

DEVELOPING REGIONAL EXERCISES INVOLVING MULTIPLE DAMS

by

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ABSTRACT

Owners and operators of dams across the United States are focused on enhancing protection efforts against natural or manmade disasters and improving preparedness, response, and rapid recovery in the event of dam failures or other emergencies. In a collaborative effort led by the U.S. Department of Homeland Security (DHS), multiple dam owners are actively participating in several exercise efforts aligned with the Homeland Security Exercise and Evaluation Program (HSEEP). This performance-based exercise program provides a standardized methodology for exercise design, development, execution, evaluation, and improvement planning, and can be adapted to a variety of scenarios and events.

The HSEEP framework is particularly useful for exercise efforts involving multiple dams, which have dominant regional and multi-jurisdictional characteristics when the corresponding scenarios trigger significant cascading impacts affecting extended areas. These types of exercises provide an effective mechanism to identify any required improvements to the Emergency Action Plans (EAPs) of the facilities involved. An example of these types of regional initiatives is a recently conducted effort that tested communications protocols between government and non-government entities facing a catastrophic event involving two dams located along the same river basin in the Midwest. Another example is a current series of exercises involving significant flooding in the Pacific Northwest, affecting several dams along the Columbia River Basin. This paper describes these efforts and their relevance as an important vehicle to increase preparedness and resilience at the regional level.

KEYWORDS: HSEEP methodology; emergency preparedness; resilience; exercise series; regional perspective; emergency action plan.

1.0 INTRODUCTION

Comprehensive emergency management planning is the most effective approach to prepare for, prevent, respond to, and recover from catastrophic emergency situations. This is especially important for dam owners in the event of a dam failure. Although emergency management efforts for dams in the U.S. officially began over thirty years ago, efforts have intensified in recent years due to terrorist attacks against the U.S. in 1993, 1995, and 2001. Since 2001, officials in all areas of emergency management, at all levels of government, and in all types of communities have been focused on enhancing protection efforts against both natural and manmade disasters. These efforts include the creation of the U.S. Department of Homeland Security (DHS) in 2002, and dedicated efforts by the dam safety and security communities toward improving preparedness, response, and rapid recovery in the event of dam failures or other emergencies.

Developing and maintaining a comprehensive emergency exercise program plays a crucial role in these efforts. Conducting emergency exercises provides opportunities for emergency responders and officials to practice notification and response actions and assess their collective capabilities. Conducting emergency exercises is one of the primary activities that help safeguard against the loss of life and property damage that can result from the failure of a high-hazard potential dam.

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The Homeland Security Exercise and Evaluation Program (HSEEP) was developed by DHS to provide exercise policy and program guidance that constitutes a national standard for exercises. During the past two years, the DHS Dams Sector Branch has utilized the HSEEP framework as part of joint exercise efforts developed in collaboration with the U.S. Army Corps of Engineers (USACE), other federal agencies, State and local agencies, and private dam owners/operators.

2.0 THE HSEEP METHODOLOGY

The HSEEP methodology was developed by DHS in response to the need for a comprehensive and consistent emergency exercise program. It is a capabilities- and performance-based exercise program that provides standardized methodology and terminology for exercise design, development, conduct, evaluation, and improvement planning. It can be adapted to a variety of scenarios and events from natural disasters to manmade incidents. HSEEP promotes the use of consistent terminology that can be used by all exercise planners, regardless of the nature and composition of their sponsoring agency or organization. It provides tools to help exercise managers plan, conduct, and evaluate exercises to improve their overall emergency preparedness. HSEEP also provides guidance and resources to facilitate the management of self-sustaining exercise programs.

Development of the HSEEP methodology incorporated lessons learned and best practices from existing exercise programs. HSEEP integrates language and concepts from the National Response Plan, National Incident Management System, National Preparedness Goal, Universal Task List (UTL), Target Capabilities List (TCL), existing exercise programs, and prevention and response protocols from all levels of government. It has been accepted as the standardized policy and methodology for the execution of the National Exercise Program (NEP). The NEP is the Nation's overarching exercise program formulated by the National Security Council / Homeland Security Council. All interagency partners in the U.S. have adopted HSEEP as the methodology for all exercises that will be

conducted as part of the NEP. It is also being used at the State, regional, county, and city levels, in addition to usage by private company and other organizations.

