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Sandia National Laboratories

# Assessment: Jordan Royal Medical Society Biorisk Management Training Facility

## Background

On behalf of the U.S. Department of Defense, Defense Threat Reduction Agency (DTRA) Biological Threat Reduction Program (BTRP), Sandia National Laboratories (SNL) Global Chemical and Biological Security (GCBS) group visited the Jordan Royal Medical Society (RMS) from 8 to 11 April 2019. The goal of this visit was to provide subject matter expertise and advisory support to DTRA/BTRP and RMS regarding RMS' desire to establish a self-sufficient biorisk management (BRM) training capability housed in a training centre programmed to provide biorisk management training to the Jordan military services and beyond. This report provides SNL/GCBS' assessment of the status of RMS' current and desired capability as a BRM Training Centre across four critical components: 1) Curriculum, 2) Trainers, 3) Oversight and Administration, and 4) Facility.


## Assessment Agenda

**Monday 8 April 2019** – After a brief welcome by Dr/BG William and LTC/Dr. Rame Khasanaweh, site visitors[1] attended a one-day Institutional Biorisk workshop intended to introduce RMS newcomers to biorisk management.

**Tuesday 9 April 2019** – Site visitors met with Drs. Rame and Dr. Mohammad to discuss RMS' current and desired future training program and to view potential sites for an option of building a training centre facility. Site visitors met with RMS engineering and facility staff. Site visitors also toured the RMS Mobile Laboratory.

**Wednesday 10 April 2019** Site visitors toured the RMS Microbiology Laboratories. They also provided Drs. Rame and Mohammad with preliminary observations in preparation for presenting initial findings to Dr. William on Thursday.

**Thursday 11 April 2019** – Site visitors presented initial findings to Dr. William and discussed challenges and additional options for upgrading training facilities.

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[1] SNL/GCBS: Mr. Alex Walser and Ms. LouAnn Burnett; HDR (subcontractor for SNL/GCBS): Mr. Warren Hendrickson

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## Summary of Conclusions

### Curriculum

Observations and Discussions: SNL/GCBS visitors observed a one-day Institutional Biorisk workshop designed to introduce RMS newcomer laboratorians to biorisk management. After the visit, RMS provided SNL/GCBS with copies of the materials used in the workshop. RMS also briefed SNL/GCBS on their current and desired future training curriculum (audience and topics).

Conclusions: The following efforts were identified by SNL/GCBS as training initiatives that can be undertaken by RMS using existing facilities and expertise:

- Continue to offer the Institutional Biorisk for Newcomers workshop. Specific comments and recommendations on the session observed 8 April are provided later in this report (pages 4 to 6).
- Actively develop an Institutional Biorisk for Laboratorians training event and offer to all RMS laboratory staff, with considerations for using the curriculum in initial and/or refresher training. Optionally, laboratory staff members from Jordan Armed Forces and other Ministry of Defense laboratories could also be included.
- Start a training event plan by identifying audience, learning objectives and key messages for each of the following potential training events, focusing on:
    - Mobile Lab (possibly continuing to leverage the expertise and input of Public Health England)
    - Waste Management
    - Principles of Biosecurity
    - Applied Biorisk Management (case-based biosafety and biosecurity training)
    - Field Biosecurity
        - Incident Response
        - Survey Teams
- More details on each of these potential initiatives is provided below (pages 6 to 8) along with other potential training events identified by RMS to be included in their training centre capacity.

### Trainers

Observations and Discussions: SNL/GCBS had the opportunity to observe 8 RMS trainers at work during the Institutional Biorisk Workshop and held discussions with these trainers and some additional RMS staff, during lunches over the week. RMS employs twenty-five BRM trainers (all with full-time duties in other assignments). These trainers have been divided in to five cadres of five trainers each and the cadres rotate teaching the Institutional Biorisk Workshop every 2 to 3 months. The session SNL/GCBS observed was the seventh session in an 18-month period.

Conclusions: Observed trainers were professional, comfortable, confident, and knowledgeable. RMS trainers should receive continued opportunities to design and deliver training (see curriculum above). To increase trainer confidence, capability, and credibility, SNL/GCBS recommends that RMS trainers are encouraged to participate in professional development opportunities such as the IFBA Biorisk Management Professional Certification exam

(http://www.internationalbiosafety.org/index.php/professional-certification/ifba-professional-certifications/about-the-program)and the SNL/GCBS Trainer Registry and Certificate Program (to be provided by SNL/GCBS).

