



Sandia National Laboratories' International Biological Threat Reduction Department (SNL/IBTR) has an ongoing mission to enhance biosecurity and biosecurity risk assessment methodologies and tools. These methods and tools will aid laboratories seeking to implement biosecurity as advocated in the recently released World Health Organization's "Biorisk Management: Laboratory Biosecurity Guidance." BioRAM 2.0 is the software tool developed by SNL/IBTR designed to complement the 'Laboratory Biosecurity Handbook' written by Reynolds Salerno and Jennifer Gaudioso defining biosecurity risk assessment methodologies. The BioRAM concept was originally developed under the Sandia National Laboratories laboratory directed research and development program.

The SNL/IBTR biosecurity risk assessment methodology represented within BioRAM 2.0 is focused on theft of a biological agent from a bioscience facility. Risk is defined as the likelihood of theft of a biological agent and the severity of the consequence of an attack with that agent.

The assessment process is broken into three components:

- Evaluate the biological agents that exist at the facility.
- Evaluate the potential adversaries of the facility.
- Identify the facility vulnerabilities.

Within each component are several criteria and sub-criteria that are scored independently. These scores are weighted and then rolled up to provide the overall consequence and likelihood (or threat potential) score. This method is based on a Multi Criteria Decision Analysis (MCDA) scheme, quantifying the various aspects of biosecurity risk using qualitative definitions.

The likelihood of theft, or threat potential, is defined as: the agent's desirability and potential use as a biological weapon; the ability of an adversary to steal the agent; and the facility vulnerabilities. Some of the agent, adversary, and facility vulnerability criteria are used to calculate this potential. The criteria and sub-criteria that comprise the threat potential score are weighted using an analytical hierarchical process (AHP). The weights were uniquely assessed based upon the adversary classification. The rationale for the unique weight, based upon adversary classification, is that facility insiders would pose a different risk and have different driving factors than outsiders or a large organized group of outsiders. Each adversary is assigned one of four classifications: insider, single outsider, large outsider group, or colluding insider and outsider. The threat potential scores for each criterion are calculated using the unique adversary weight classification. BioRAM 2.0 produces a separate threat potential score for each adversary, agent, and facility.

The consequence of an attack is defined by potential of a given biological agent to cause harm and the extent of the harm. This is calculated qualitatively using the agent's biological properties. The consequence score is comprised of the agent's population impact (that is, the potential to cause and transmit disease in humans or animal), the economic impact, and the psychological impact. Each of these criteria and the sub-criteria was also weighted using AHP. The BioRAM 2.0 consequence score is unique to each agent, but generally does not change from facility to facility or adversary.

BioRAM 2.0 works as a stand alone, windows program or as a web-based application. Both

versions use a web browser, like Firefox, Netscape, or EI, for display. The stand alone version runs on an open-source program called Instant Rails, which was designed to support programs developed in the Ruby language. The BioRAM 2.0 database can run on any standard SQL database, but was developed using a MySQL instance included in Instant Rails.

BioRAM 2.0 includes agent and adversary libraries that can be modified. Modification of the agent libraries can enable a facility to account for local and regional factors that may alter the consequence assessment. Both libraries have a web-form interface, which lists the criteria as qualitative definitions. The application and database convert these definitions into predetermined scores used in calculating the risk.

For facility assessments, BioRAM 2.0 has a web-form interface that, like the agent and adversary forms, lists facility vulnerability criteria as qualitative definitions. Upon completion of the facility vulnerability form, the assessment is completed by selecting the agents located at the facility and the adversaries that pose potential threat to the facility. The risk is presented as a consequence score ranging from zero (the lowest consequence) to four (the highest consequence) for each agent. The threat potential is likewise presented as a score ranging from zero to four. The results can be graphed on a two-dimensional plane, with one axis representing the consequence and the other the threat potential.

The final results show the relative risk of agents at the given facility, and give program management a mechanism to determine risks that are unacceptable. This scheme can aid program management in allocating resources to mitigate facility biosecurity risks, or to assess current biosecurity effectiveness.