2.1 Exercise Program Management

The HSEEP methodology provides the user with information and guidance to promote effective exercise program management. The functions required for a user to sustain a variety of exercises targeted toward preparedness priorities on an ongoing basis are provided within the HSEEP framework. These include project management, multi-year planning, budget development, grant management, staff hiring, funding allocation, and expenditure tracking.

Effective exercise program management should function as a cyclic process. To support this, the development of a Multi-Year Training and Exercise Plan is recommended by considering the user's preparedness priorities. As a first step, a Training and Exercise Plan Workshop should be conducted. During the workshop, participants typically review priority preparedness capabilities and coordinate exercise and training activities that can improve and validate those capabilities. Next, specific training and exercise activities are planned and conducted according to the multi-year plan's schedule. Finally, exercise planners consider post-exercise After Action Reports / Improvement Plans (AARs/IPs) when developing priorities for the next multi-year plan, as well as updating plans and procedures, acquiring new equipment, and conducting additional training.

2.2 Exercise Project Management

Exercise project management is an important component of exercise program management. It is used to carry out the activities needed to execute an individual exercise. Exercise project management involves five phases, which are collectively known as the *exercise cycle*. Exercises conducted in accordance with the phases of the exercise cycle lead to tangible preparedness improvements.

The five phases of the exercise cycle, as provided by HSEEP, are as follows:

1. **Foundation:** The following activities must be accomplished to provide the foundation for an effective exercise: create a base of support (i.e., establish buy-in from the appropriate entities and/or senior officials); develop a project management timeline and establish milestones; identify an exercise planning team; and schedule planning conferences.

2. **Design and Development:** Building on the exercise foundation, the design and development process focuses on identifying objectives, designing the scenario, creating documentation, coordinating logistics, planning exercise conduct, and selecting an evaluation and improvement methodology.

3. **Conduct:** After the design and development steps are complete, the exercise takes place. Exercise conduct steps include setup, briefings, facilitation/control/evaluation, and wrap-up activities.

4. **Evaluation:** The evaluation phase for all exercises includes a formal exercise evaluation, an integrated analysis, and an AAR/IP that identifies strengths and areas for improvement in an entity's preparedness, as observed during the exercise. Recommendations related to areas for improvement are identified to help develop corrective actions to be tracked throughout the improvement planning phase.

5. **Improvement Planning:** During improvement planning, the corrective actions identified in the evaluation phase are assigned, with due dates, to responsible parties; tracked to implementation; and then validated during subsequent exercises.

2.3 Exercise Options

HSEEP is a very versatile tool that allows the user to tailor an exercise to address specific objectives and meet the particular user needs. Integral to this versatility are the multiple exercise options, documentation capabilities, and planning and after action report options that are defined within the HSEEP methodology.

Seven types of exercises are defined within the HSEEP methodology along with guidance for their application. The exercises range from

small scale seminar style events to full scale events (see Figure 1). Each of the exercises is considered to be either discussion-based or operation-based activities.

Discussion-based exercises are used to familiarize participants with current plans, policies, agreements and procedures, or may be used to develop new plans, policies, agreements, and procedures.

Types of discussion-based exercises include:

Seminar. An informal discussion, designed to orient participants to new or updated plans, policies, or procedures (e.g., a seminar to review a new Evacuation Standard Operating Procedure).

Workshop. Resembles a seminar, but is employed to build specific products, such as a draft plan or policy (e.g., a Training and Exercise Plan Workshop is used to develop a Multi-year Training and Exercise Plan).

Tabletop Exercise (TTX). Involves key personnel discussing simulated scenarios in an informal setting. TTXs can be used to assess plans, policies, and procedures, and is probably the most utilized of all exercise types.

Games. A simulation of operations that often involves two or more teams, usually in a competitive environment, using rules, data, and procedure designed to depict an actual or assumed real-life situation.

Operation-based exercises are used to validate plans, policies, agreements and procedures, clarify roles and responsibilities, and identify resource gaps in an operational environment.