Once further design and development of curriculum and training event plans, as described above, has been completed, SNL/GCBS recommends that RMS trainers self-evaluate their comfort level with the content and methodology for the various initiatives. Based on this self-assessment, RMS (and SNL/GCBS, in concurrence with DTRA/BTRP) may recommend further trainer development activities to support trainer capacity adequate to staff a training centre approach.

### Oversight and Administration

Observations and Discussions: SNL/GCBS site visitors met with RMS leaders who voiced and demonstrated their support for RMS' current training initiatives. SNL/GCBS did not observe active administrative support, beyond that of the trainers, during the execution of the workshop.

Conclusions: RMS leaders are vocally and demonstratively supportive and proud of RMS BRM training initiatives. This leadership is critical to demonstrating, to staff and future training centre trainees, a strong institutional commitment to training and biorisk management. Even small training workshops require significant administrative support to execute workshops seamlessly and effectively. Because all RMS trainers have full-time duties in other assignments, this administrative support is especially critical. As the capacity for BRM training grows internally at RMS (expanding Institutional Biorisk training to include current laboratorians and refresher training for all RMS laboratorians), RMS leadership can better assure smooth training workshops by assigning administrative staff to support the trainers[2]. If RMS transitions from strictly internal BRM training to a training centre targeting, at a minimum, the Jordan Armed Forces (JAF), dedicated leadership and administrative positions will be necessary to assure adequate oversight and administration.

### Facility

Observations and Discussions: Mr. Warren Hendrickson, an architect with HDR and subcontractor with SNL/GCBS, attended all the discussions and training sessions listed above. In addition, Mr. Hendrickson spoke with RMS engineering and planning staff about various options for developing a facility to support an RMS Biorisk Management Training Centre.

Conclusions: The HDR facility assessment report accompanies this report separately. Briefly, the facility assessment options presented are based on observations and discussions of RMS goals and objectives for the RMS BRM Training Centre, presented elsewhere in this document, as well as observations of existing facilities and potential construction sites.

The training centre facility options presented:

- are designed according to published and adopted BRM guidelines and best practices, so that the facility itself promotes laboratory biosafety and biosecurity;
- create flexible space to support a variety of training modules and events and teaching styles; and
- enhance training capacity and capability.

[2] Please note that this administrative support may already be in place. SNL/GCBS did not explore this nor have the opportunity to observe what may be in place in the background.

The HDR options presented are supported by the concept that a training facility should itself demonstrate and facilitate key biorisk management principles for safe and secure laboratory operations. For example, equipping the facility with access controls, handwashing facilities, and an area to don and doff personal protective equipment provides a trainer with the opportunity to demonstrate these biorisk management best practices and to have students exercise these practices. In the case of new construction, the building can also be designed as a teaching tool to explain the importance of lab design to improve outcomes. For example, some ceilings can be left open to show supply and exhaust ducting to demonstrate airflow principles.

Including laboratory space as part of the training facility, improves organizational biosafety and biosecurity by limiting student access to working laboratories. This minimizes disruption to routine laboratory activities and also eliminates the possibility of contamination of the students. Providing students with a safe, non-hazardous environment in which to practice and evolve their understanding of biorisk management leads to more effective and sustainable transfer of learning objectives and key messages to their home laboratory.

## Assessment of Current and Desired Curriculum

### Current Curriculum – Institutional Biorisk for RMS Newcomers

As stated above, SNL/GCBS observed one session of the Institutional Biorisk for RMS Newcomers training event that RMS has reportedly offered seven times since late 2017. The topics and instructors were as follows:

- *Orientation to BRM* (Dr. Areen)
- *Good Laboratory Work Practices* (Dr. Sanna)
- *Personal Protective Equipment* (Dr. Tanya)
- *Incident Management and Response* (Dr. Mohammad)
- *Decontamination* (Dr. Tanya)
- *Laboratory Waste Disposal* (ENG Deena)
- *Laboratory Biosecurity* (Dr. Nabeeha)
- *Shipping of Biological Specimens* (MLT Ghandy)
- *Biocontainment Facility* (ENG Deena)
- *Biochemical Inventory and MSDS* (Dr. Mohammad)


The following summary lists positive observations, areas for improvement, and general training tips that may aide the trainers as they move forward with their training program.

