valuable source of information not only for the BWNP scenario assessment but for other active projects as well.

The continuation of this project in FY06 will focus on scenario development and continued data collection with regard to acquisition, production and dissemination on a pathogen basis. The objective of the BWNP scenario development is to help prioritize BWNP activities worldwide and biodefense countermeasures at home. This process is expected to help focus intelligence efforts, mechanisms for managing disease outbreaks securely, and identification of targets for biological material management strategies, among others.

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