The types of operation-based exercises include:

Drill. A coordinated, supervised activity usually employed to test a single, specific operation or function within a single entity (e.g., a fire department conducts a decontamination drill).

Functional Exercise (FE). Examines and/or validates the coordination, command, and control between various multi-agency

coordination centers (e.g., emergency operation center, joint field office, etc.). A functional exercise does not involve any "boots on the ground" (i.e., first responders or emergency officials responding to an incident in real time).

Full-Scale Exercises (FSE). A multi-agency, multi-jurisdictional, multi-discipline exercise involving functional (e.g., joint field office, emergency operation centers, etc.) and "boots on the ground" responses (e.g., firefighters decontaminating mock victims).

2.4 Exercise Documentation

Documentation is a very important part of any exercise. HSEEP provides information and guidance for seven important document types that can be used for most exercises. The list below briefly describes each of these documents.

Situation Manual (SitMan). A participant handbook for discussion-based exercises, particularly TTXs. It provides background information on exercise scope, schedule, and objectives. It also presents the scenario narrative that will drive participant discussions during the exercise.

Exercise Plan (ExPlan). Typically used for operation-based exercises. Provides a synopsis of the exercise and is published and distributed to players and observers prior to the start of the exercise. The ExPlan includes the exercise objectives and scope, safety procedures, and logistical considerations such as an exercise schedule. The ExPlan does not contain detailed scenario information.

Controller and Evaluator (C/E) Handbook. Supplements the ExPlan for operation-based exercises. Contains more detailed information about the exercise scenario, and describes exercise controllers' and evaluators' roles and responsibilities. Because the C/E Handbook contains information on the scenario and exercise administration, it is distributed only to those individuals specifically designated as controllers or evaluators.

Master Scenario Events List (MSEL). A chronological timeline of expected actions and scripted events (i.e., injects) to be inserted into operation-based exercise play by controllers in order to generate or prompt player activity. It ensures necessary events happen so that all exercise objectives are met.

Player Handout. A 1-2 page document, usually handed out the morning of an exercise, which provides a quick reference for exercise players on safety procedures, logistical considerations, exercise schedule, and other key factors and information.

Exercise Evaluation Guides (EEGs). Help evaluators collect and interpret relevant exercise observations. EEGs provide evaluators with information on the tasks they should expect to see accomplished during an exercise, space to record observations, and questions to address after the exercise as a first step in the analysis process. In order to assist entities in exercise evaluation, standardized EEGs have been created that reflect capabilities-based planning tools, such as the TCL and UTL. The EEGs are not meant to be interpreted as report cards. Rather, they are intended to guide an evaluator's observations so that the evaluator focuses on capabilities and tasks relevant to exercise objectives to support development of the AAR/IP.

After Action Report/Improvement Plan (AAR/IP). The final product of an exercise. The AAR/IP has two components: an AAR, which captures observations and recommendations based on the exercise objectives as associated with the capabilities and tasks; and an IP, which identifies specific corrective actions, assigns them to responsible parties, and establishes target dates for completion. The lead evaluator and exercise planning team draft the AAR and submit it to conference participants prior to an After Action Conference (see below). The draft AAR is distributed to conference participants for review no more than 30 days after exercise conduct. The final AAR/IP is an outcome of the After Action Conference

and should be disseminated to participants no more than 60 days after exercise conduct.

2.5 Planning and After Action Conferences

The HSEEP methodology defines a variety of planning and after action conferences. The need for each of these conferences varies depending on the type and scope of the exercise. They include:

- Concepts and Objectives Meeting
- Initial Planning Conference
- Mid-Term Planning Conference
- Master Scenario Events List Conference
- Final Planning Conference
- After Action Conference

3.0 EMERGENCY ACTION PLANS

The EAP constitutes an essential component of a comprehensive emergency management framework for dam owners and operators, as it plays a crucial role in preventing the loss of life and property damage that can result from the failure of a high-hazard potential dam. The document identifies potential emergency conditions at a dam and specifies pre-planned actions to be followed in order to minimize property damage and loss of life. It is essential because it identifies the area below a dam that would be flooded as a result of a failure; establishes communication between the dam owner and State/local emergency responders; provides for notifications and evacuations conducted by police, fire, and rescue teams; and predicts the timing of the impending flood wave.