#### Positives

- The training event ran very smoothly. The overall facilitation offered by Dr. Sanaa and the transition between trainers was excellent.
- Utilizing eight different trainers allowed the students to hear different voices which enhances auditory learning.

- Trainers utilized a variety of interactive exercises to illustrate the points of PowerPoint-based lecture. Most exercises involved a single student volunteer while the remaining students observed. These interactive exercises were inventive and well-designed to utilize the resources at hand.
- The curriculum included a large collection of RMS-scripted and -filmed videos. The videos provided students with RMS-customized examples, using faces and settings with which they are familiar. The use of videos also enhanced the visual intensity of the training topics which should aid in retention.
- The students were attentive and were surprisingly knowledgeable on the topics for newcomers. This may indicate good on-the-job training in the laboratories where these students are newly employed and/or good awareness during their university education or prior workplaces.

### Considerations for Improvement of Training Methodology

- The short duration of the training event limited the ability to communicate the topics beyond a general awareness level. If the training is intended to equip students with the ability to apply the training in their workplace, additional time must be devoted to involving all students in some of the practical and interactive exercises.
- Students will benefit from worksheets or handouts highlighting the learning objectives and key messages from each module within the training event. The opportunity to take notes on these worksheets will allow students to synthesize key points in their own words and give them something to refer to once they return to their workplace.
- Some, but not all, of the training modules begin with the objectives or key messages. Providing students, early in the module, with the objectives for the course allows them to understand and adjust their expectations for their learning during the training.
- If SOPs exist for the procedures shown by live demonstration or by video, consider handing these out for students to follow while observing the procedure.
- Assure that in addition to the "how" for laboratory procedures, the curriculum also addresses, even if briefly, the "why".
- Consider developing a common template for course PowerPoint slides. This will be especially important should RMS training be expanded to an audience beyond RMS.
- Consider an exercise at the end of the training event, before the evaluation, where students are asked to reflect on three things they learned and/or want to change in their biorisk management practices. Ask them to write these down. This activity will allow the students to "own" the training by taking responsibility for what they have learned once they leave the training. While no one should be forced to share their reflection, if students wish to share, this further discussion can reinforce a desire for enhanced behaviors and will also create a spirit of joint peer responsibility.
- Please see a list of ideas for interactive exercises to enhance training in Appendix A.

### Considerations for Improvement of Biorisk Management Content

The following notes are technical findings observed by SNL during the one-day training that are assessed to be important corrections:

- Orientation
    - Consider a broader discussion on "hierarchy of controls" in the "effectiveness of controls" section of orientation module.

- PPE
    - Module appeared to be for mobile lab rather than for all other labs. Consider developing similar discussions and videos for microbiology lab training as well.
    - Demonstrate respirator fit-check (are respirators fit-tested?).
    - Consider adding discussion of fit-test equipment that is provided by manufacturer (separate purchase required).
- Biosecurity
    - Module requires significant expansion even for a basic awareness level (SNL/GCBS will follow-up with RMS trainers to see what additional resources can be provided to support this expansion)
    - Consider adding discussions on email use, encryption, and document labeling/classification to information security section.
- Decontamination
    - Assure that verbal responses to the scenario are accurate for the disinfectants discussed, especially for contact time and concentration.
        - In many cases, the very limited contact time before volatilization makes isopropyl alcohol an inappropriate disinfectant.
        - Assure that you discuss the importance of using ~70% isopropyl versus 90% (or at least assure that you don't give the impression that the higher concentration is more effective).
        - Check your statement about hypochlorite being only medium level disinfectant (it can be high at the right concentration).
    - Add discussion on biological indicators for autoclave to supplement slides on chemical indicators
    - Susceptibility chart does not show non-enveloped viruses. This is important, as these viruses require special techniques (i.e. more concentrated disinfectants) for effective disinfection.
- Accident management:
    - Consider adding first aid module to "accident management" module. This should include first aid awareness, first aid kit use, onsite treatment, and follow-up procedures.
- Waste Management
    - Images show sealed bag being readied for autoclaving. Add discussion on the benefits of leaving bag open during autoclave process.
    - Include section on confirmation strips
- Inventory
    - Discussion is mostly about chemical reagents. Consider adding discussion on importance of maintaining and protecting (via information security) pathogen inventories as well.
- General Recommendations

- As stated above, assure that procedures demonstrated match lab SOPs and/or state that students should check with their lab directors for any lab-specific procedures.

