Dams Sector Crisis Management Handbook

A Guide for Owners and Operators

2015

Homeland Security

Agency Quick Reference Contact List

"Build relationships with these groups before an incident occurs"

Response agencies and stakeholders for your community and geographic region

Resource	Contact	Phone Number
Local Law Enforcement		
State Law Enforcement		
Fire and Emergency Medical Services		
City Emergency Management		
County Emergency Management		
State Emergency Management		
FBI Joint Terrorism Task Force (Local)		
Federal Bureau of Investigation Field Office		
State and Urban Fusion Centers		
State Dam Safety Office		
Downstream Dam and Levee Operators		
Upstream Dam and Levee Operators		
U.S. Coast Guard District		
DHS IP Protective Security Advisor		
DHS IP National Infrastructure Coordinating Center		

Acknowledgments

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The development of the 2015 update of the Dams Sector Crisis Management Handbook was led by the Dams Sector Security and Education Workgroup, comprised of members of the Dams Sector Coordinating Council, the Dams Sector Government Coordinating Council, the Levee Sub-sector Coordinating Council, and the Levee Sub-sector Government Coordinating Council, under the auspices of the Critical Infrastructure Partnership Advisory Council.

Distribution

This document is available on the Homeland Security Information Network – Critical Infrastructure (HSIN-CI) Dams Sector Portal. The Dams Sector Portal within HSIN-CI allows for information sharing among Federal, State, and local agencies and private sector owners and operators. For additional distribution information and access requirements for the HSIN-CI Dams Sector Portal, contact dams@hq.dhs.gov.

Notice

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Additional Information

Dams Sector Security Awareness Handbook
An overview of how to recognize security concerns, coordinate proper response, and establish effective partnerships with local law enforcement and first responder communities.

Dams Sector Protective Measures Handbook
An overview of security strategies and protective measures addressing physical, cyber, and human elements; and general recommendations for developing site security plans.

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INTRODUCTION

This handbook is intended to provide information about planning and response measures that may be used to prevent dam failures, and minimize the consequences of damage or failure. This handbook provides an introduction to crisis management concepts for dam owners. It explains how crisis management measures are an important component of an overall risk management framework, and provides templates and guidelines to apply these concepts to dams and related infrastructure.

The Dams Sector is comprised of the assets, systems, networks, and functions related to dam projects, navigation locks, levees, hurricane barriers, mine tailing impoundments, and other similar water retention and/or control facilities. Dam projects are complex facilities that typically include water impoundment or control structures, reservoirs, spillways, outlet works, powerhouses, canals, or aqueducts. In some cases, navigation locks are also part of the project.

Each dam is unique because of differences in project configurations, engineering details, project benefits, and potential consequences from possible damage to the dam. Therefore, applying appropriate crisis management measures as part of a risk management program will be unique for each project.

The need for this handbook was identified by the Dams Sector Security Education Workgroup, which is composed of members from the Dams Sector Coordinating Council (SCC) and the Dams Sector Government Coordinating Council (GCC). The SCC and the GCC were established as a partnership mechanism to collaborate with the Dams Sector-Specific Agency (SSA) in Sector-wide security and protection activities. The councils provide a forum for owners and operators, and their government agency counterparts to discuss, act in concert, and monitor security issues affecting the Dams Sector. Sector partners jointly identified critical infrastructure protection priorities for the Dams Sector, which included the need to develop mechanisms for education, outreach, and communication of security and protection issues. The Dams Sector-Specific Plan (Dams SSP) serves as a vehicle for Sector security partners to work cooperatively with DHS to identify issues, set goals, create strategies, and implement protective programs that make effective use of available resources. This handbook is one outcome of that process.

The Homeland Security Act of 2002, Presidential Policy Directive 8 (PPD-8), and Presidential Policy Directive 21 (PPD-21) provide the overarching framework for protecting the Nation's critical infrastructure. This framework includes the following basic elements:

- Establishment of the 16 critical infrastructure sectors
- Identification of an SSA for each critical infrastructure sector
- Development of a National Infrastructure Protection Plan (NIPP)
- Establishment of the sector partnership mechanism
- Development of a Sector-Specific Plan for each critical infrastructure sector, and
- Systematic preparation for the threats that pose the greatest risk to the Nation's security

The Dams Sector is one of the Nation's 16 identified critical infrastructure sectors. The SSA for the Dams Sector is the Office of Infrastructure Protection, U.S. Department of Homeland Security (DHS), National Protection and Programs Directorate.

The Critical Infrastructure and Key Resources Support Annex to the National Response Framework (NRF) represent a major step towards integrating the Nation's critical infrastructure protection mission as a key component of domestic incident management. The annex describes policies, roles and responsibilities, as well as the concept of operations for assessing, prioritizing, protecting, and restoring the Nation's critical infrastructure following natural disasters, terrorist events, or other manmade or technological emergencies. Additional information is available at http://www.fema.gov/national-response-framework.

Target Audience

This handbook has been prepared for Dams Sector owners and operators, regardless of the size or type of the facility.

Dams are a vital part of the Nation's infrastructure and provide a range of economic, environmental, and social benefits. These benefits include irrigation, electric power generation, "black start" capabilities[1], water storage, recreation, navigation, flood mitigation, sediment/hazardous materials control, and impoundment of mine tailings and industrial waste.

While dams offer numerous benefits, they also provide some potential hazards. In the event of a dam failure, the volume of the water stored, even behind a small dam, is capable of causing loss of life and significant property damage. Dams may fail for one or a combination of the following reasons:

- Overtopping caused by floods
- Structural failure
- Foundation failure
- Earthquake
- Piping and internal erosion
- Inadequate maintenance
- Operational errors
- Deliberate manmade actions

While the final reason—the potential for deliberate manmade actions—was a primary catalyst for developing this handbook, the crisis management measures described herein are broadly applicable to almost any type of natural or manmade incident.

1 A black start is the process of restoring a power station to operation after a wide-area power outage without assistance from the electrical system. Some generating plants using steam turbines require up to 10% of their capacity for this restart. Such a large standby capacity cannot economically be provided at each location; such black-start power must be provided over transmission lines from other sources. Since hydroelectric power stations need little power to restart, they can be used as power sources for restart of other types of power generation.

SECTION 1: SECTOR OVERVIEW

More than 87,000 dams are listed in the National Inventory of Dams (NID), including dams over 25 feet in height or reservoirs having more than 50 acre-feet in storage capacity. In the NID, the downstream hazard potential (e.g., the amount of risk or damage a dam can pose due to failure or negligent operation) is classified as high, significant, or low. About 14,000 dams are classified as having a high-hazard potential.

Dams can have a number of purposes including: irrigation, water supply, electric power generation, flood control/flood damage reduction (hereafter, flood control), storm surge protection, navigation, recreation, or control of sediment, mine tailings or hazardous material. However, these benefits are associated with potential risks.

In the event of a dam failure, uncontrolled release of the water stored behind even a small dam, could potentially cause property damage and loss of life. For some dams, failure has the potential to cause massive casualties, as well as severe long-term economic consequences. Even if damage to a dam only prevents it from operating as intended, there could be significant economic impacts to the owner, the surrounding community, the region, and potentially the Nation.

Certain characteristics of dams make them an unusually difficult type of facility to protect. While critical assets in many other sectors are small or concentrated and can be contained within buildings, dams are often large facilities whose components are not necessarily enclosed within buildings. Dams are often located in remote areas and can be approached via land, water, or air. In addition, many facilities are required to provide public access to certain portions of the facility. These factors pose especially difficult problems in controlling access.

The combination of benefits that our Nation derives from dams, the potential consequences of damage or disruption, and the difficulties in protecting dams, can make them inviting targets for potential adversaries. This handbook addresses situations in which damage or failure is imminent, or has occurred. It identifies planning measures that should occur before such an incident, and emergency response measures that should occur during and immediately after the incident. (The other resources in this series include the —*Dams Sector Security Awareness Handbook* and *Dams Sector Protective Measures Handbook* which discuss security awareness, and strategies and measures to protect dams, respectively).

SECTION 2: RISK MANAGEMENT

Risk management is discussed in the *Dams Sector Protective Measures Handbook*. The discussion focuses on using risk management to identify appropriate protective strategies and measures as part of a cost-effective plan to protect dams and prevent or minimize the potential for harm caused by both man-made and natural disaster events.

As noted in the introduction, dams may fail for a number of reasons, including overtopping due to flooding, structural or foundation failure, and operational error. Therefore, any comprehensive risk management program must also consider what happens if the dam is damaged, if dam failure is imminent, or if the dam has already failed—either partially or completely—regardless of the cause. The objective of crisis management is to limit consequences by containing the damage and preventing failure, and minimizing the safety and economic impacts caused by damage or failure. These issues can all be addressed as part of a crisis management program.

SECTION 3: CRISIS MANAGEMENT PROGRAMS

In a broad sense, crisis management is planning for, and responding to, any emergency incident. In 2007, Congress directed the development and implementation of a voluntary private sector preparedness accreditation and certification program. The result of this directive, The Voluntary Private Sector Preparedness Program (PS-Prep™), is designed to improve the preparedness of private sector entities and nonprofit organizations through conformance to consensus-based preparedness standards and best practices. PS-Prep™ enables organizations to identify and implement the necessary steps for instituting and maintaining a comprehensive management system that addresses business continuity, organizational resilience, and disaster management.

Through the PS-Prep™ program, private sector entities and non-profit organizations may be certified by an accredited third party organization establishing that the entity or organization conforms to one of the adopted preparedness standards. The adopted standards are as follows:

- NFPA 1600 – Standard on Disaster/Emergency Management and Business Continuity Programs
- BS 25999 – Business Continuity Management
- ASIS SPC.1-2009 – Organizational Resilience: Security, Preparedness, and Continuity Management Systems

These standards provide a comprehensive management systems approach to organizational resilience, preparedness, and business continuity widely applicable for private and non-profit organizations. The areas covered by these standards are important elements of a corporate crisis management program. This handbook has a more specific scope, as it is focused on incidents involving damage, disruption, or failure of Dams Sector facilities, and their resulting impacts on human safety and infrastructure. This handbook addresses the following components of a crisis management program:

- Emergency Action Plans
- Recovery Plans
- Continuity Plans, and
- Exercises.

Each of these components is discussed here briefly, and in more detail in the following sections of this handbook.

Emergency Action Plans

The Emergency Action Plan (EAP) is a formal document that identifies potential emergency conditions at a dam and specifies actions to be followed to minimize loss of life and property damage. The EAP describes actions the dam owner will take to moderate or alleviate a problem at the dam, as well as actions the dam owner, in coordination with emergency management authorities, will take to respond to incidents or emergencies related to the dam.

Recovery Plans

In addition to the immediate safety issues addressed in the EAP, damage or failure of a dam can have long-term economic impacts. These will certainly impact the dam owner, but might also have wider impacts on the community, other industries, or even regional or national economies. Therefore, rapid restoration of dam functions may be necessary to help minimize such impacts. Recovery plans can be used to help prepare for quick repair of damage. Recovery plans might address both short-term repairs to partially restore project functions and long-term repairs to fully restore the project.

Continuity Plans

It may be necessary to continue dam operations during the absence of several key personnel. Continuity planning can be used to identify personnel with the skills required to manage crises and to define shifts of roles and responsibilities to respond to the absence of key personnel.

Exercises

While planning is essential for effective crisis management, periodic exercising of those plans is necessary to test their adequacy and appropriateness. Exercises raise general awareness of potential crisis situations, and ensure that key staff members are familiar with the plans and understand their roles and expected actions. In addition, exercises can help identify shortcomings in the plans, leading to their improvement.

SECTION 4: EMERGENCY ACTION PLANS

Emergency Action Plans (EAPs) guide owners and operators in the response to and the prevention and mitigation of impending incidents and minimize the potential risks to life safety and to property. EAPs include notification lists to mobilize resources to prevent imminent failures during emergency situations and to communicate appropriate danger warnings to local authorities, upstream and downstream dams, and the public. They may also address a variety of preparedness issues such as alternative communications systems, emergency supplies, and equipment. EAPs must be site-specific because conditions are unique at each dam and downstream from the dam.

The Interagency Committee on Dam Safety has established Federal Guidelines for Dam Safety. One portion of these guidelines is Emergency Action Planning for Dam Owners (FEMA P-64), published by the Federal Emergency Management Agency (FEMA). Much of the content in this section of this handbook parallels those guidelines. In addition to this section, appendix A provides a template that can be used to assist in the development of a site-specific EAP. The guidance also parallels much of the "suggested EAP format" presented in FEMA P-64. For more detail, see FEMA P-64, which can be obtained from FEMA in print or on CD, and can be viewed online at http://www.fema.gov/plan/prevent/damfailure/fema64.shtm.

Federal Guidelines for Dam Safety: Hazard Potential Classification System for Dams (FEMA 333) is used in conjunction with FEMA P-64 to define the types of dams for which an EAP should be developed. FEMA 333 is available at http://www.fema.gov/library/viewRecord.do?id=1830.

In addition to the Federal Guidelines, dam safety is also regulated through State guidelines, which might include requirements for EAPs. FEMA has addressed this in *Emergency Action Planning for State Regulated High Hazard Potential Dams* (FEMA 608), available at http://www.fema.gov/library/viewRecord.do?id=3122.

