ABSTRACT

The accredited Environmental Health Science BS degree program at Salisbury University, a member institution of the University System of Maryland, has developed an integrated chemical and bioterrorism course for undergraduate students and emergency management professionals. The one-credit class meets once a week. Course design is adapted from the Federal Emergency Management Agency’s (FEMA) integrated approach to chemical and bioterrorist defensive training strategies. Course objectives are to gain knowledge of specific chemical and biological agents; become familiar with peacetime equivalents and surrogate agents; understand biomedical and environmental factors related to agent exposures; become familiar with integrated response strategies; and gain understanding of government policy issues, agency coordination, and field operations.

Student input is based on specific discipline group response and participation in a simulated bioagent release. Discipline groups include public and emergency health, media, critical incident stress analysis, and conflict resolution. Student evaluations of the first course offered in the fall semester of 2002 indicated that the simulated release exercise gave each student an increased awareness of multiagency response necessary to mitigate bioterrorist-initiated events. Evaluation results also suggested the following modifications: include at least one community professional in each discipline group, extend the course to two credits, and schedule the class in late afternoon to accommodate working professionals.

INTRODUCTION

The Environmental Health Science (ENVH) program at Salisbury University, a member institution of the University System of Maryland, offers an undergraduate integrated emergency management course dealing with terrorist-initiated releases of chemical and biological agents. The ENVH program is fully accredited by the National Environmental Health Science and Protection Accreditation Council and is in its 11th year at Salisbury University.

As an accredited program, ENVH at Salisbury University is expected to offer a curriculum that prepares undergraduates to protect the public from a biological or chemical hazard. Traditionally, essential activities, such as protection of the drinking water, air, and food supply, as well as vector and sewage control, have been included in accredited ENVH programs. Today, there are new environmental threats that must be addressed by the environmental health work force and, consequently, by accredited environmental health science degree programs. Unfortunately, needs associated with protecting against terrorism, diseases, and other threats arise at a time when the economy limits the abilities of state and local agencies to meet demands.1 Institutions that offer a traditional environmental health science education need to train future employees to respond to these threats.

CURRICULUM DESIGN

Our undergraduate course design is not all-inclusive. Courses that deal with chemical and bioterrorist defense training strategies have been developed for various subspecialties.2,3 However, there is a current need for an undergraduate course addressing integrated response concepts and issues. The Integrated Emergency Management Course (IEMC) perspective is recognized as a primary training methodology for multiagency
The course is assigned one credit hour, requires one science course as a prerequisite, and is scheduled to meet once a week.

The course offered at Salisbury University is designed to attract a student profile that consists of upper-level undergraduates and health and emergency response professionals. As all students at Salisbury University are required to have three science courses (two of which must have laboratory sections), the prerequisite is met for students by their junior or senior year. The course is designated as a general education course. The purpose is to appeal to students across the university community and take advantage of diversified disciplines. Of particular interest is the need for environmental health groups to interact with various other disciplines in order to address different facets of community response. Nondegree-program students who are health professionals and emergency responders are also recruited.

Designated reading is *Terrorism: Defensive Strategies for Individuals, Companies and Governments*. The course grade is based on a final exam, a written report, and an oral presentation based on the written report. The final exam constitutes 25 percent of the final grade and tests students on their knowledge and understanding of integrated response concepts. The written report (50 percent) is based on the specific discipline’s understanding of their role in agent identification and effects, necessary community resources, and agency responses with regard to a simulated release exercise. The oral portion (25 percent) also involves students as a part of a discipline.

**COURSE GOALS AND OBJECTIVES**

The goal is to give students from various disciplines a working concept of the IEMC approach. This approach stresses the integrated team approach as opposed to a single response by a single agency. To accomplish this goal, the following course objectives are part of the overall design: 1) gain knowledge of specific chemicals and bioagents; 2) become familiar with peacetime equivalents and surrogate agents; 3) understand basic biomedical and environmental factors related to agent releases and exposures; 4) become familiar with multiagency integrated response strategies and understand issues that complicate integrated operations; and 5) gain understanding of relevant government policy issues, agency coordination, and field operations.

To address the wide range of issues, the lecture portion of the course deals with the various specialties

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<th>Date</th>
<th>Topic</th>
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<tr>
<td>Week 2</td>
<td>Federal law enforcement bioterrorism</td>
<td>Robert Scripp Counter Terrorism</td>
<td>Federal Bureau of Investigation (FBI)</td>
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<td>Week 5</td>
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<td>Col. Joseph Bolestra (Ret.) Police Department</td>
<td>City of Baltimore</td>
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<td>Week 6</td>
<td>Terrorism and public policy federal government</td>
<td>Larry Hogan (Ret.) House of Representatives</td>
<td>United States Congress</td>
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<td>Week 7</td>
<td>Federal response: FEMA chemical &amp; bioterrorism</td>
<td>Stephen Sharrow Superintendent</td>
<td>Emergency Management Institute, National Emergency Training Center</td>
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<td>Week 11</td>
<td>Federal response: CDC federal health component</td>
<td>Kent Gray, Chief (Ret.) Emergency Response</td>
<td>Centers for Disease Control (CDC)</td>
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<td>Week 13</td>
<td>Mental health component critical incident stress</td>
<td>Dr. Jeffrey Mitchell Associate Professor</td>
<td>University of Maryland, Baltimore County</td>
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required in an integrated approach to a terrorist event. On-campus lecturers who have the necessary expertise with chemical and biological agents, emergency medicine, and media issues teach these assigned sections. Off-campus lecturers are used when on-campus expertise is not available or when certain speakers provide highly specialized knowledge. A list of off-campus lecturers is shown in Table 1. Student knowledge gained from these lectures is applied (in group discipline format) to the development of oral presentations and written reports that define responses to a simulated bioagent release.