It is essential that dam owners develop this critical information and provide it to appropriate responders to effect safe and successful evacuations, save lives, and help keep responders out of danger. An EAP contains procedures and information to assist the dam owner in issuing early warning and notification messages to responsible downstream emergency management authorities of the emergency situation. It also contains inundation maps to show emergency management authorities the critical areas for action in case of an emergency.

The effectiveness of an EAP can be enhanced by using uniform guidelines during its

development. This helps to ensure that all aspects of emergency planning are covered in each plan. Uniform EAPs and advance coordination with local and State emergency management officials and organizations should facilitate a timely response to a developing or actual emergency situation.

3.1 EAP Structure

The following guidelines are provided for preparing or revising EAPs for all high and significant hazard potential dams. Ownership and development of the floodplain downstream from each dam varies; therefore, the potential for loss of life as a result of failure or operation of a dam will also vary. It is very important that the EAP for a given dam be tailored to the particular needs and site-specific conditions that exist at that dam.

An EAP generally contains six basic informational elements:

1. Notification Flowchart
2. Emergency Detection, Evaluation, and Classification
3. Responsibilities
4. Preparedness
5. Inundation Maps
6. Appendices

While the dam owner is responsible for the development or revision of the EAP, it must be done in coordination with those having emergency management responsibilities for the affected areas at the State and local levels. Emergency management agencies need and will use the information in a dam owner's EAP to facilitate the implementation of their responsibilities. Brief descriptions of the six basic elements of an EAP are listed below.

1. *Notification Flowchart.* Shows the priority chain of notification. The information on the notification flowchart is necessary for the timely notification of persons responsible for taking emergency actions.
2. *Emergency Detection, Evaluation, and Classification.* Early detection and evaluation of the situation(s) or triggering event(s) that initiate or require an emergency

action are crucial. The establishment of procedures for reliable and timely classification of an emergency situation is imperative to ensure that the appropriate course of action is taken based on the urgency of the situation. It is better to activate the EAP while confirming the extent of an emergency than to wait for the extent of the emergency to be confirmed.

3. *Responsibilities.* A determination of responsibility for EAP-related tasks must be made during the development of the plan. Dam owners are responsible for developing, maintaining, and implementing the EAP. State and local emergency management officials having statutory obligation are responsible for warning and evacuation within affected areas. The EAP must clearly specify the dam owner's responsibilities to ensure that effective, timely action is taken should an emergency occur at the dam. The EAP must be site-specific because conditions at the dam and downstream of all dams are different.
4. *Preparedness.* Actions taken to moderate or alleviate the effects of a dam failure or operational spillway release and to facilitate response to emergencies. This section identifies actions that should be taken before an emergency.
5. *Inundation Maps.* Delineate the areas that would be flooded as a result of a dam failure. Inundation maps are used both by the dam owner and emergency management officials to facilitate timely notification and evacuation of areas affected by a dam failure or flood condition. These maps greatly facilitate notification by graphically displaying flooded areas and showing travel times for flood peaks at critical locations.
6. *Appendices.* Contain information that supports and supplements the material used in the development and maintenance of the EAP.

It is vital that development of the EAP be coordinated with all stakeholders, jurisdictions, and agencies that would be affected by a dam failure and/or flooding as a result of large operational releases, or that have statutory

responsibilities for warning, evacuation, and post-flood actions. The finished product should be user friendly as it realistically takes into account each organization's capabilities and responsibilities.

Coordination with State and local emergency management officials at appropriate levels of management responsible for warning and evacuation of the public is essential to ensure that there is agreement on their individual and group responsibilities. Participation in the preparation of the EAP and in exercises where the EAP is tested will enhance confidence in the EAP and in the accuracy of its components. Coordination will provide opportunities for discussion and determination of the order in which public officials would be notified, backup personnel, alternate means of communication, and special procedures for nighttime, holidays, and weekends.