The dam owner is responsible for developing the EAP. However, it must be done in coordination with those agencies having emergency management responsibilities at the State and local levels. The dam owner must also ensure that the EAP conforms to any applicable State and Federal requirements. Emergency management agencies will use the information in a dam owner's EAP to facilitate the implementation of their responsibilities. State, county, and local emergency management authorities will generally have either a local emergency operations plan or a warning and evacuation plan.

Basic Elements of an EAP

- **Notification Flowcharts and contact information.** A Notification Flowchart identifies who is to be notified of a dam safety incident, by whom, and in what order. An example Notification Flowchart is provided in Appendix A. The information on the flowchart is critical for the timely notification of those responsible for taking emergency actions. For ease of use during an incident, the EAP should include Notification Flowcharts that clearly present the information listed below. One chart (or a set of charts) may be needed depending on the complexity of the hazards associated with the dam and the potentially affected downstream areas.

  - Emergency level of the Notification Flowchart if more than one flowchart is required
  - Individuals who will notify dam owner representatives and/or emergency management Authorities
  - Prioritization of notifications
  - Individuals who will be notified

  The Notification Flowchart should include appropriate contact information such as names, positions, telephone numbers, and radio call numbers. Supplemental contact information may be included in a list or table of emergency contacts. Supplemental contact information may include fax numbers, e-mail addresses, direct connect numbers, and alternate contacts. The Notification Flowchart may also be supplemented by NIMS ICS Forms, such as ICS Forms 205 and 205a, available at www.training.fema.gov/EMIWeb/is/ICSResource/icsforms.htm.

  The Notification Flowchart must be tailored to the needs and notification priorities of each dam. It is usually recommended that one person be responsible for contacting no more than three or four other parties. At a minimum, the Notification Flowchart should designate who dam owners will contact and who the local emergency management authorities will contact as described below.

  Dam owners will contact:

  - Engineer/management staff/public affairs officer
  - Local emergency authorities or 911 centers
  - State dam safety program representatives
  - Other regulatory authorities
  - Upstream and downstream dam owners

  Local emergency management authorities will contact:

  - Other local responders such as police or fire
  - State emergency management authorities
  - Affected residents and businesses
  - Appropriate NWS WFO

- **EAP Response Process.** There are generally four steps that should be followed when an unusual or emergency incident is detected at a dam. These steps constitute the EAP response process. The steps are:
    - **Step 1:** Incident detection, evaluation, and emergency level determination
    - **Step 2:** Notification and communication
    - **Step 3:** Emergency actions
    - **Step 4:** Termination and follow-up

  Early detection and evaluation of the condition(s) or triggering event(s) that initiate or require an emergency response action are crucial. It is important to develop procedures for reliable and timely determination of an emergency level to ensure that the appropriate response actions are taken based on the urgency of the situation. Procedures for early notification are required to allow all entities involved with plan implementation to respond appropriately. Preventive or mitigating actions can be taken to attempt to address conditions at the dam. Eventually, a determination will need to be made concerning termination of the incident. After the incident is over, follow-up activities may be required. All of these steps make up the general EAP response process and should be discussed in the plan.

- **Responsibilities**. A determination of responsibility for EAP-related tasks must be made during the development of the plan. Dam owners are responsible for developing and maintaining the EAP. Dam owners, in coordination with emergency management authorities, are responsible for implementing the EAP. Emergency management authorities with statutory obligations are responsible for warning and evacuation within affected areas. All entities involved with EAP implementation should document incident-related events. The EAP must clearly specify the responsibilities of all involved entities to ensure that effective and timely action is taken if an emergency at the dam occurs. The EAP must be site-specific because conditions at the dam and upstream and downstream of the dam are unique to every dam. Part I, Section I, of the EAP should summarize the critical responsibilities for responding to an incident and implementing the plan.

Preparedness Activities. Preparedness, as it relates to an EAP for a dam, typically consists of activities and actions taken before the development of an incident. Preparedness activities attempt to facilitate response to an incident as well as prevent, moderate, or alleviate the effects of the incident. Examples of preparedness actions include conducting regular inspections or surveillance, installing monitoring equipment, installing warning sirens, developing emergency operating instructions, and planning for equipment, labor, and materials to be used in emergency situations. At a minimum, the EAP should address the following categories related to preparedness:

- Surveillance and monitoring
- Evaluation of detection and response timing
- Access to the site
- Response during periods of darkness
- Response during weekends and holidays
- Response during periods of adverse weather

- Alternative sources of power
- Emergency supplies and information
- Training and exercising
- Alternative systems of communication
- Public awareness and communication

- **Inundation Maps.** The primary purpose of an inundation map is to show the areas that would be flooded, and travel times for wave front and flood peaks at critical locations if a dam failure occurs or there are operational releases during flooding conditions. Inundation maps are a necessary component of the EAP, and are used by both the dam owner and emergency management authorities to facilitate timely notification and evacuation of areas potentially affected by a dam failure or flood condition.
- **Appendices.** The appendices should contain supplementary information. The appendices typically include material that was used to develop the EAP and information that can be used to assist with decision-making during an incident (e.g., detailed operation and maintenance requirements, dam break information and analyses, record of plan reviews and updates, plan distribution list, and incident tracking forms). When developing the appendices, dam owners, in coordination with emergency management authorities, should consider including supporting information that will help them respond rapidly and effectively to an incident.

Coordination

It is vital that the development of the EAP be coordinated with all entities, jurisdictions, and agencies that would be affected by an incident at the dam or that have statutory responsibilities for warning, evacuation, and post-incident actions. The EAP should contain clearly defined roles and responsibilities for each entity. Coordination with emergency management authorities, responsible for warning and evacuating the public, is essential for ensuring agreement on individual and group responsibilities. Participation in the development of the EAP will enhance confidence in the EAP and its accuracy. Coordination will provide opportunities to discuss critical emergency planning concerns such as the order of public official notification, use of backup personnel, alternate means of communication, and special procedures for nighttime, holidays, and weekends.

Communications

Reliable communications are essential during emergency situations to quickly exchange critical information between key individuals and organizations. The possibility of unreliable primary communication systems in times of emergency should be addressed during the development of the EAP. It may be necessary to provide back-up communications systems for use during emergencies. Such systems should be developed and regularly tested prior to an emergency. The availability of alternative communications systems at the dam site should be identified in the EAP. These may include, but are not limited to, emergency sirens, cellular phones, direct connect, email, intranet, radios, social media, and couriers. Operating procedures and special instructions for the use of these systems should be described. Consideration should be given to the target audience involved and the best means for communicating with them. Dams that are immediately upstream of residences, recreation areas, and campgrounds pose unique challenges.

It may be necessary for the dam owner to assist emergency management authorities in developing public awareness measures. These measures typically explain the proximity of the dam, how people will be informed of an emergency, and the actions people should take during an emergency. The EAP should include a brief description of any public awareness measures that are performed. Emergency management authorities may consider the use of social media for both primary and alternate systems of communication with the public.

Evacuation

Evacuation planning and implementation are the responsibility of State and local emergency management authorities. Although the EAP does not need to include an evacuation plan, it should indicate who is responsible for evacuation and whose plan will be followed.

Inundation maps developed by the dam owner must be shared with emergency management authorities and included in the EAP. These maps may help in the development of warning and evacuation plans. It is important for dam owners to coordinate with the appropriate emergency management authorities and provide information from dam inundation studies that can assist with evacuation planning. Dam owners should also include procedures in the EAP for ensuring that emergency management authorities are provided with timely and accurate information on dam conditions during an incident. This information will help agencies make the appropriate decisions on evacuations.

Security Provisions

Most large dams have some type of security plan (SP) in place and these plans should be coordinated with the EAP. Due to areas of potential overlap between these plans, an appropriate security representative should be involved during the development of the EAP.

Security Plans

This handbook uses the term security plan when referring to a plan for a specific dam project. Various organizations within the Dams Sector might use the terms “site security plan” or “site-specific security plan” to refer to such a document, and may instead use the term “security plan” to refer to an overall organizational plan. For more information about security plans, see the *Dams Sector Protective Measures Handbook.*

One area of interest in both the Security Plan (SP) and the EAP is that a security incident could result in damage to a dam, possibly even dam failure. In such a case, law enforcement agencies have the added responsibility of investigating the incident to identify and apprehend the perpetrators. This could complicate the incident command authorities among local responders and potentially interfere with emergency actions planned by the dam owner.

During an insider attack, an adversary could threaten the cyber systems that are used to operate many dam projects. Attempts could be made to disable such systems or hijack them to intentionally operate the dam improperly in order to cause damage. Dam safety incidents caused by cyber-attacks should be considered during development of the EAP.

If a dam safety incident is caused by a security incident, the dam site might remain dangerous because the adversaries are still in the area and may attempt to harm the incident responders. Such intentions have been demonstrated at previous bombing locations within and outside of the United States. Any emergency situation (even if not caused by an attack) could be an especially sensitive time, and the EAP should address necessary site security actions during these situations.

Declaring and Terminating the Emergency

The dam owner is usually responsible for making decisions that an emergency condition exists or no longer exists at the dam or that the level of the emergency has changed. The EAP should clearly designate the individual responsible for making those decisions. State or local emergency management officials are responsible for initiation and termination of the evacuation or disaster response activities. Those parts of the emergency are usually managed in accordance with the National Incident Management System (NIMS). The dam owner and State and local officials should agree on when it is appropriate to terminate an emergency.

Post-Emergency Evaluation

Following an emergency, all participants should take part in a review that identifies

- Events occurring before, during, and following the emergency
- Significant actions taken by each participant, and possible improvements for future emergencies, and
- Strengths and deficiencies found in procedures, materials, equipment, staffing levels, and leadership.

Maintaining an EAP

After the EAP has been developed, approved, and distributed, continual reviews and updates must be performed. Without periodic maintenance, the EAP will become outdated and ineffective. The EAP should be updated promptly to address changes in personnel and contact information, significant changes to the facility, or emergency procedures. The EAP should be reviewed at least annually for adequacy and updated as needed. Even if no revisions are necessary, the review should be documented. The review should include an evaluation of any modifications to the reservoir, downstream development, or changes in expected inundation areas. The review should also include a determination of whether any revisions, including updates to inundation maps, are necessary.

The EAP should be updated promptly with the outcome of any exercises, including periodic reviews and verifications of personnel and contact information from Notification Flowcharts and contact lists. Any changes to the dam and/or inundation zone should be reviewed because the changes may affect the inundation maps. Maps should be changed as soon as practicable and noted in the EAP.

Sensitive Information

Since EAPs often receive wide distribution, it may be necessary to exclude sensitive information from some copies. Necessary, but sensitive information could be included in the EAP as a supplement or as another appendix. Distribution of this portion could be limited to those individuals or agencies with a specific need-to-know.

SECTION 5: RECOVERY PLANS

Certain dam projects, especially some large Federal dams, provide a wide range of benefits to a broad community. These can include economic, environmental, and social benefits, including irrigation, electric power generation, "black start" capabilities, water storage, recreation, navigation, flood mitigation, and control of sediment/hazardous materials and mine tailings. Disruption of such projects for extended periods could have devastating economic impacts regionally or even nationally. Even if smaller dams might not provide the same level of regional or national benefits, there is still the potential for disruptions to have extensive impacts on local communities and financial impacts on the dam owner.

Failure of the I-35 bridge in Minneapolis is a reminder that aging infrastructure is always at risk. The Taum Sauk Dam failure in Missouri is a reminder that operational failures still occur. The attention given to infrastructure protection since September 11, 2001 has also made it evident that it is impossible to fully protect everything. Security plans, emergency action plans, and dam safety programs are intended to reduce the chances of damage and to limit the immediate consequences if failure does occur. Despite sound design, proper operation, and excellent emergency planning, a full or partial dam failure remains a real possibility.

For many organizations, the increased emphasis on infrastructure protection has drawn additional attention to the need for recovery plans in case of such failures. In anticipation of dam disruptions and failures, recovery plans must focus on restoring the dam project to a functional condition. Dam owners should consider the need for a recovery plan as part of the risk management process. A recovery plan helps aid in the process of restoring the critical function of the dam such as water supply, flood protection, hydropower, etc. The recovery plan for the dam should feed the recovery plan for the organization.

Recovery Plans

Various organizations within the Dams Sector might use the terms "recovery plan" or "rapid recovery plan" to refer to the same type of document. Some might include the equivalent of a recovery plan as a section of another document such as an emergency action plan. This handbook uses the term recovery plan as a generic, encompassing term to refer to any of these documents.

The recovery plan should focus on a short-term response that begins immediately after an incident in order to restore project function as soon as possible, but it should also address longer term recovery. Since it is not possible to know the type of damage that might occur, the recovery plan should be general enough to be useful for recovery from any type of damage, regardless of cause.

Since these plans will be fairly general, it might be possible to develop a single plan applicable to a group of dams with similar components. The same approach might be possible for owners and operators of multiple projects on the same river system. When multiple-project recovery plans are used, any issues unique to an individual dam could be included in a separate appendix.

Recovery Plan Objectives

The objectives for developing a recovery plan are to:

- Minimize the extent of damage progression
- Restore project function, beginning just after initial response
- Minimize economic losses through quick restoration of function; and
- Address all types of potential hazards (natural, accidental, intentional).