## Desired Curriculum Expansion

SNL/GCBS and RMS discussed the types of training that RMS visualizes as they expand their training capacity. Table 1, below, lists the topics and audiences expressed by RMS along with an SNL/GCBS assessment of current RMS capacity for those curriculum expansions along with a list of resources or actions needed to support current RMS capacity to adequately execute the desired curriculum.

Table 1. Curriculum Expansion for Desired RMS Training Centre

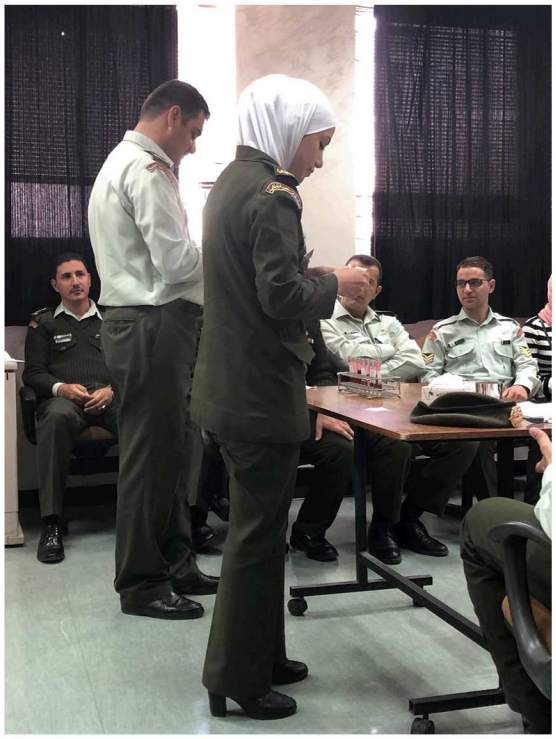
| Topic | Target Audience(s) | Resources currently existing | Additional resources/actions needed to execute |
|---|---|---|---|
| Institutional Biorisk | • Current RMS Laboratorians<br>• JAF Laboratorians<br>• Undergraduate | • Newcomer curriculum<br>• Trainers with knowledge to train<br>• Access to the Global Biorisk Management Curriculum library and other training resources. | • Revise learning objectives and key messages to reflect experienced laboratorians<br>• Develop new materials and activities as needed to meet new objectives and key messages |
| Mobile Lab Biosafety & Biosecurity | • Current RMS Mobile Laboratorians<br>• CDD and CSU Laboratorians (esp. for biosecurity sections) | • Public Health England curriculum<br>• Trainers with knowledge to train<br>• Access to the Global Biorisk Management Curriculum library and other training resources. | • Develop learning objectives and key messages to reflect desired audience<br>• Develop materials and activities to meet objectives and key messages |
| Waste Management (just bio or include chem/rad?) | • Waste generators who dispose on RMS campus<br>• RMS waste management personnel | • Equipment and facilities for demonstration<br>• Access to the Global Biorisk Management Curriculum library and other training resources. Trainers with knowledge to train | • Validated waste management SOPs<br>• Develop learning objectives and key messages to reflect topic and audience<br>• Develop materials and activities to meet objectives and key messages |
| Principles of Biosecurity | • Current RMS Laboratorians<br>• JAF Laboratorians | • Equipment and facilities for demonstration | • Expand current Institutional Biorisk module or create new training event |