**SIMULATED BIOAGENT RELEASE**

As previously mentioned, the integration of disciplines into a coherent structure requires a scenario-driven approach to reinforce integration methodologies and maximize student interaction among groups. The class is presented a simulated release scenario relating to a specific agent utilized by a fictitious terrorist group. The agent of choice is based upon the agent matrix, as shown in Table 2. Although the matrix is not inclusive, the list provides a realistic choice of chemical and biological agents released during a simulated event. Specific chemical agents are those that are documented warfare agents as well as toxicants that can be used as peacetime equivalent surrogates. The bioagents are divided into infectious agents and toxins. This category is adapted from the Centers for Disease Control’s A and B list. Specific toxicants are also included. Many of these chemicals are commercially available and are excellent candidates for terrorist use. An additional reason for incorporating a short list of toxicants and toxins is to give the student exposure to the complexity of accurate agent identification. In many instances, symptoms associated with toxin exposure may be confused with those associated with chemical toxicants. For example, T-2 toxin (a fungal metabolite produced by *Fusarium spp.*) produces symptoms similar to those associated with mustard gas.

The agent release involves a variety of community targets, exposure pathways, delivery systems, sensitive target groups, and response agencies. Each student is required to choose a discipline group and participate in both the oral and written report phases. The student must choose a discipline early in the semester to integrate a specific response into the overall class strategies.

Discipline groups include public/emergency health,
media, critical stress management, conflict resolution, and governmental emergency response agencies. Reports and the presentations must include agent identification, agency response, event mitigation and emergency response, and community involvement. Each presentation is based upon the planning criteria shown in Table 3. (The planning criteria matrix was adapted from the EMI/IEMC planning matrix used in The Office of Homeland Security’s Consequences of Terrorism courses.) Course design and student backgrounds do not make it feasible to undertake policy planning to any degree. Instead, the course focuses on operation and coordination phases. The recovery phase is briefly examined only from the standpoint of “what’s next” after the official announcement is made when the event is terminated.

**TECHNICAL AND GRANT RESOURCES**

Electronic databases, Thomson MICROMEDEX®, ChemKnowledge™ and BioDex™ are made available to students developing strategies to simulated releases of chemical and bioagents. The ChemKnowledge database includes extensive data on chemical and biological agents used in warfare as well as safety and handling procedures and medical treatment procedures. The BioDex database contains information designed specifically for first responders and contains information that includes containment and decontamination information.

**FUTURE CONSIDERATIONS**

Anticipated modifications for future courses were based, in part, upon student evaluations after the first course in fall 2002. Of the forty students that had enrolled, approximately one-quarter were community response professionals, which included representatives from the local county hazardous materials team, environmental health department, and law enforcement. The remainder of the student body comprised upper-level students whose majors included environmental health science, biology, media, and business. Some psychology majors also enrolled. At least one community response professional was assigned to each group. Once the groups were formed, the remainder of the semester was devoted to the development of response and mitigation strategies relating to simulated agent releases. Upon completion of specific group presentations (both oral and written) at the end of the semester, students were asked to evaluate the course.

Evaluation results indicated that the simulated release exercise gave each student an increased awareness of multiagency responses necessary to mitigate a terrorist-initiated release. Previously, many students had a preconceived idea that only one or a few agencies were involved in an actual exercise. They were surprised at the scope of the effort and the need for a wide variety of agencies to successfully mitigate the event. Professional responders appreciated the creative solutions designed by undergraduates (unrestricted by bureaucratic limitations). Most students indicated that they were not fully aware or appreciative of media, conflict resolution, and incident stress professionals who dealt with catastrophic events. Student insight into this multiagency process

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<th>Table 3. Planning issues matrix</th>
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<td><strong>Preparedness</strong></td>
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<td><strong>Policy</strong></td>
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<td><strong>Coordination</strong></td>
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<td><strong>Operations</strong></td>
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was most evident when each discipline group contained a mix of undergraduates and professional responders. As a result, future course offerings should make every attempt to include at least one community professional into each discipline group.

Another consideration would be to extend the course to two credit hours due to student comments that one hour did not allow for student questions when outside lecturers were invited. The presentation time averaged one hour, leaving no time for adequate discussion or queries by the students. To allow professionals with job-related time constraints to participate in the course, students suggested that they schedule the two-hour class in the late afternoon.

CONCLUSION

Students found chemical and bioterrorist issues complicated and difficult to understand because the associated risks and consequences of a terrorist event are difficult to define. Cost-benefits are also difficult to establish. In addition, requisite expertise may vary for each incident. Information concerning a terrorist event is often vague, and technical problems are multifaceted.

Considering all these factors, our course helped students understand the type of training necessary to prepare professional emergency responders. Serious consideration was given in the course design to appeal to a broad academic audience that worked in conjunction with the professional response community. By putting community responders and future professionals together in an undergraduate setting, students gained understanding of the scope and complexity of an integrated response approach. As this process evolved, the students began to evaluate various response activities and formulate creative solutions.

ACKNOWLEDGMENTS

We express our appreciation to Stephen Sharro, Superintendent of the Emergency Management Institute, National Emergency Management Training Center, Emmitsburg, Maryland, for participating as a guest lecturer. We also extend our thanks to the Emergency Management Institute staff whose training courses bring the IEMC concept to first responders throughout the United States.

Special thanks goes to Salisbury University’s Provost, Dr. David Buchanan and Dr. Thomas Jones, Dean of the Richard A. Henson School of Science and Technology for providing financial support. This assistance insured the participation of internationally known speakers and provided up-to-date biomedical databases for utilization in simulated bioagent releases.

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REFERENCES