Recovery Plan Contents

The recovery plan should be consistent with similar content and guidelines in the EAP. This will ensure consistent objectives and clear instructions for site personnel conducting recovery operations. The Federal Energy Regulatory Commission (FERC) and the U.S. Army Corps of Engineers (USACE) have developed guidelines for recovery plans. A summary of those suggested guidelines is below. See Appendix B for more detailed guidelines for recovery plan content.

The recovery plan should address each critical component of the dam. The team developing the plan should identify the likely hazards and predict the type and magnitude of damage from those hazards. Based on that probable damage, there should be an order of magnitude estimate of the direct and indirect consequences. The team should develop a list of options to minimize consequences—either by reducing initial damage, limiting the progression of damage, or reducing the time needed to recover from the damage. The team should recommend one of those options based on the magnitude of the consequences. This process does not necessarily require a lengthy evaluation.

The results of this planning effort should be consolidated into a list of recommended actions that might include: procurement; stockpiling; on-the-shelf designs; and identifying local equipment repair contractors, suppliers of key materials and equipment, and providers of rental equipment or heavy transport. Selection of the recommended actions may be dependent on the rapid availability of materials and equipment, and on potential staging areas.

In addition to physical repair, reconstruction, and replacement, the recovery plan should address issues such as communications, the basic logistics of the response, and cybersecurity. Reconstruction could require coordination with local authorities and regulatory agencies. To facilitate a quick response, it may be necessary to streamline internal authorities for procurement or contracting. Recovery will also likely require rapid access to key information such as maps, drawings, specifications, and original design documents. This information, or references to where the information can be found, should be included in the recovery plan. Possible loss of project function caused by interruption of communications links or by cyber-attacks that make the automated control system inoperable should also be considered, since many dam projects are becoming more highly automated, relying on automatic computerized control systems, or on remote operation and monitoring via communication links.

Training and Exercise

Like the EAP, the recovery plan should address training for appropriate personnel and periodic exercises simulating plan implementation to assure that designated personnel are familiar with the project's recovery strategy and to develop best practices from lessons-learned. There should also be a requirement for periodic recovery plan updates to incorporate changing project requirements and best practices.

Response Coordination

In the event of any major damage to a dam or to other infrastructure, multiple agencies could have significant roles in the initial response to the incident. This involvement might extend into the recovery phase for restoring project function.

Law enforcement agencies might be interested in preserving the site in the post-incident condition to facilitate criminal forensic investigations. If there has been a release of hazardous materials, extensive, long-term clean-up activities involving Federal and State environmental, health, and safety agencies may be needed. If extensive project reconstruction is required, there may be a need to obtain approvals from several Federal and State permitting agencies. The required interagency coordination and the conflicting priorities of the agencies could complicate the recovery process. The recovery plan should address these possible conflicts to the extent possible.

Financial Information

Major recovery activities are dependent on available funding. For common types of project components, the recovery plan should include tables that list the types of damage that might be expected, followed by various repair/replacement options to restore full or partial function, and probable time and cost for those options. These tables can provide a quick reference to assist decision makers during the tense post-incident period when important decisions must be made quickly.

Sensitive Information

Recovery plans need to be disseminated and easily accessible in case of an incident. However, development of a recovery plan might require use of sensitive information such as specific vulnerabilities and potential consequences. Therefore, sensitive material should be kept separate from the portion of the plan that contains recommendations and courses of action. Sensitive material should only be available to persons with a need to know.

Coordination with Other Plans

The content of recovery plans should be coordinated with existing emergency planning documents (emergency action plans, security plans, etc.) to minimize redundant content. Where other documents already contain information that is pertinent to recovery efforts, it is generally more efficient to reference those plans rather than repeat the same information in multiple plans. This will make the recovery plans simpler to develop, easier to maintain, and easier to read. It will also help prevent inconsistencies between plans.

SECTION 6: CONTINUITY PLANS

Continuity planning helps facilitate the performance of an organization's essential functions during any situation that may disrupt normal operations. A continuity plan can encompass a wide range of topics such as leadership devolution, physical relocation of worksites, data preservation, and virulent disease. Organizations often address these topics and others as components of a continuity program. While discussing some of these broader aspects of continuity planning, this handbook is focused primarily on those issues that affect continued safe operation of dams and related infrastructure.

Many resources provide information about continuity programs. FEMA, for example, provides access to a number of continuity of operations resources, including online training for various aspects of continuity planning, at www.fema.gov/about/org/ncp/coop.

Continuity Plans

Continuity of operations (COOP) is a term in wide use. COOP is sometimes used to refer to an entire continuity program, covering all of the interrelated aspects of continuity. It is often used to refer to business continuity for an organization in the absence of key personnel. This handbook refers to "*continuity plan*" as it relates to continued safe operation of a dam.

The following elements can be included in a continuity plan that focuses on safe operation of infrastructure in the Dams Sector. These elements can be broken into separate plans or part of an overall continuity program:

- Identification of essential functions
- Interoperable communications
- Delegations of authority
- Alternate facilities
- Vital records
- Human capital, and
- Computer disruptions

Identification of Essential Functions

Given the limited scope of the discussion in this handbook, essential functions and the essential personnel to carry out the functions are primarily those related to the safe storage or release of water. These functions and personnel might include:

- Controls and systems that open or close gates and valves
- Personnel who manipulate those systems and controls

- Personnel who decide when and how much to adjust release of water
- Dam safety engineers authorized to make decisions on the safety of the dam
- Collection of data that forms the basis of such decisions, and
- Communication between those operating the controls and those deciding on releases.

Interoperable Communications

Continuity of communications could become an issue during a crisis for a number of reasons. Phone systems (land line and cell) have occasionally experienced varying degrees of disruption, and disruptions have been even more prevalent during certain emergency situations. The crisis-related relocation of certain functions to alternate facilities can contribute to disruptions in communications systems and computer networks at a time when reliable communication is most needed. Continuity plans should focus on maintaining critical communication capabilities and what to do when that is not possible.

Delegations of Authority

Certain types of emergency situations might result in the temporary or permanent loss or incapacitation of key personnel. This could also result in loss of communications between key personnel and others in the organization. Continuity plans should clarify what decision-making authority will be transferred in various circumstances. For example, if communications with the chief hydrologist are disrupted, will an onsite supervisor be expected to open gates after a heavy rain? It is also necessary to clarify, prior to an actual event, who has the authority to commit resources or to sign emergency contracts.

Alternate Facilities

Some continuity plans address relocation of essential functions if the primary location has been disrupted. In the Dams Sector, there is no possibility of relocation of the actual dam infrastructure, but relocation of some functions that support onsite operations may apply.

Vital Records

At a minimum, vital records should consist of reservoir levels, stream-flow data upstream and downstream of a dam, expected near-term inflows, and release rates for various gate positions. All of this information is critical to maintaining safe water levels in the reservoir and downstream. There are a number of ways such data might become unavailable, including: computer network malfunctions, loss of communications, sensor failures, and disruption in National Weather Service systems. Continuity plans should focus on methods to maintain access to such information and alternatives when information is not available.

Human Capital

All organizations are dependent upon their staff for successful operation. Continuity plans should describe how to maintain essential functions in case of serious disruption to staffing that could be

caused by events such as a highly contagious disease; a natural disaster in a surrounding area, or a biological, or chemical incident.

Planning should identify the staff needed to support essential functions, to include the number of people and the skills required. These requirements should be matched against the potential availability of others, both within and outside of the organization, who might be able to fill in during emergency situations. It might even be necessary to develop plans for use of temporary staff from outside the organization. Examples of this are the mutual aid agreements that are common in the firefighting community and contracting for line crews after extensive electrical power outages due to severe storms. Appendix C.1 presents possible response actions to varying degrees of personnel absentee rates.

In addition to planning for disruptions to staffing, attention should also be paid to planning for the retirement or non-availability of personnel with critical institutional knowledge of the facility and its operations. Succession planning can take the form of identifying personnel who have demonstrated their capabilities and, with appropriate training and guided experience, can move into greater positions of responsibility and authority.

Computer Disruptions

Disruption of an organization's information technology (IT) systems could be considered to belong within the above discussions on interoperable communications, alternate facilities, or vital records. It could also be appropriate to consider IT as an additional, separate category. In the modern automated workplace, disruption of the IT system could bring any organization to a standstill, or lead to a dangerous lack of control over sensitive records or physical processes (e.g., operational control over dam releases or power generation). Considering the potential consequences of an IT disruption, this topic must be specifically addressed during continuity planning. Content guidelines for a sample plan for a computer incident response team are provided in Appendix C.2.

The United States Computer Emergency Readiness Team (US-CERT) is a partnership between the Department of Homeland Security and the public and private sectors. Established in 2003 to protect the Nation's internet infrastructure, the mission of US-CERT is to improve the nation's cybersecurity posture, coordinate cyber information sharing and proactively manage cyber risks to the Nation. The US-CERT website (www.us-cert.gov) provides extensive information related to cybersecurity.

SECTION 7: EXERCISES

Emergency incidents at dams and/or dam failures are uncommon. Therefore, training and exercises are necessary to maintain operational readiness, timeliness, and responsiveness**.**

Exercises are one of the topics addressed in FEMA P-64, *Emergency Action Planning for Dams*; DHS has also developed an exercise program. The FEMA P-64 guidelines emphasize that dam owners should exercise the Emergency Action Plan (EAP) in coordination with State, local and tribal emergency management authorities. Exercises promote prevention, preparedness, and response to incidents and emergencies. Exercises may also be extended to include recovery operations. Exercises also demonstrate the EAP's effectiveness and the readiness levels of key personnel in an actual situation. Periodic exercises result in an improved EAP because lessons learned are incorporated into the updated EAP document.

Dam owners should include State, local, and tribal emergency authorities in exercise activities. This includes, but is not limited to, entities listed on the Notification Flowchart. To facilitate participation of emergency management authorities, dam safety exercises can also be coordinated with, or integrated into, other event exercise scenarios for earthquakes, floods, hurricanes, and other hazards.

The DHS Homeland Security Exercise and Evaluation Program (HSEEP) provides a set of guiding principles for exercise programs, as well as a common approach to exercise program management, design and development, conduct, evaluation, and improvement planning.

HSEEP is compliant with, and complements several Federal directives and initiatives, such as the National Strategy for Homeland Security; Homeland Security Presidential Directive (HSPD)-5, Management of Domestic Incidents; Presidential Policy Directives 8 and 21. In addition, HSEEP integrates language and concepts from the following:

- National Response Framework (NRF) - a guide to how the Nation conducts all-hazards response;
- National Incident Management System (NIMS) - a system that provides a consistent nationwide template to enable Federal, State, tribal, and local governments; the private sector; and nongovernmental organizations to work together to prepare for, prevent, respond to, recover from, and mitigate the effects of incidents; and
- National Infrastructure Protection Plan (NIPP) - the unifying structure for the integration of critical infrastructure protection into a single national program.

HSEEP exercise types can be categorized as discussion-based or operations-based. Discussion-based exercises are orientation seminars, workshops, tabletops, and games. Drills, functional, and full-scale exercises are the operations-based exercises. The HSEEP descriptions of these exercises are described in the following sections; guidelines for them are provided in Appendix D. Owners and operators within the Dams Sector may have different definitions of these exercise types stemming from their organizational processes.

Training and levels of readiness should be evaluated in nonthreatening, simulated, periodic emergency exercises for key dam personnel. Key personnel from State and local emergency management agencies should be encouraged to participate in any preplanning, training, and exercises whenever possible. Including other dam owners within the same drainage basin can be beneficial since incidents often have cascading effects. Involving relevant organizations and agencies will maintain plan familiarity among the participants, and can help identify possible deficiencies of the plan. Informational site visits are also important in keeping potential responders familiar with the dam location, access routes, and key features.

Exercise programs do not have to include all types of exercises. However, robust exercise programs build complex exercises by combining multiple exercise types together. In addition, exercises should be developed and conducted in an ascending order of complexity. It is important that sufficient time be provided between exercises to learn and improve from the experiences of the previous exercise before conducting a more complex exercise. The exercise types, listed from simplest to most complex, are described below.

Discussion-Based Exercises

Discussion-based exercises familiarize participants with current plans, policies, agreements, and procedures. They may also be used to develop new plans, policies, agreements, and procedures. The following are types of discussion-based exercises:

Seminar

Seminars generally orient participants to, or provide an overview of, authorities, strategies, plans, policies, procedures, protocols, resources, concepts, and ideas. As a discussion-based exercise, seminars can be valuable for entities that are developing or making major changes to existing plans or procedures. Seminars can be similarly helpful when attempting to assess or gain awareness of the capabilities of interagency or inter-jurisdictional operations.

Workshop

Although similar to seminars, workshops differ in two important aspects: participant interaction is increased, and the focus is placed on achieving or building a product. Effective workshops entail the broadest attendance by relevant stakeholders.

Products produced from a workshop can include new standard operating procedures (SOPs), emergency operations plans, continuity of operations plans, or mutual aid agreements. To be effective, workshops should have clearly defined objectives, products, or goals, and should focus on a specific issue.