The tasks and responsibilities of the dam owner and emergency management officials during dam emergencies need to be as compatible as possible. To facilitate compatibility, the dam owner should coordinate emergency response actions with local emergency management officials who have the responsibility to provide a timely warning and evacuation notice to the population at risk. This should help prevent over, or under, reaction to the incident by various organizations.

4.0 APPLICATION TO REGIONALLY-BASED, MULTIPLE DAMS EXERCISES

The HSEEP framework is particularly useful for exercise efforts involving multiple dams, which have dominant regional and multi-jurisdictional characteristics when the corresponding scenarios trigger significant cascading impacts affecting extended areas. These types of exercises provide an effective mechanism to identify any required improvements to the EAPs of the individual facilities and the local, State, and Federal agencies involved. They are an important vehicle to increase preparedness and resilience at the regional level.

DHS has utilized HSEEP for conducting two separate exercise efforts involving multiple dams and cascading impacts with regional and

multi-jurisdictional effects. The first effort was conducted in 2008 in collaboration with USACE and other partners across the Dams Sector. It consisted of a series of exercises focused on enhancing protection efforts against manmade attacks and improving preparedness, response, and rapid recovery in the event of an attack, natural disaster, or other emergency. The second effort is currently underway and involves significant flooding of several dams and communities along the Columbia River Basin in the Pacific Northwest. It also consists of a series of exercises and is a collaborative effort with USACE and other partners across the Dams Sector.

4.1 2008 Dam Security Exercise Series– Bagnell/Truman (DSES-08)

The 2008 Dam Security Exercise Series– Bagnell/Truman (DSES-08) was a series of exercises designed to test existing interoperability and communications protocols between government and non-government entities facing a catastrophic security-related event involving two dams located along the same river basin. DSES-08 was comprised of multiple events, including a series of workshops, a tabletop exercise, and a functional exercise.

The events associated with DSES-08 involved Bagnell Dam, owned by AmerenUE, and Harry S. Truman Dam and Reservoir, owned by the USACE Kansas City District. Additional participants included DHS, the Missouri State Emergency Management Agency, and other Federal, State, local agencies, and private entities. DSES-08 was developed by an Exercise Planning Team comprised of representatives from all participating entities. The exercise series consisted of four main activities: an EAP Workshop, an Inundation Modeling and Mapping Workshop, a Security TTX, and a Functional Exercise (FE). The first three activities were conducted on August 7, 2008 in Lake of the Ozarks, Missouri. The fourth activity was conducted on September 17, 2008 in Jefferson City, MO. A total of 311 personnel from 64 organizations attended all DSES-08 events.

DSES-08 sought to exercise interagency interoperability and communications in response

to all-hazard, dam emergencies to improve Truman Dam and Bagnell Dam EAPs, and readiness of associated critical infrastructure and key resources (CIKR). Exercise participants successfully exercised the EAPs in workshop and FE forums that validated the plans and will guide refinements to established procedures. The FE scenario involved a response to terrorist attacks. The FE scenario facilitated participants' review of roles and responsibilities, coordinate and integrate capabilities, examine planning processes, identify issues and seek solutions. The FE included agency participation from Missouri and Washington DC, as well as representatives from the Dams Government Coordinating Council and the Sector Coordinating Council, who participated from their respective locations across the US (see Figure 2).

DSES-08 provided many valuable lessons learned in five functional areas: Exercise Organization Planning and Execution; Communications, Information Sharing and Interoperability; EAP Scope; Inundation Modeling and Mapping; and Interaction with Local and State Agencies. In particular, challenges in communication protocols faced during the exercise underscored the critical need to ensure that plans incorporate redundant means of communications, and that users receive adequate training on the use of incident management communications systems.

DSES-08 successfully utilized the HSEEP program in achieving exercise objectives, including exercising interagency interoperability and communications in response to almost-simultaneous security-related incidents at multiple dams. These efforts clearly assisted in improving the readiness conditions at the participating projects, as well as the information dissemination framework established across the sector.