| Topic | Target Audience(s) | Resources currently existing | Additional resources/actions needed to execute |
|---|---|---|---|
| | | • Access to the Global Biorisk Management Curriculum library and other training resources. | • Revise learning objectives and key messages to reflect expanded topic<br>• Develop materials and activities to meet objectives and key messages<br>• Assure training comfort level with topic and methodology |
| Applied Biorisk Management (Case-Based Biosafety and Biosecurity) | • Laboratorians requiring biorisk management refresher training | • Institutional Biorisk Curriculum<br>• Access to the Global Biorisk Management Curriculum library and other training resources.<br>• Trainers with knowledge to train | • Develop case-studies (in writing and via demonstration) and facilitated exercises to test student ability to apply biorisk management principles to real situations. |
| Field Biosecurity – Incident Response | • RMS Mobile Laboratorians<br>• CDD and CSU Field Laboratorians | • Incident Response Curriculum<br>• Trainers with knowledge to train<br>• Open terrain for training exercises | • Develop course objectives and materials in coordination with CDD and CSU stakeholders |
| Field Biosecurity – Survey Teams | • RMS Mobile Laboratorians<br>• CDD and CSU Field Laboratorians | • HAZMAT and field survey curriculum<br>• Open terrain for training exercises | • Develop course objectives and materials in coordination with CDD and CSU stakeholders<br>• Assure training comfort level with topic and methodology |

SNL/GCBS has identified the topics and audiences above as the most likely options for successfully expanding RMS biorisk management training capacity in the near term, utilizing, for the most part, existing (or easily upgraded) training and/or laboratory facilities and trainers. Some RMS trainers are currently enrolled in a Curriculum Development initiative, facilitated by SNL/GCBS and have already begun work on the expanded audience for the Institutional Biorisk course (expanding beyond newcomers to current laboratorians at RMS and beyond). This effort will be continued and

can be further utilized to develop design documents (detailing learning objectives and key messages) for the additional courses listed above.

## *Assessment of Trainers and Trainer Capacity*



RMS has reported that over 25 trainers "have been qualified as BS&S trainers." Nine of these trainers have been through one or more of SNL/GCBS trainer or curriculum development programs. Of the eight trainers observed on 8 April 2019, five are graduates of an SNL/GCBS training or curriculum development program.

The quality and competence of trainers is the most critical component of an effective training program whether it is a small program targeting just newcomers or a sophisticated training centre serving a region. Trainers not only deliver training, but also design training and training events to successfully lead to desired actions and behaviors in the students. Trainers must be well-versed in not only the topic to be trained, but also in training techniques that create memorable training and sustainable actions and behaviors long-term in the students.

The eight trainers observed on 8 April 2019 were all professional, confident, comfortable with both the topic and approach, and knowledgeable. This reflects the time and dedication that the trainers put into the design, delivery, and execution of the training event. Some of the trainers related to SNL/GCBS that the time committed to training takes away from their primary responsibilities, especially for those who are department heads. The trainers expressed their desire to enhance and improve the training sessions with small group work, longer sessions, and more interactive exercises. SNL/GCBS notes that these additional enhancements will require further time away from primary responsibilities.

If RMS wishes to expand their curriculum and training capacity, management and leadership will need to evaluate whether the current trainer pool is sufficient (both in number and in training and knowledge) to support the desired expansion. SNL/GCBS recommends that all RMS trainers be enrolled in an SNL/GCBS Biorisk Management Trainer Development Program (or a similar trainer development initiative) to assure that all trainers are working from the same training and learning principles.

SNL/GCBS recommends two actions for RMS trainers who are graduates of SNL/GCBS training programs:

- Application, preparation, and sitting for the *International Federation of Biosafety Associations (IFBA) Level 1 - Professional Certification in Biorisk Management*. This certification is designed to identify individuals with demonstrated competencies in the fundamental principles & practices of biorisk management. SNL/GCBS has successfully mentored applicants and proctored examinations elsewhere in the world. In addition to the targeted trainers, RMS department heads may also benefit from this certification process.

- For the trainers who have access to the Global Biorisk Management Curriculum (GBRMC) library, enrollment in the GBRMC Trainer Registry and Certificate Program. This on-line program allows trainers to complete small tasks related to training at their institution and to receive points and badges acknowledging their training activities. These points and badges accumulate towards a GBRMC Trainer certificate recognizing the efforts of the trainer to support and build biorisk management human capacity.

## Assessment of Oversight and Administration

While the most visible components of training events are the curriculum and trainers, no training program is sustainable without significant management oversight and support. Likewise, training execution requires administrative actions to facilitate the execution of the event and to allow the trainers to focus on the delivery of the training.