Tabletop Exercise

A tabletop exercise (TTX) is intended to generate discussion of various issues regarding a hypothetical, simulated emergency. TTXs can be used to enhance general awareness, validate plans and procedures, rehearse concepts, and/or assess the types of systems needed to guide the prevention of, protection from, mitigation of, response to, and recovery from a defined incident. Generally, TTXs are aimed at facilitating conceptual understanding, identifying strengths and areas for improvement, and/or achieving changes in perceptions.

Games

A game is a simulation of operations that often involves two or more teams, usually in a competitive environment, using rules, data, and procedures designed to depict an actual or hypothetical situation. Games explore the consequences of player decisions and actions. They are useful tools for validating plans and procedures or evaluating resource requirements.

Operations-Based Exercises

Operations-based exercises validate plans, policies, agreements, and procedures; clarify roles and responsibilities; and identify resource gaps in an operational environment. Types of operations-based exercises are:

Drill

A drill is a coordinated, supervised activity usually employed to validate a specific function or capability in a single agency or organization. Drills are commonly used to provide training on new equipment, validate procedures, or practice and maintain current skills. For example, drills may be appropriate for establishing a community-designated disaster receiving center or shelter. Drills can also be used to determine if plans can be executed as designed, to assess whether more training is required, or to reinforce best practices.

Functional Exercise

Functional Exercises (FEs) are designed to validate and evaluate capabilities, multiple functions and/or sub-functions, or interdependent groups of functions. FEs are typically focused on exercising plans, policies, procedures, and staff members involved in management, direction, command, and control functions. In FEs, events are projected through an exercise scenario with event updates that drive activity typically at the management level. An FE is conducted in a realistic, real-time environment; however, movement of personnel and equipment is usually simulated.

Full-Scale Exercises

Full-Scale Exercises (FSEs) are typically the most complex and resource-intensive type of exercise. They involve multiple agencies, organizations, and jurisdictions and validate many facets of preparedness. FSEs often include many players operating under cooperative systems such as the Incident Command System (ICS) or Unified Command.

Functional and full-scale exercises are considered comprehensive exercises that provide the necessary verification, training, and practice to improve the EAP and the operational readiness and coordination efforts of all parties responsible for responding to emergencies at a dam. The basic difference between these two exercise types is that a full-scale exercise involves actual field movement and mobilization; in a functional exercise, field activity is simulated.

The primary objectives of a comprehensive exercise (functional and full-scale) are listed below:

- Reveal the strengths and weaknesses of the EAP, including specified internal actions, external notification procedures, and adequacy of other information, such as inundation maps;
- Reveal deficiencies in resources and information available to the dam owner and emergency management authorities;
- Improve coordination efforts between the dam owner and emergency management authorities; (Close coordination and cooperation among all responsible parties is vital for a successful response to an actual emergency.)
- Clarify the roles and responsibilities of the dam owner, and emergency management authorities;
- Improve individual performance of the people who respond to the dam failure or other emergency conditions; and
- Gain public recognition of the EAP.

Exercise Frequency

The seminar, drill, tabletop exercise, and functional exercise should receive the most emphasis in an EAP exercise program. The following are recommended frequencies for these exercise types. Dam owners, in consultation with emergency management authorities, should determine actual frequencies appropriate for their dams.

- Seminars with primary emergency management authorities – annually
- Drills to test the Notification Flowchart and emergency equipment/procedures – annually
- Tabletop exercise – every 3 to 4 years or before functional exercises
- Functional exercise – every 5 years

A full-scale exercise should be considered when there is a need to evaluate actual field movement and deployment. When a full-scale exercise is conducted, safety is a major concern because of the extensive field activity. If a dam owner has the capability to conduct a full-scale exercise, a commitment should be made to schedule and conduct the entire series of exercises listed above before conducting the full-scale exercise. At least one functional exercise should be conducted before conducting a full-scale exercise. Functional and full-scale exercises should also be coordinated with other scheduled exercises, whenever possible, to share emergency management resources and reduce costs.

Post-Exercise Evaluation

Emergency exercises and equipment tests should be evaluated orally and in writing. An after-action review should be conducted immediately after an exercise or actual emergency, with all involved parties identifying strengths and deficiencies in the EAP. The after-action review should focus on procedures and other information in the EAP (i.e., outdated telephone numbers on the Notification Flowchart; inaccurate inundation maps; and problems with procedures,

priorities, assigned responsibilities, and materials, equipment, and staff levels). The after-action review should also address both the procedures that worked well and the procedures that did not. Responses from all participants involved in the exercise should be considered. The after-action review should discuss and evaluate the events before, during, and after the exercise or actual emergency; actions taken by each participant; the time required to become aware of an emergency and implement the EAP; and improvements for future emergencies.

After the after-action review has been completed, the EAP should be revised, as appropriate, and the revisions disseminated to all involved parties.

Exercise Resources

The HSEEP Web site offers a range of tools that can facilitate exercise planning and execution.

The Dams SSA developed the Dams Sector Tabletop Exercise Toolbox (DSTET) to provide dam owners and operators with a useful exercise-planning tool to maximize the limited resources available for exercise purposes. DSTET is a HSEEP-compliant tabletop exercise which provides the materials needed to conduct a discussion-based exercise using either an active shooter threat or an international adversary threat. The DSTET is available through contacting dams@hq.dhs.gov.

The DSTET scenarios feature short videos to set the stage for the events. Both scenarios contain three modules that detail the progression of the incidents in chronological order. The toolbox is intended to be flexible; the scenarios can be tailored by dates, times, and facility names. The DSTET includes the following components.

- Situation manuals include detailed descriptions of the scenarios and potential questions to be used during the exercise;
- Briefing slides mirror the situation manuals and guide participants through the scenarios and discussion questions;
- The facilitator and evaluator handbook provides instructions and examples to properly capture information and feedback during the exercise for review and development of an after-action report and improvement plan;
- Exercise-planner instructions guide the exercise planner, providing step-by-step instructions on how to develop and execute a tabletop exercise;
- Participant feedback forms are used to gather information for exercise improvements and key outcomes expressed by participants; and
- Exercise feedback forms are used to consolidate additional feedback on overall improvements.

Appendix A: Emergency Action Plan Template

Emergency action plans (EAPs) are discussed in Section 4 of the handbook. EAP content is also discussed in more detail in *Federal Guidelines for Dam Safety: Emergency Action Planning for Dams* (FEMA P-64), which can be obtained from FEMA in print or on CD, or is available online at http://www.fema.gov/plan/prevent/damfailure/fema P-64.shtm.

The May 2005 document, *Preparations for Handling Emergencies and Potential Emergencies at Projects*, issued by the Federal Energy Regulatory Commission contains information for inclusion in an EAP. The document is available at http://www.ferc.gov/industries/hydropower/safety/guidelines/eap/prep.pdf.

The Natural Resource Conservation Service (NRCS) of the U.S. Department of Agriculture developed an EAP template which is available at http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/ndcsmc/?&cid=nrcs143_009164. The template in this appendix is roughly based on the NRCS template.

Additional sample EAPs are posted on the HSIN-CI Dams Sector Portal.

Dam owners must ensure that their EAPs conform to any applicable State or Federal requirements.

NOT FOR PUBLIC DISTRIBUTION

Emergency Action Plan

_____Dam
Any county, Any town, Any state

Structure: _____
National Inventory of Dams ID#: _____

OWNER: _____
ISSUE DATE: _____

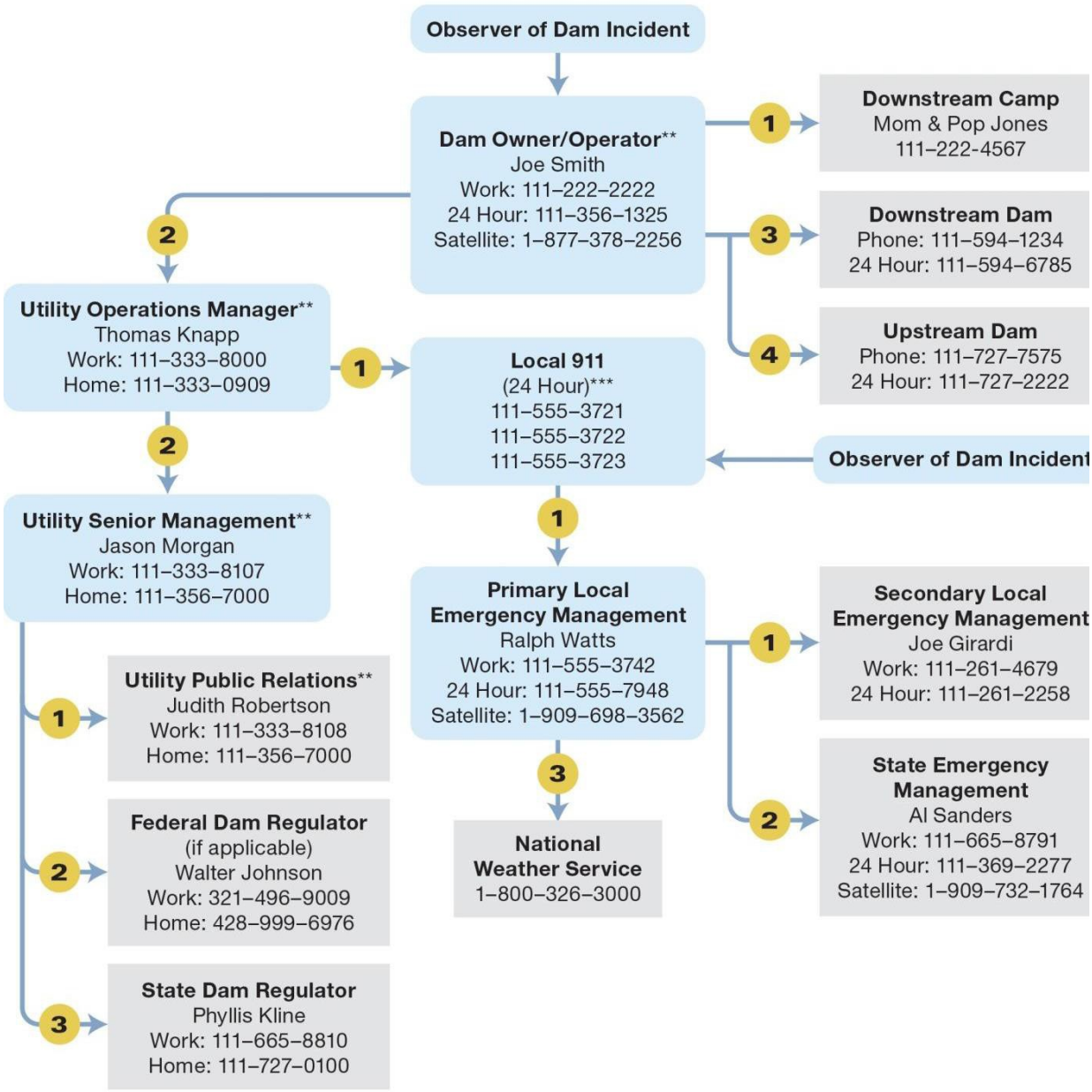
TABLE OF CONTENTS

I. Summary of EAP Responsibilities

Entity	Responsibilities
Dam Owner / Operator	1. Verify and assess emergency conditions 2. Notify other participating emergency management agencies 3. Take corrective action at facility 4. Declare termination of emergency at facility 5. Update EAP on at least an annual basis 6. Respond to emergencies at the facility 7. Receive condition status reports from the dam operator
Town Anywhere (in County Y) Police, Fire and Rescue	1. Receive condition status reports from dam owner 2. Notify Public within Town Anywhere limits 3. Conduct evacuation from inundation areas within town limits, if required 4. Render assistance to County Y, as necessary 5. Render assistance to dam owner, as necessary
County X Police, Fire and Rescue, and Emergency Services	1. Receive condition status reports from dam owner 2. Notify public within County X 3. Conduct evacuation from inundation areas in County X, if required 4. Provide mutual aid to County Y, if requested and able
County Y Police, Fire and Rescue, and Emergency Services	1. Receive condition status reports from dam owner 2. Notify public within County Y 3. Conduct evacuation from inundation areas in County Y, if appropriate

II. Notification Flowchart

Warning: Notification charts must be customized per local circumstances



= call sequence

* Use this chart in coordination with Notification Contact Table for additional contact information.

** Utility personnel should refer to EAP for sample warning messages.

*** Call Dam Operator if 911 is notified by non-utility observer.

III. Statement of Purpose

The EAP should include a brief statement describing the purpose of the EAP. Two examples are provided below.

E**xample 1:** "This Emergency Action Plan defines responsibilities and provides procedures designed to identify unusual and unlikely conditions that may endanger Alpha Dam in time to take mitigating action and to notify the appropriate emergency management authorities of possible, impending, or actual failure of the dam. The plan may also be used to provide notification when flood releases can create major flooding."

Example 2: "The purpose of this EAP is to safeguard the lives and reduce damage to the property of the citizens of Alpha County living along Beta Creek, in the event of failure of the Beta Creek Dam or flooding caused by large runoff."

IV. Project Description

A description of the dam, its location, and the National Inventory of Dams (NID) identification number should be provided in this section. If the NID identification number is not available, the State identification number should be used. Inclusion of a dam vicinity map and a simple drawing showing the dam's features is recommended, along with a list of any significant upstream or downstream dams and downstream communities potentially affected by a dam failure or by flooding as a result of large operational releases. The dam owner should redact design information and site-specific concerns in EAP copies that are distributed to outside organizations if the organizations do not need the information to implement the plan.