4.2 2009 Dams Sector Exercise Series– Columbia River Basin (DSES-09)

The 2009 Dams Sector Exercise Series– Columbia River Basin (DSES-09) consists of a series of exercises involving significant flooding in the Pacific Northwest, affecting several dams along the Columbia River Basin. Participants in this effort include the Pacific Northwest Economic Region, DHS, USACE, and various

stakeholders in the Pacific Northwest region. The primary objective of DSES-09 is to facilitate the development of an Integrated Regional Strategy to improve disaster resilience and preparedness initially for the Tri-Cities area of Washington State (Kennewick, Pasco, and Richland) and ultimately for the broader Columbia River basin.

The DSES-09 effort consists of pre-exercise training seminars, a series of TTXs, and follow-up after action/strategy workshops. DSES-09 is currently underway and is utilizing the HSEEP methodology as the framework for all exercise components. The versatility of HSEEP is proving integral to achieving the primary objective of the exercise series, which is the development of an Integrated Regional Strategy to improve disaster resilience and preparedness across multiple sectors and jurisdictions.

DSES-09 is being conducted with a somewhat unique approach. The effort has been divided into five tracks. Each track is being conducted separately with completion scheduled to complement the other tracks as the overall effort progresses. Each track is briefly described below.

Track 1 - Modeling and Mapping. Use existing models to estimate hydrological and hydraulic conditions based on weather and dam operations, update inundation maps, and identify additional modeling requirements.

Track 2 - Pre-Disaster Operational Response. Examine the effectiveness of plans and procedures for dams with regards to communication, coordination, roles and responsibilities, information-sharing, and response and mitigation procedures associated with cascading events that could create a potentially catastrophic inundation scenario in the Tri-Cities area.

Track 3 - State and Local Preparedness/Emergency Response. Identify disaster management challenges during a major regional flood within multiple highly populated communities that consist of CIKR, some of which pose unique environmental concerns.

Track 4 - Long-term Restoration/Economic Resilience. Address issues related to assessing consequences of a major flood event on CIKR and associated regional infrastructure interdependencies, duration of disruptions, impacts on recovery and longer-term restoration, and potential prevention and mitigation measures.

Track 5 - Integrated Regional Strategy. Develop an Integrated Regional Strategy that leverages lessons learned from the series of exercises in order to improve regional disaster resilience.

Track 1 entailed the creation of a Modeling and Mapping Workgroup to address modeling approaches and capabilities that can be leveraged from other efforts. The initial focus was on updating inundation maps and refining the scenario, which is being used during Tracks 2, 3 and 4. The workgroup conducted a Modeling and Mapping Workshop to assist with exercise development.

Tracks 2, 3, and 4 consist of a concepts and objectives meeting, training seminar, TTX, and post-exercise workshop for each track. These tracks are designed to help build the Integrated Regional Strategy. The workgroups for Tracks 2-4 are being tailored to include additional stakeholder organizations beyond those in Track 1, as appropriate.

Finally, Track 5 will include development of an AAR/IP to identify lessons learned and assign responsibilities for areas that require improvement. The results of the first 4 tracks as well as the AAR/IP will be integrated into a regional strategy for the Columbia River basin in the Pacific Northwest region.

5.0 CONCLUDING REMARKS

EAPs and exercises are essential components of comprehensive emergency management planning for dam owners and operators. An EAP is essential for major dams in order to save lives and reduce property damage in areas that would be affected by dam failure. Exercises are the primary tool for dam owners to test EAPs and other emergency procedures, assess emergency response capabilities, and identify

areas for improvement. The HSEEP methodology is a capabilities and performance-based tool that provides guidance for exercise design, development, conduct, evaluation, and improvement planning. The HSEEP framework is scalable and easily applied to regionally-based, multi-dam scenarios that involve multi-jurisdictional and multi-agency components. It is an invaluable tool for dam owners and operators for improving their preparedness, response, and recovery capabilities. Large scale exercises such as DSES-08 and DSES-09 provide an excellent opportunity for building coordination and compatibility.