SNL/GCBS observed strong leadership support of the Institutional Biorisk training as well as a strong vision and passion in developing RMS capacity as a training centre for JAF and beyond. However, this vison and passion will need to be leveraged to create dedicated positions for oversight and administration if RMS wishes to establish training beyond institutional boundaries. This action also applies to trainers. All the trainers have other primary responsibilities. At some point, when training expands to other audiences, they may be required to decide to choose either training or focusing on their laboratory responsibilities. Or additional trainers may be required to support the increased training load.

SNL/GCBS did not have the opportunity to observe the administrative support provided to the training event on 8 April 2019 and cannot not assess whether this capacity is adequate. If the trainers, in addition to their training role and their primary responsibilities, are also taking on administrative tasks such as enrolling students, reserving training rooms, arranging for refreshments, printing course materials, etc., this burden is likely to be unproductive in the long-run, especially if additional training events are added.

## Assessment of Options for Training Facilities

Please see below for images of areas that are proposed to used as field biosecurity training lanes. For more detailed information on recommended facility upgrades, please see the HDR Assessment Report, provided separately.

Figure 1: Proposed field biosecurity training area. Image taken from recommended start point for field training lanes. Building in distance represents potential facility for clandestine laboratory training lane.

Figure 2: Open area for field biosecurity training. Space is sufficient for survey team and tactical movement raining.

Figure 3: Structure to potentially be used as clandestine lab training lane.

## Appendix A – Some Activity Options to support Active Learning

- Consider developing a waste segregation exercise where each student is given a picture of a type of common laboratory waste. Put five buckets around the room, each labelled with a type of waste (solid waste, sharps, liquid waste, etc.). Ask the students to get up and put their picture in the right bucket.
- "Find your twin" – Write terms that were defined in the course on slips of paper. Make sure that each term is written twice (there will be two slips of paper with the same term). There will need to be an even number of participants (ask another trainer to serve as a student if needed). Fold each slip so that the term cannot been seen. Mix up the slips and distribute one slip to each participant. Tell the participants to find their twin – the participant who has the same term written on their slip of paper. Ask them to work together to define the term in their own words and to come up with an example of where the term is used. Once the twins have been matched and each set has their answers, go through the group asking for their answers. Ask the entire class if they have anything to add.
- "Cabbage" – Write a question on a topic that was discussed during the training event. (Example – "What does AMP stand for?"). Write 8 to 12 questions on separate pieces of A4 paper. Crumple up one piece of paper into a small ball with the question on the inside. Using that ball as the center, shape the next piece of paper around the ball and repeat with all of the paper. The result should be a larger ball where the pieces of paper can be peeled off like cabbage leaves. The cabbage should be prepared before the students arrive for the day. Ask the students to gather in a circle. Toss the cabbage to a student. Ask them to peel off one "cabbage leaf" and read the question out loud and then answer the question. If they have trouble answering, ask the group to help. The student with the cabbage now tosses the cabbage to another student, who repeats the process. This is repeated until all pieces of paper have been peeled off. This exercise does not require a piece of paper for all students – just 8 to 12 pieces is sufficient.
- Matching exercise – Develop a list of key messages or phrases from the training topic(s). An example could be: "Biosafety = Protecting People from Pathogens." Write part of the phrase on one piece of paper ("Biosafety=") and the other part of the phrase on another piece of paper ("Protecting People from Pathogens"). Do this for all the phrases – it is best to have enough pieces of paper for all students. Fold each paper in half or in quarters. The papers should be written and folded before the students arrive. Pass out a piece of folded paper to each student. Ask them to gather in a circle. Start with one student and ask them to reveal what is written on their paper. Have the other students look at their papers and see if they think they match. Ask the class if they agree. Make sure everyone has a match and that the matching has been doing accurately.
- Quiz show – ask each table to write three questions to ask their fellow students. After they have written down their questions (in secret), ask Table 1 to ask Table 2 one of their questions. At first, only Table 2 is able to answer. If after a short time (~20 seconds), Table 2 can't answer, Table 3 can be given a chance to answer, etc. Whichever table answers correctly gets one point. Go around until each question has been asked. The table with the most points can be given a small prize or can have first choice during an activity.

----End of report----