Official Dam Name:_____NID ID#:_____
Structure:
Stream:
Location: Lat._____Long. _____ Any county, Any state
Directions to dam:

Dam Owner/Operator:

Type of Dam:	Year Constructed:
Dam Height:	Dam Length:
Drainage Area:	Hazard Classification:
Principal Spillway Type:	Principal Spillway Capacity:
Auxiliary Spillway Type:	Max Capacity:
Maximum Storage Volume:	
Elevations (Mean Sea Level)	Principal Spillway Crest
	Auxiliary Spillway Crest
	Top of Dam
	Impact Basin

Vertical Datum Used:
Description of Impacted Property: (list residences, businesses, infrastructure, etc.)
[Add vicinity map that shows the location of the dam with respect to nearest town]
[Add plan view of dam from construction drawings]
[Add aerial photographs]

V. EAP Response Process

Step 1: Incident Detection, Evaluation, and Emergency Level Determination.

During Step 1, an unusual condition or incident is detected and confirmed.

Unusual conditions or incidents are unique to each dam and, to the extent possible, should be identified in the EAP. The following information should be considered for inclusion or reference in the plan to assist the dam owner in this step:

- Measures for detecting existing or potential failures
- Operating information, such as normal and abnormal reservoir level data
- Description of monitoring equipment, such as water level sensors and early warning systems
- Monitoring and instrumentation plans
- Inspection procedures
- Process for analyzing and confirming incoming data

After an unusual condition or incident is detected and confirmed, the dam owner will categorize the condition of incident into one of the established emergency levels based on the severity of the initiating condition or triggering events. Both the dam owner and emergency management authorities should understand the emergency levels and each other's expected responses. Consistency of the emergency level categories is recommended to eliminate confusion for emergency responders whose jurisdictions contain multiple dams and dam owners.

The four dam safety emergency level categories listed below are recommended. However, dam owners, in coordination with emergency management authorities, should determine the number of emergency levels required for each dam on a case-by-case basis.

- High flow
- Non-failure
- Potential failure
- Imminent failure

The EAP should describe how each emergency level applies to the particular dam. Information to assist the dam owner in determining the appropriate emergency level should be developed and included in the EAP. The four emergency levels are discussed below.

High Flow. The High Flow emergency level indicates that flooding is occurring on the river system, but there is no apparent threat to the integrity of the dam. The High Flow emergency level is used by the dam owner to convey to outside agencies that downstream areas may be affected by the dam's release. Although the amount of flooding may be beyond the control of the dam owner, information on the timing and amount of release from the dam may be helpful to authorities in making decisions regarding warnings and evacuations.

Notifications should be predetermined based on correlations between releases and the timing of impacts to downstream areas. High Flow emergency level notifications are typically made to local jurisdictions that would be affected, the NWS, downstream dam owners, and other agencies, as necessary. For smaller dams that have no downstream impact from releases, this category may not be necessary. If the High Flow emergency level is used, dam owners should consider developing a table that correlates gate openings and/or reservoir levels to outflows, expected downstream impacts, and agencies that will be contacted.

Non-Failure. The Non-Failure emergency level is appropriate for an event at a dam that will not, by itself, lead to a failure, but requires investigation and notification of internal and/or external personnel. Examples are (1) new seepage or leakage on the downstream side of the dam, (2) presence of unauthorized personnel at the dam, and (3) malfunction of a gate.

Some incidents, such as new seepage, may only require an internal response from the dam owner. Others, such a gate malfunction, may lead to unexpected high releases that could pose a hazard to the downstream public and would require the notification of outside agencies

Potential Failure. The Potential Failure emergency level indicates that conditions are developing at the dam that could lead to a dam failure. Examples are (1) rising reservoir levels that are approaching the top of the non-overflow section of the dam, (2) transverse cracking of an embankment, and (3) a verified bomb threat. Potential Failure should convey that time is available for analyses, decisions, and actions before the dam could fail. A failure may occur, but predetermined response actions may moderate or alleviate impacts of failure.

Imminent Failure. The Imminent Failure emergency level indicates that time has run out, and the dam has failed, is failing, or is about to fail. Imminent Failure typically involves a continuing and progressive loss of material from the dam. It is usually not possible to determine how long a complete breach of a dam will take. Therefore, once a decision is made that there is no time to prevent failure, the Imminent Failure warning must be issued. For purposes of evacuation, emergency management authorities may assume the worst-case condition that failure has already occurred.

Step 2: Notification and Communication: After the emergency level at the dam has been determined, notifications are made in accordance with the EAP's Notification Flowchart(s). Details on the use of the Notification Flowchart and any additional contact information should be provided in the EAP.

When developing notification and communication procedures, dam owners should coordinate closely with emergency management authorities. All parties must understand that the formal declaration of public emergency by emergency management authorities can be a very difficult decision. During this step, the dam owner should provide any information that will assist in that decision. An early decision and declaration are critical to maximizing available response time. When performing notification and communication activities, it is important that people speak in clear, nontechnical terms to ensure that those being notified understand what is happening at the dam, what the current emergency level is, and which actions to take. To assist in this step, the EAP may include checklists and/or prescript messages to help the caller adequately describe the

emergency situation to emergency management authorities. Different messages can be developed for each emergency level.

After initial notification, the dam owner should make periodic status reports to the affected emergency authorities and other stakeholders in accordance with the Notification Flowcharts and associated procedures. If it appears that the situation is continuing to deteriorate despite actions being taken to moderate or alleviate failure, local authorities may decide to change their course of action. Depending on the location of downstream residents and the estimated time required to warn them, the evacuating agencies may consider early evacuation or continued warnings until the emergency has passed.

Step 3: Emergency Actions. After the initial notifications have been made, the dam owner will act to save the dam and minimize impacts to life, property, and the environment. During this step, there is a continuous process of taking actions, assessing the status of the situation, and keeping others informed through communication channels established during the initial notifications. The EAP may go through multiple emergency levels during Steps 2 and 3 as the situation improves or deteriorates. The dam owner should develop tables that include specific actions for minimizing impacts of dam safety incidents. Additional information related to response actions may also be provided in the dam operating manuals and instructions.

During an incident, safety and security measures should be implemented to secure the affected operational areas at the dam to protect operations personnel and the public, and permit an effective performance of emergency response actions.

Step 4: Termination and Follow-up. The EAP should explain the expected termination and follow-up procedures for dam safety incidents and emergencies. This step should explain the process to follow and the criteria for determining that the incident at the dam has been resolved. A Dam Emergency Termination Log may be developed and used to document conditions and decisions. Generally, the dam owner, or the dam owner's dam safety expert, is responsible for notifying the authorities that the condition of the dam has been stabilized. Government officials are responsible for declaring an end to the public emergency response.

Following the termination of an incident, the dam owner, in coordination with emergency management authorities, should conduct an evaluation that includes all affected participants. At a minimum, the following should be discussed and evaluated in an after-action review:

- Events or conditions leading up to, during, and following the incident
- Significant actions taken by each participant and improvements for future emergencies
- All strengths and deficiencies found in the incident management process, materials, equipment, staffing levels, and leadership
- Corrective actions identified and a planned course of action to implement recommendations

The results of the after-action review should be documented in an After Action Report (AAR) and used as a basis for revising the EAP. The dam owner should participate in the after-action review and the development of the AAR.

VI. General Responsibilities

A determination of responsibility for EAP-related tasks must be made during the development of the plan. Dam owners are responsible for developing and maintaining the EAP. Dam owners, in coordination with emergency management authorities, are responsible for implementing the EAP. Emergency management authorities with statutory obligations are responsible for warning and evacuation within affected areas. All entities involved with EAP implementation should document incident-related events. Appendix I includes an example Emergency Incident Log. The EAP must clearly specify the responsibilities of all involved entities to ensure that effective and timely action is taken if an emergency at the dam occurs. The EAP must be site-specific because conditions at the dam and upstream and downstream of the dam are unique to every dam.

Dam Owner Responsibilities

The duties of the dam owner should be clearly described. In general, the dam owner is responsible for detecting and evaluating dam safety incidents, classifying the incidents, notifying emergency management authorities, and taking appropriate response actions.

The dam operator's duties should be described in the EAP, and operators should be trained on the importance and use of the plan. Examples of duties may include opening spillway gates per a required sequence and opening or closing water intakes, as appropriate. Instructions for the operation of the project during the anticipated emergency should be provided.

The chain of command in the dam owner's organization should be clearly described. Officials and alternates that must be notified should be identified and priority of notification determined. Notification of supervisory personnel is recommended if time permits. Advice may be needed concerning predetermined remedial action to delay, moderate, or alleviate the severity of the emergency condition. Responsibilities should be coordinated with appropriate levels of management to ensure full awareness of organizational capabilities and responsibilities.

Notification and Communication Responsibilities

The individuals authorized to notify emergency management authorities should be determined and clearly identified in the EAP. If time allows, onsite personnel may be able to seek internal advice and assistance. However, under an Imminent Failure condition, the responsibility and authority for notification may have to be delegated to the dam operator or a local official. When developing the EAP, the dam owner and emergency management authorities should discuss and determine the most efficient notification protocol to follow.

Throughout the United States, the NWS and/or other agencies have the primary responsibility for issuing flood warnings. It is highly recommended that the Notification Flowchart include the agency with this responsibility so that its facilities can enhance warnings being issued. Once notified of an incident at the dam, local emergency management authorities may activate an Emergency Operations Center (EOC) to serve as a central coordination center for emergency response, warning, and evacuation activities. A representative of the dam owner should go to the EOC to help agency personnel understand the project-specific information and inundation maps.

Interaction with the media should be implemented through the local or State emergency management authority. These agencies should have a Public Information Officer (PIO) and/or a Joint Information Center for disseminating information and handling inquiries. It is highly

recommended that the dam owner and the appropriate incident or emergency management authority work in partnership to accomplish this task. Proper coordination and communication among onsite technical personnel at the dam, PIOs, and emergency personnel at the EOC are of critical importance to the successful implementation of the EAP. These activities should be thoroughly tested during comprehensive EAP exercises and modified as necessary.

Evacuation Responsibilities

Warning and evacuation planning and implementation are responsibilities of local emergency management authorities with the legal authority to perform these actions. Under the EAP, the dam owner is responsible for notifying the appropriate emergency management authority when an incident is anticipated, is imminent, or has occurred. Warning and evacuation protocols are key elements in an EAP exercise but are not typically included in the EAP. The EAP should, however, clearly describe the notification, warning, and evacuation responsibilities of the dam owner and the local emergency management authority.

Dam owners should not assume or usurp the responsibility of government entities for evacuation of people. However, there may be situations in which routine notification and evacuation will not be sufficient, as in the case of a residence located immediately downstream of a dam or a campground that would be inundated within minutes of a dam failure. In some cases, dam owners may arrange to notify the residence or campground directly. Such procedures should be coordinated with the appropriate authorities before an emergency situation develops.

Monitoring, Security, Termination, and Follow-Up Responsibilities

A person should be designated as an onsite monitor from the beginning of a dam safety incident until the emergency has been terminated. This person should provide status updates to the dam owner so the owner can keep all those involved with the implementation of the EAP informed of developing conditions.

Provisions for security measures during the emergency should be specified in the EAP. For additional information on security measures, see *Dams Sector Security Awareness Handbook: A Guide for Owners and Operators* (DHS, 2015), available at the HSIN-CI Dams Portal.

Termination of a dam safety emergency is usually twofold. The entity that activates the EAP is usually responsible for determining when the dam safety situation has stabilized. This is typically the dam owner in consultation with engineers and dam safety experts but may include other State and Federal regulatory entities. The applicable emergency management authorities, on the other hand, are responsible for termination of the emergency response activities, including termination of an evacuation. Both the dam owner and the emergency response authorities should coordinate closely while making decisions to terminate both the dam safety event and response efforts.

Recovery activities will continue on different levels for all involved in the dam safety incident after the emergency has been terminated. Although not typically addressed in a dam EAP, recovery activities should be considered by all dam owners and particularly for those dams that can affect a critical public utility such as water supply or electricity.

The dam owner should coordinate a follow-up evaluation after any emergency. All participants should be involved in this evaluation and should keep logs and records during the incident. The results of the follow-up evaluation should be documented in a written report (After Action Report) and used to improve future response actions.

EAP Coordinator Responsibilities

The dam owner should specify an EAP Coordinator who will be responsible for overall EAP-related activities, including but not limited to preparing revisions to the EAP, establishing training seminars, and coordinating EAP exercises. This person should be the EAP contact for questions about the plan.

VII. Preparedness

Preparedness actions are taken to prevent a dam failure incident, or to help reduce the effects of a dam failure and facilitate response to emergencies. This section of the EAP should describe preparedness actions already completed, as well as established, preplanned actions that can be taken after the development of emergency conditions**.**

Surveillance and Monitoring

The EAP should contain provisions for surveillance and monitoring at the dam. Prompt detection and evaluation of information from instrumentation and physical monitoring is critical to the effectiveness of the EAP and timely emergency response. Consideration should be given to times when the dam is attended and unattended.