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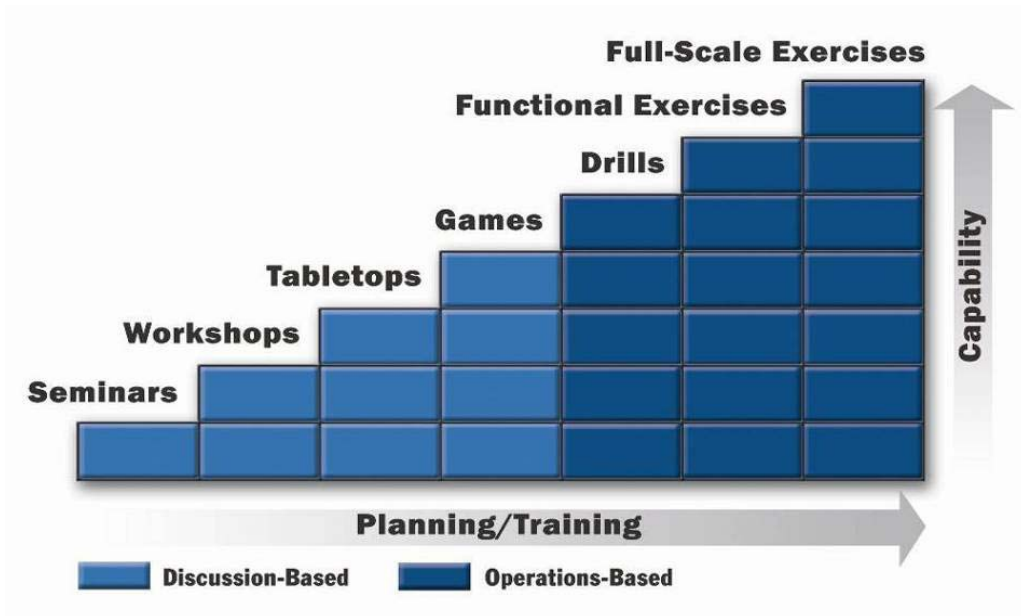


Figure 1. Exercise Types

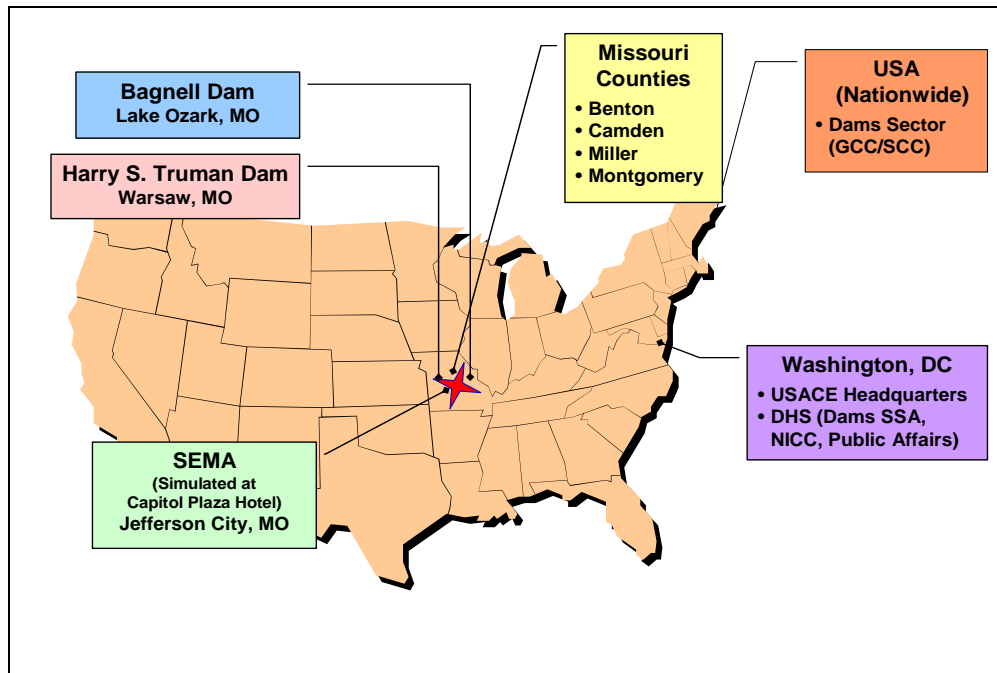


Figure 2. DSES-08 Functional Exercise Locations