When a dam is not continuously attended and an incident could endanger life or cause significant property damage, it is imperative that instrumentation be installed and/or procedures developed to monitor conditions at the facility. To promptly identify and notify emergency management authorities of emergency conditions, a dam owner should be able to detect, confirm, and evaluate developing conditions. Monitoring systems must be able to deliver clear, concise, and reliable information so that emergency authorities with warning and evacuation responsibilities may be promptly alerted. While the EAP is being activated, personnel should visit the site to verify and continue to monitor conditions.

For an unattended dam, remote surveillance systems that include instrumentation for continuous monitoring of headwater and tailwater levels should be considered. If the dam owner has an operations center that is attended 24 hours a day, these systems should include monitoring for water level rate of change and alarms when prescribed limits or levels are exceeded. Monitoring system design must be site-specific and account for changes in headwater and tailwater that may occur during normal dam operations, floods, and maintenance activities. Tailwater monitoring is generally more sensitive to a dam breach than headwater monitoring. Changes in tailwater will alert operators more quickly to site conditions and help determine whether the EAP should be implemented. If continuous readings of both the headwater and tailwater are available, the operator can obtain concurrent readings at any time and verify alarm conditions.

If automated monitoring systems are used, provisions should be made for indicating power interruptions and loss of communication with the monitoring instrumentation. When a dam operator lives close to a project, consideration may be given to installing an alarm at the

operator's home. When power to, or communication with, the site is interrupted, the dam should be manned until conditions return to normal. Operation of the alarms should be checked periodically. Proper functioning of alarms should be confirmed by testing. For instance, annual testing of the EAP may be initiated by artificially tripping one of the alarms.

Reaction time must be minimized when inhabited structures are located immediately downstream of the dam. When these conditions exist, special procedures may need to be included in the EAP to notify the occupants involved. Local emergency management authorities should be fully involved in the development of these special procedures.

Procedures should be described for providing continuous surveillance for periods of actual or forecasted high flows. It may be necessary to send an observer to the dam during these periods and not rely on the instrumentation alone. It is very important that an observer be at the dam when flood conditions or signs of serious structural distress have been identified, provided that it is safe to do so.

If remote surveillance at the dam is not applicable, reasons to support that decision should be provided in this section of the EAP. Backup systems and procedures should be developed to verify that instrumentation readings are correct. Camera systems that can be accessed from the command center or over the Internet can allow for quick verification of water level alarms and other dam safety conditions.

Evaluation of Detection and Response Timing

Total EAP implementation time from the initiation of an actual incident to determination of an emergency situation and notification of appropriate entities involved with implementation should be evaluated and understood. The impact of the timing should be considered when developing preparedness actions. Timely implementation of the EAP and coordination and communication with emergency management authorities are crucial elements in the effectiveness of the emergency response effort.

Access to the Site

The description of access should focus on primary and secondary routes for reaching the site using various access methods (e.g., foot, boat, helicopter, snowmobile). The expected response time should also be discussed. If the main road to the dam crosses the downstream channel and could be impassable due to flood waters, this situation should be identified and alternate access options described.

Response during Periods of Darkness

Response to potential or actual emergency conditions during periods of darkness should be clearly addressed in the EAP and include any special instructions for the dam operator and/or emergency management authorities. Response times, if not during daylight hours, should also be included. Actions to be taken to illuminate the abutments, spillways, operating decks, non-overflow sections, or other areas where failures could occur should be described. Other actions that may facilitate the operation of gates or other emergency equipment should be described if they are different during periods of darkness. Any special procedures during a power failure should be provided, including manual operation of electrically powered equipment and any additional notification requirements.

Response during Weekends and Holidays

Response during weekends and holidays should be clearly addressed in the EAP and include any special instructions for the dam operator and/or emergency management authorities. Response times, if different from non-holiday or weekdays, should also be included. The availability of the dam operator should be considered, and any special procedures for contacting or notifying personnel addressed.

Response during Adverse Weather

Response under adverse weather conditions should be included and any specific actions to be taken should be described in detail. Actions should be based on whether the dam is attended or unattended. Methods of access to the site (e.g., foot, boat, snow mobile) should be described. The expected response time should be discussed in detail. Any other special instructions for the dam operators or emergency management authorities should be described.

Coordination of Information

Where applicable, the following should be described:

- The need for coordination of information on flows based on weather, runoff forecasts, dam failure, and other emergency conditions, including how coordination is achieved and the chain of communication, including names and contact information for responsible parties. Coordination with the NWS or other appropriate agency is recommended to monitor storms, river stages, and flood waves resulting from a dam break. The NWS or other appropriate agency may also be able to supplement the warnings being issued by using its own communication system. If coordination of information on flows is not applicable, this decision should be documented in the EAP.

Emergency Supplies and Information

Planning and organizational measures that can help the dam owner and emergency management authorities manage an emergency situation more safely and effectively include stockpiling materials and equipment for emergency use and coordinating information between organizations. The availability of local resources should be predetermined through discussions with local emergency management authorities and additional resource needs should be identified. The EAP should include the name and contact information (including backups) for suppliers, additional personnel, contractors, consultants, and any other entities who may be needed to assist the dam owner or emergency management authorities in responding to a dam emergency.

Stockpiling Materials and Equipment

Where applicable, the following should be documented:

- Materials needed for emergency repair, including source. Materials should be as close as possible to the dam site
- Equipment needed for emergency response or repair, its location, and who will operate it

- Local contractors, vendors, and suppliers for dam-related equipment and supplies, including contact information and maps or directions to their locations
- Justification of decision not to stockpile materials and equipment if stocking is not warranted

Coordination of Information

Where applicable, the following should be described:

- The need for coordination of information on flows based on weather, runoff forecasts, dam failure, and other emergency conditions, including how coordination is achieved and the chain of communication, including names and contact information for responsible parties. Coordination with the NWS or other appropriate agency is recommended to monitor storms, river stages, and flood waves resulting from a dam break. The NWS or other appropriate agency may also be able to supplement the warnings being issued by using its own communication system. If coordination of information on flows is not applicable, this decision should be documented in the EAP
- Actions to be taken to lower the reservoir water surface elevation, if applicable, including when and how this action should be taken. If not applicable, this should be documented in the EAP
- Actions to be taken to reduce inflow to the reservoir from upstream dams or control structures. The EAP should provide instructions for contacting operators of these structures and how these actions should be taken. If such actions do not apply, this should be documented in the EAP
- Actions to be taken to reduce downstream flows, such as increasing or decreasing outflows from downstream dams or control structures on the waterway on which the dam is located or on its tributaries. The EAP should provide instructions for contacting operators of these structures and how these actions should be taken. If such actions do not apply, this should be documented in the EAP

Training and Exercise

Results of training and exercise programs are critical components in evaluating the effectiveness of an EAP. Training and exercise plans should be designed and developed by those entities with responsibilities identified in the EAP. Since many emergency management authorities follow the FEMA Homeland Security Exercise and Evaluation Program (HSEEP) framework, HSEEP should be considered by the dam owner and other entities involved with the EAP when developing training and exercise activities. More information on the HSEEP can be found at hseep.dhs.gov.

Training

The people involved in the implementation of the EAP should be receive training to ensure that they are thoroughly familiar with all elements of the plan, the available equipment, and their responsibilities and duties under the plan.

Technically qualified personnel should be trained in the incident management process, including detection, evaluation, notification, and appropriate response actions during all emergency level determinations. A sufficient number of people should be trained to ensure adequate coverage at all times. A brief description of the training performed at the dam and how often it is performed should be included in the EAP.

Local emergency management authorities may want to consider developing evacuation and shelter-in-place training materials for people who would be affected by a dam failure in their jurisdictions. This is particularly important when a dam is categorized as unsafe or the population immediately downstream of a dam would be inundated within a short time.

Exercise

If the EAP action items and procedures are not exercised periodically, those involved in its implementation may lose familiarity with their roles and responsibilities. A proposed exercise schedule and plans for an EAP exercise program should be included in the EAP. Plans for conducting an evaluation of the exercise and for updating the EAP based on the outcome of the evaluation should be considered.

Alternative Systems of Communication

The availability of alternative communications systems at the dam site should be identified in the EAP. These may include, but are not limited to, emergency sirens, cellular phones, direct connect, e-mail, intranet, radios, social media, and couriers. Operating procedures and special instructions for the use of these systems should be described. Consideration should be given to the target audience involved and the best means for communicating with them.

Public Awareness and Communication

Dams that are immediately upstream of residences, recreation areas, and campgrounds pose unique challenges. It may be necessary for the dam owner to assist emergency management authorities in developing public awareness measures. These measures typically explain the proximity of the dam, how people will be informed of an emergency, and the actions people should take during an emergency. The EAP should include a brief description of any public awareness measures that are performed. Emergency management authorities may consider the use of social media for both primary and alternate systems of communication with the public.

VIII. BREACH INUNDATION MAP

____homes could be affected by a major flood caused by a sudden breach of the dam. These homes are marked on the attached inundation map. Floodwaters would reach the first home approximately ___ minutes after the dam failure.

Number	Resident	Distance Downstream	Max Water Depth (above 1st Floor)

(Provide similar information for businesses and other non-residential structures)
(Attach Inundation Map)

IX. DISTRIBUTION

Copies of this Emergency Action Plan have been provided to all individuals or groups who are signatory parties to the plan. Large-scale maps are on file with the local emergency management agency for evacuation purposes.

X. APPROVAL OF THE PLAN

We, the undersigned individuals, as authorized by the laws and regulations of the State of _____, hereby adopt this Emergency Action Plan and agree to execute it.

_____ _____

Name/Title Date
(Provide signatures of key responsible parties for the dam owner, State/local emergency managers, and local response organizations)

XI. REVIEW AND UPDATE OF THE PLAN

This plan will be reviewed and updated annually, and tabletop exercises will be conducted at least once every five years. Document the reviews below:

Date of review:_____Participants:
Date of review:_____Participants:
Date of review:_____Participants:
Date of review:_____Participants:
Date of tabletop exercise: _____

Condition	Description of Condition	Action to be Taken
High Water Level / Large Spillway Release	Reservoir level reaches elevation XXX ft. and is rising at a rate of greater than one foot per hour.	1. Check for signs of erosion from spillway channel, particularly near wing walls.
		2. Assess cause of increased reservoir stage, especially during fair weather conditions.
		3. Perform additional tasks as directed by Dam Engineer.
		4. Make notifications if condition worsens such that downstream flooding is imminent.
Seepage	Localized new seepage or boil(s) observed along downstream face / toe of earthen embankment with muddy discharge and increasing but controllable discharge of water.	1. Measure and record feature dimensions, approximate flow rate, and relative location to existing surface features. Take photos if camera is available. Document location on a site plan and in inspection report.
		2. Place a ring of sand bags with a weir at the top towards the natural drainage path to monitor flow rate. If boil becomes too large to sand bag, place a blanket filter over the area using non-woven filter fabric and pea gravel. Attempt to contain flow in such a manner (without performing any excavations) that flow rates can be measured. Stockpile gravel and sand fill for later use, if necessary.
		3. Inspect the dam and collect piezometer, water level and seepage flow data daily unless otherwise instructed by engineer. Record any changes of conditions. Carefully observe dam for signs of depressions, seepage, sinkholes, cracking or movement.
		4. Contact geotechnical engineer and provide all data collected.
		5. Maintain continuous monitoring of feature. Record measured flow rate and any changes of condition, including presence or absence of muddy discharge.
		6. Review information collected by field inspection and provide additional instructions / actions as required. Recommend remedial seepage and stability measures.
		7. Make notifications if condition worsens such that failure is imminent.
Sabotage and Miscellaneous Other Issues	Criminal action with significant damage to embankment or structures where significant repairs are required and the **integrity** of the facility is **compromised – condition appears stable with time**.	1. Contact law enforcement authorities and restrict all access (except emergency responders) to dam. Restrict traffic on dam crest to essential emergency operations only.
		2. Assess extent of damage and visually inspect entire dam for additional less obvious damage. Based on inspection results, confirm if extent of damage to various components of the dam warrants revised emergency level and additional notifications.

Condition	Description of Condition	Action to be Taken
Sabotage and Miscellaneous Other Issues (cont.)	Criminal action with significant damage (cont.)	3. If necessary to lower reservoir level, open drain valve(s).
		4. Perform additional tasks as directed by the Dam Engineer or designee.
		5. Make notifications if conditions worsen.
Embankment Deformation	**Cracks:** New longitudinal (along the embankment) or transverse (across the embankment) cracks more than 6 inches deep or more than 3 inches wide or increasing with time. New concave cracks on or near the embankment crest associated with slope movement.	1. Measure and record feature dimensions, approximate flow rate, and relative location to existing surface features. Take photos if cameral is available. Document location on a site plan and in inspection report.
		2. Restrict traffic on dam crest to essential emergency operations only.
		3. Contact geotechnical engineer and provide all data collected.
		4. Place buttress fill (min 3 ft. high, 15 ft. wide) against base of slope immediately below surface feature and extending 20 ft. beyond visible feature limits (parallel to the embankment). Stock pile additional fill.
		5. Place sand bags as necessary around crack area to divert any storm water runoff from flowing into crack(s).
		6. Inspect the dam; collect piezometer and water level data twice daily unless otherwise instructed by engineer; and record any changes of condition. Carefully observe dam for signs of depressions, seepage, sinkholes, cracking or movement.
		7. Review information collected by field inspectors and provide additional instructions / actions as required. Consider survey monitoring.
		8. Make notifications if conditions worsen such that failure is imminent.
	Slides / Erosion: Deep slide / erosion (greater than 2 feet deep) on the embankment that may also extend beyond the embankment toe but does not encroach onto the embankment crest and appears stable with time.	1. Measure and record feature dimensions, approximate flow rate, and relative location to existing surface features. Take photos if camera is available. Document location on a site plan and in inspection report.
		2. Restrict traffic on dam crest to essential emergency operations only.
		3. Contact geotechnical engineer and provide all data collected.
		4. Re-establish embankment fill slope. Place 5 ft. high buttress fill against base of slope at the slide location that extends at least 15 ft. beyond the furthest downstream limits (perpendicular to the embankment) and extending 20 ft. beyond visible feature limits at either end (parallel to the embankment).

Condition	Description of Condition	Action to be Taken

Embankment Deformation (cont.)	Slide / Erosion (cont.)	5. Place sand bags as necessary around slide area to divert any storm water runoff from flowing into slide(s).
		6. Inspect the dam; collect piezometer and water level data daily unless otherwise instructed by engineer; and record any changes of condition. Carefully observe dam for signs of depressions, seepage, sinkholes, cracking or movement.
		7. Review information collected by field inspectors and provide additional instructions / actions as required. Consider survey monitoring.
		8. Make notifications if conditions worsen such that failure is imminent.
	Sinkholes: Small depression observed on the embankment or within 50 feet of the embankment toe that is less than 5 feet deep and 30 feet wide or which is increasing with time.	1. Slowly open drain valve(s) to lower reservoir elevation.
		2. Measure and record feature dimensions, approximate flow rate, and relative location to existing surface features. Take photos if camera is available. Document location on a site plan and in inspection report.
		3. Restrict traffic on dam crest to essential emergency operations only.
		4. Contact geotechnical engineer and provide all data collected.
		5. Backfill the depression with relatively clean earth fill (free of organic materials) generally even with surrounding grade and slightly mounded (6 to 12 inches higher) in the center in order to shed storm water away from the depression. Stock pile additional fill.
		6. Inspect the dam; collect piezometer and water level data daily unless otherwise instructed by engineer; and record any changes of condition. Carefully observe dam for signs of depressions, seepage, sinkholes, cracking or movement.
		7. Review information collected by field inspectors and provide additional instructions / actions as required. Consider remedial construction such as grouting.
		8. Make notifications if conditions worsen such that failure is imminent.
Gate (Valve) Malfunction or Failure	Dam gates / valves damaged structurally (sabotage, debris, etc.) with uncontrolled release of water at a constant volume. Condition appears stable.	1. Close any other gates, if open.
		2. Install XXX or use other methods to stop or slow down the flow of water.
		3. Consult a structural / mechanical engineer for evaluation and recommendations. Consult dam remediation contractor for evaluation and recommendations.

Condition	Description of Condition	Action to be Taken
Gate (Valve) Malfunction or Failure (cont.)	Dam gates / valves (cont.)	4. Repair / replace gate / valve as necessary.
		5. Make notifications if conditions worsen such that further structural failure is imminent.
Sabotage and Miscellaneous Other Issues	Criminal action with significant damage to embankment or structures where significant repairs are required and the **integrity** of the facility is **compromised – condition appears stable with time**.	1. Contact law enforcement authorities and restrict all access (except emergency responders) to dam. Restrict traffic on dam crest to essential emergency operations only.
		2. Assess extent of damage and visually inspect entire dam for additional less obvious damage. Based on inspection results, confirm if extent of damage to various components of the dam warrants revised emergency level and additional notifications.
		3. If necessary to lower reservoir level, open drain valve(s).
		4. Perform additional tasks as directed by the Dam Engineer or designee.
		5. Make notifications if conditions worsen.

Appendix B: Recovery Plan Content Guidelines

Recovery plans are discussed in Section 5 of this handbook. The plans should provide information to deal with mitigation and emergency repair of affected projects for any emergency arising at the site, whether from natural or manmade causes.

A recovery plan is developed primarily for the benefit of the owner of the facility, but will also be useful to the region or nation by rapidly recovering essential project functions. Having a comprehensive plan enables dam owners to more quickly mitigate, recover, and "get back on line" following a serious incident at a facility. It makes good business sense to formulate a recovery plan for those facilities that would seriously impact the generating capability and/or the local, regional, and/or national economic bottom line. Recovery plans are not necessarily applicable to every facility.

The recovery phase should begin as soon as possible after the catastrophic event (dam failure, loss or damage to a powerhouse, loss of main transmission line, etc.) and usually overlaps the "Response Phase" of the event. Planning and actions during the "Response Phase" should consider any actions that might be implemented to return the dam to service.

Recovery phases include "initial" (within one week) and "long-term" activities (recovery could continue for months), depending upon the magnitude of impact on facility operations including dams, powerhouses, and water conveyance.

This appendix provides two sample tables of contents for recovery plans and detailed content guidelines. A sample recovery plan is also available on the HSIN-CI Dams Sector Portal; more samples will be posted as they become available.

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (USACE) requires recovery plans for many of its dams and navigation locks. Many parts of the USACE guidelines are similar to those issued by the Federal Energy Regulatory Commission (FERC) discussed below.

One USACE district developed a generic recovery plan to cover all of its affected projects; the following sample table of contents borrows elements from that plan. It should be noted that the sample table of contents demonstrates that the recovery plan should address more than just physical repair and reconstruction issues.

Recovery Plan - Sample Table of Contents

I. Purpose

II. Recovery Organization

III. Description of Projects

IV. Coordination Responsibilities

- Internal (within the organization)
- External (with Federal, State, and local authorities)

V. Response and Recovery Operations

- Incident Command and Management
- Procurement Procedures
- Resource Coordination
- Mutual Aid
- Public Information Dissemination

VI. Response and Recovery Actions

- Site Security
- Continuity of Operations
- Restoration of Critical Infrastructure

VII. Training and Exercise

- Training
- Exercises
- Evaluation and Corrective Action

VIII. Plan Maintenance

Federal Energy Regulatory Commission

The Federal Energy Regulatory Commission (FERC) issued guidelines for use by its licensees when developing an internal emergency recovery plan to supplement their emergency action plan. The FERC guidelines frequently address issues that are specifically related to hydroelectric power generation, and sometimes refer to specific licensee requirements. The guidelines consist of a recommended table of contents and a content description for each of the main sections. These FERC guidelines include fairly comprehensive coverage of issues related to the primary recovery activities. The guidelines also address related issues such as the National Incident Command System (NIMS), responsibilities, communications, coordination, and logistics. FERC suggests that the main body of the plan, not including the appendices, could be less than 25 pages.

The complete guidelines are available at http://www.ferc.gov/industries/hydropower/safety/guidelines.asp. An abbreviated version of the guidelines is provided below.

Recovery Plan - Sample Table of Contents

I. Purpose
II. Applicable Emergency Scenarios
    - Overtopping
    - Earthquake Damage
    - Loss of Dam Crest Length
    - Slide on Upstream or Downstream Slope of Embankment
    - Slide on Underlying Potential Failure Plane
    - Excessive Settlement
    - Sinkhole Activity
    - Loss of Foundation or Abutment Material
    - Excessive Seepage/Piping through Embankment, Foundation, or Abutments
    - Failure of Appurtenant Structure such as a Spillway Gate
    - Excessive Cracking in Concrete Section
    - Penstock Rupture/Failure
    - Turbine or Other Equipment Failure
    - Vandalism/Bomb Threat/Terrorism
    - Other
III. Incident Command System & Company Internal Assignments/Responsibilities
    - Incident Command System (ICS)
    - ICS Chart: Company Personnel Assignments
    - Incident Command Post and Alternate Command Post
    - Personnel at On-Site Incident Command Post
    - Main Headquarters Emergency Personnel
    - Media Contact (Public Information Officer)
IV. Coordination with Local Authorities
    - Multiple-Jurisdiction Incident (Unified Command (NIMS))
    - Safety/Clearance Issues and Authorization
V. Communications, Maps, and Drawings
    - Communications Center
    - Alternate Communications Methods
    - Drawings, Maps, and Photographs

VI. Vehicles, Equipment, Materials, and Contractors
    - Plant On-Site Inventory
    - Other Available Company Vehicles, Equipment, Materials, and Supplies
    - Non-Company Supplies/Materials
    - Outside Contractors and Consultants

VII. Response Times and Geographical Limitations
    - Call-Out Procedure
    - Estimated Response Times
    - Primary and Secondary Access Roads & Alternatives
    - Staging Areas for Personnel and Equipment

VIII. Meals & Lodging
    - Company Living Facilities
    - Local Restaurants and Motels

IX. Internal Maintenance of Plan

X. Appendices
    - List of Company Response Personnel (Internal call-out list of phone numbers)
    - List of Contractors/Consultants (Addresses and phone numbers)
    - List of Equipment Suppliers (Addresses and phone numbers)
    - Local Restaurants and Motels (Addresses and phone numbers)
    - Other Utilities/Mutual Aid (Phone numbers of key contacts)
    - Federal/Governmental Assistance (Phone numbers of key contacts)
    - Engineering Key Drawing List (Location of drawings (Two secure, non-inundated areas near the facility))
    - Highway Maps and Photos of Dam
    - Emergency Helicopter Rescue Numbers
    - Bomb Threat Procedures
    - EAP Flowcharts A and B (Identical to those in the regular EAP)

Section I. Purpose

The recovery plan is designed as a separate document that can supplement the primary Emergency Action Plan (EPA). Whereas the EAP is designed to facilitate early warning and evacuation of potentially affected downstream areas, the recovery plan provides guidance to respond to, mitigate, and perform emergency repair of affected company structures and plant facilities. A recovery plan should be prepared on a site-specific basis since different facilities (i.e., dams and associated structures) will require specific considerations. The recovery plan is not intended to be a company-wide Continuity of Operations Plan, but rather a plan to bring a specific facility back in operation as efficiently as possible. It is intended for internal use and response only.

Section II. Applicable Emergency Scenarios

The description of each scenario need only be one page in length, including primary concerns, materials/equipment needed, and operating procedures. A universe of potential emergency scenarios need not be listed for each facility, but rather, a list tailored to the site-specifics of the facility. For example: "overtopping" may be a minor concern for a facility designed to accommodate flows over the entire structure. A good start in developing applicable emergency scenarios is the Potential Failure Modes Analysis (PFMA) approach, although all applicable scenarios, such as manmade threats, may not be covered in the PFMA process.

Each critical component for the applicable scenario should be identified with the likely range of potential hazards and consequences. An example of a likely scenario would be: Predicting the type and magnitude of damage, and developing a list of options to minimize the consequences, either by reducing initial damage, limiting the progression of the initial damage, or reducing the time needed to repair the damage. The results of this effort should be consolidated into a list of recommended actions that might include procurement, stockpiling, on-the-shelf designs, or general preparedness actions. The following are brief examples of what a component analysis could entail:

Component: Switchyard Transformer

Likely Type/Magnitude of Damage: Ballistic damage to shell and windings

Consequences of Damage:

- No immediate loss of hydropower transmission (Due to the availability of redundant transformer capacity)
- System is less reliable until transformer is replaced (Normal replacement time - 18 months)
- Possible power loss would impact a very small percentage of regional capacity

Options to Minimize Consequences:

- Rely on existing redundant transformer capacity
- Install additional redundant capacity
- Initiate emergency procurement for new transformer (Normal replacement time - 9 months)

Recommended Option: Option No.1, however, this will limit system reliability until a new transformer is online
Component: Tainter Gates

Likely Type/Magnitude of Damage: Trunion pin failure deforms gate, making gate inoperable

Consequences of Damage: Until the gate is replaced (Normal replacement time - 14 months), there will be loss of pool, reduction of recreation, and loss of power production

Options to Minimize Consequences:

- Procure and store a spare gate (Two-week recovery time)
- Emergency procurement of a new gate (Normal replacement time - 9 months)
- Procure and store a bulkhead to restore pool until new gate is installed

Recommended Option: Option No.3,(Storing a bulkhead) is more broadly suitable for use at five company projects

Section III. Incident Command System (ICS) and Company Internal Assignments/Responsibilities

The purpose of this section is to describe the emergency response structure in which the dam owner will operate, and briefly discuss the roles and responsibilities expected from personnel internal to the dam owner's organization. This section should also address the roles and responsibilities of dam owner personnel to respond to the emergency, both on an initial and a long-term basis. Examples of long-term recovery operations are revising operational plans and emergency action plans, as appropriate, and identifying any enhancements that should be made to hydroelectric facility components.

Section IV. Coordination with Local Authorities

This section should briefly discuss dam owner responsibility to coordinate with the local law enforcement and emergency response personnel, and any special needs identified. The complete list of applicable agencies would be included in the EAP notification flowchart.

Section V. Communications, Maps, and Drawings

This section should describe how communications will occur throughout the emergency; list alternate communication sources; and include a brief section with pertinent maps, drawings, and photographs that would be useful in responding to an emergency. Maps, drawings, and photographs may be included in the appendices.

Section VI. Vehicles, Equipment, Materials, and Contractors

This section should list all of the vehicles, materials, and equipment the dam owner would require to respond to the applicable emergency scenarios identified in Section II. A current list of

contractors and support personnel who can be utilized during the emergency should also be listed in this section for easy reference.

Section VII. Response Times and Geographical Limitations

Anticipated response times, call-out procedures, and geographic limitations should be addressed in this section. Clearly defined directions to critical areas and other locations should be included in textual and graphical format. Security exclusion zones and potential staging areas should also be identified.

Section VIII. Meals and Lodging

Any logistical considerations for sustaining personnel detailed to temporary quarters should be identified in this section.

Section IX. Internal Maintenance of Plan

This section should address how the recovery plan is maintained/updated. Internal employee training on the procedures and information contained within the plan should also be defined.

Section X. Appendices

The most critical section of the plan is the “Appendix” section; the "nuts and bolts" that help mitigate/recover from an emergency. The appendices could most likely suffice by themselves as the "recovery" plan for most dams. They contain information that hopefully most dam owners already have on file to mitigate an emergency. This information could simply be consolidated into a single document. Appendices should be designed so that critical information contained therein may easily be verified and updated on an annual basis.

Appendix C: Continuity Plan Guidelines

As discussed in Section 6, organizations develop continuity plans to facilitate performance of their essential functions in situations that challenge their normal operations. The scale of operations will dictate if one continuity plan will be sufficient or if multiple, discrete plans constitute an organization's continuity program. . Continuity plans could be developed for escalating operations in the event of a natural disaster or manmade incident, black start contingencies, civil unrest, pandemics, labor unrest, or physical or cyber security breaches.

Appendices C.1 and C.2 contain information on developing continuity plans for two areas of particular interest to many organizations: incidents resulting in high degrees of absenteeism and computer incidents.

As with the other plans discussed in this handbook, continuity plans must be made readily available to the people who need them, and sensitive business or security information must be protected. They must also be updated on a regular schedule or as circumstances warrant.

The following basic guidelines have been drawn from NFPA 1600, *Standard on Disaster/Emergency Management and Business Continuity Programs*. NFPA 1600, issued by the National Fire Protection Association, is one of three standards selected as the basis for the PS-Prep™ certification program for private sector entities. This standard should be consulted for a more thorough discussion of the planning process.

Continuity Planning Guidelines:

- Clearly state the objectives of the plan
- Identify:
  - Functional roles and responsibilities of internal and external agencies and organizations;
  - Lines of authorities for those agencies and organizations;
  - Logistics support;
  - Resource requirements;
  - Process for managing an incident; and
  - Systems for managing communication and information flow.

Based on these suggested guidelines, a continuity plan could be structured as described by the following table of contents.

Continuity Plan – Sample Table of Contents

Appendix C.1: Response to Incidents Causing Absenteeism

A natural hazard, pandemic, or incident (whether intentional or not) affecting a community, region, or the Nation could result in high degrees of worker absenteeism. Employees may be absent because they are ill, incapacitated, providing care to family members, unwilling to go to work for fear of becoming ill, or lacking transportation. Absenteeism of a short duration may be manageable, but expectations of longer durations may trigger response actions such as those in the table below.

Absentee Rate	Response Actions
Normal (baseline case)	• Develop and refresh business continuity plans • Prioritize business processes and associated personnel, equipment or supplies • Promote organizational preparedness and planning • Conduct validation exercises
Mild to moderate (20 – 30%)	• Initiate company monitoring of disease or incident • Provide appropriate awareness communications • Advise employees on personal protection strategies • Monitor travel situation and initiate advisories as needed • Evaluate potential need for stockpiling of materials or supplies • Review and refresh organizational preparedness plans
Moderate to severe (30-40%)	• Consider limited activation of crisis management teams • Evaluate need to implement supplemental staffing strategies • Review or update response and business continuity processes associated with next level escalation • Ramp up communications and preparedness education • Resolve stockpiling concerns and order materials as appropriate • Implement mitigation processes involving critical and essential business processes and personnel
Severe (40% and greater)	• Activate crisis/emergency management teams • Evaluate communication needs and adjust as required • Implement mitigation processes involving critical and essential business processes and personnel • Enhance employee social/psychological support processes • Anticipate economic/social disruptions and mitigate as appropriate • Evaluate and adjust response actions

Background actions to prepare for responding to incidents resulting in challenging rates of absenteeism are as follows:

- Identify and assess essential services, functions, and processes
- Review equipment and assets critical to support each essential function
- Determine the most effective ways to ensure an adequate supply of essential materials
- Identify the types and number of workers critical to sustain essential functions
- Identify human resource and protective actions to sustain essential workforce
- Identify interdependent relationships and take actions to sustain those essential supports
- Identify Federal, State, and local regulatory requirements that may affect facility operations
- Identify effects from mitigation strategies and take actions to reduce negative impacts

Appendix C.2: Computer Incident Response Team Template and Resources

This appendix first provides a template that might be used to develop a continuity and response plan for a facility or a company Computer Incident Response Team (CIRT). The template was developed by a large utility company, but elements of it could be easily adopted by any size facility or company as needed.

The second section of this appendix provides resources available to dam owners and operators to avoid computer incidents or respond to them when they occur.

1. Document Control

Provide information such as document name and version number, date of last revision, distribution lists, or restrictions.

2. Introduction

Identify the purpose and scope of the document.

3. Types of Threats

Threat Category	Threat Definition
Automated Attacks	Software attacks such as viruses, worms, and Trojan horses
External Attacks	Outside individual attempting to gain unauthorized access
Internal Attacks	Employees or contractors attempting unauthorized access to information or internet sites

4. Alert Categories

Identify organization alert levels. Consider correlating those levels with the National Terrorism Advisory System (NTAS) levels of normal, elevated, or imminent. .

5. CIRT Escalation Criteria

Provide guidelines for identifying the current organization alert level and for activating the response team. Identify who has the authority to make these decisions.

6. Response Guidelines

Provide lists of expected actions by various teams/members for various types of incidents. This will not be an all-inclusive list and some measures may not be applicable against a specific threat. However, the lists will provide a convenient checklist to help guide response actions. Implementation of these measures will be at the discretion of the teams. The list should include useful information such as command post locations and instructions for obtaining information updates during the response.

7. Status Reports

The CIRT should provide periodic status reports during response to an incident. These reports should be forwarded to management and affected portions of the organization. This section should identify intervals for meetings and status reports, and suggested distribution lists.

8. CIRT Plan Maintenance

The CIRT Plan should be reviewed and/or updated at least annually.

9. Exercises

The CIRT process should be tested twice a year, and should include tests of the notification lists and a simulation of some type of incident. This simulation might be considered a tabletop exercise. The objective should be to identify any hardware, system software, or applications that may need to be changed to better ensure computer security.

Attachment A – Computer Incident Response Process Overview

This section should outline the response process. The principle objective of an incident response plan is to ensure business continuity and support recovery efforts. . The initial response should include a rapid assessment of the situation and the execution of a number of "immediate action" steps designed to contain the problem, and limit further damage. . Typical response processes might include the following:

- Determine the nature of the incident
- Determine if the incident is malicious or non-malicious in origin
- Analyze available data sources
- Respond
    - Isolate compromised host
    - Block malicious traffic with existing security devices
    - Patch/harden to address specific vulnerability
    - Report the incident to law enforcement if criminal activity is suspected
- Recover
    - Recover compromised hosts
    - Survey infrastructure for other vulnerable hosts and patch/harden as appropriate
    - Quantify loss if seeking legal remedies
    - Monitor the host and network for signs of subsequent compromise
    - Conduct post-mortem analysis
    - Revise procedures and training based on post-mortem analysis

Attachment B – Call Lists

Provide contact information for key personnel. This list should include incident response team members, management, IT organizations, and persons in potentially affected operational areas.

Attachment C – Technical Impact Assessment

This section should provide guidelines for a thorough assessment of the potential impact of a specific threat. It should address items such as:

- Type of threat
- Source of the threat
- Actions that can be taken to mitigate the threat
- Prevalence of the target of the threat

Attachment D – Business Impact Assessment

This section should identify the types of information needed to determine the impact on critical business systems. This may include:

- What type of technology is affected by the incident
- Is the incident limitable by location (can it be contained)
- Who is the person on call for the application, have they been contacted, and how quick can their response be)
- Will company revenues be impacted
- Is the external customer impacted

Attachment E – Communications Process

This section should identify:

- Key communications contacts, roles, and responsibilities;
- Target audiences and the most effective means to reach them;
- Steps in the communications process; and
- Sample messages.

Attachment F - Post-Incident Evaluation

Include guidelines for:

- Determining the cause of the incident;
- Determining the effects of the incident;
- Making recommendations for improvements to the systems; and
- Making recommendations for improvements to the incident response.

Computer Incident Resources

The National Institute of Standards and Technology (NIST) Special Publication 800-61, *Computer Security Incident Handling Guide*, Revision 1—dated March 2008—contains detailed recommendations on computer security response planning and provides an extensive list of online tools and resources. The guide is available at http://csrc.nist.gov/publications/nistpubs/800-61-rev1/SP800-61rev1.pdf.

The United States Computer Emergency Response Team (US-CERT) issues technical computer security documents that may be useful for system administrators or other technical users, as well as non-technical documents for users with less computer experience. US-CERT summarizes important security issues it receives on viruses, worms, and attack methods; and makes updates for identified vulnerabilities available.

The Cyber Security Evaluation Tool (CSET), developed by the DHS Control Systems Security Program (CSSP), provides users with a systematic and repeatable approach for assessing the cybersecurity posture of their industrial control system networks. This tool also includes both high-level and detailed questions applicable to all industrial control systems (ICS). . The CSET enables users to assess their network and ICS security practices against recognized industry and government standards, guidelines, and practices. The completed CSET assessment provides a prioritized list of recommendations for increasing the cybersecurity posture of an organization's ICS or enterprise network, and identifies what is needed to achieve the desired level of security within the specific standard(s) selected. . The CSET software is available at cset@dhs.gov.

CSSP also offers information on control system cybersecurity training, cybersecurity policy planning and preparation, and ensuring security when modernizing and upgrading cybersystems. These topics are addressed at http://www.us-cert.gov/control_systems/csstandards.html.

CSSP also offers industrial control system training courses, which are described at http://www.us-cert.gov/control_systems/cstraining.html. . Courses titled "Introductory SCADA Security" and "Intermediate SCADA Security" were developed by the Idaho National Laboratory. These courses are available at http://www.inl.gov/scada/training/index.shtml.

Cybersecurity measures that can be implemented quite easily are firewalls, virus protection systems, rigorous password procedures, information encryption software, computer access control systems, on call technical support, and computer incident response and recovery systems.

Additional cybersecurity standards are:

- American Gas Association Report Number 12 on cryptographic protection;
- U.S. Department of Energy, *21 Steps to Improve Cyber Security of SCADA Networks*;
- National Institute of Standards and Technology (NIST) Special Publication 800-82, *Guide to Supervisory Control and Data Acquisition (SCADA) and Industrial Control System Security*; *System Protection Profile - Industrial Control Systems Version 1.0*; and
- North American Electric Reliability Corporation (NERC), Critical Infrastructure Protection (CIP) Standards.

Appendix D: Exercise Guidelines

Exercises are discussed in Section 7 of this handbook. The section also briefly describes seven different types of exercises. Although the exercise types will vary significantly in terms of scope and scale, the same general framework can be applied when planning most of the exercise types. This appendix describes that basic framework. It also provides HSEEP guidelines that can be useful when planning specific types of exercises. Example statements are printed in italics.

A template for a full-scale exercise has been posted on the HSIN-CI Dams Sector Portal. Other templates will be posted as they become available.

Exercise Framework Guidelines

Define the Purpose of the Exercise

A clear definition of the need for the exercise and the purpose for conducting it will aid the planning process by clarifying who should be involved, and the exercise scope (e.g., tabletop, game, or full-scale). The following need and purpose statements were based on a tabletop exercise template provided by Alliant Energy:

Our business is highly dependent on moving information across telecommunication networks. We need to be prepared to continue important business activities even if telecommunication networks stop functioning. The purpose of this exercise is to ensure that business groups can adapt to unpracticed emergency situations, like loss of telecommunication networks, and understand the actions that may be needed to keep important business functions operating.

Assemble the Planning Team

The size of the planning team and representation on it depends on the scope of the exercise. The team should include representatives from all of the major facility organizations involved in the exercise, and local law enforcement and first responders.

Develop the Scenario

The planning team's initial task is development of the exercise scenario. The scenario should be a plausible event scaled to the purpose of the exercise. The following sample scenario was developed for a full-scale exercise:

An individual wearing a backpack was found lying unconscious inside the north gate. The backpack was leaking an orange liquid. A security officer approached the individual and has been rendered unconscious. An unidentified individual was seen running from the vicinity of the administration building and has caused an explosion resulting in a fire inside the building. His current whereabouts are unknown but he is believed to be somewhere on the site.

Develop Exercise Guidelines

Depending on the type of exercise and the scenario, the planning team should describe any limitations placed on the design, development, and implementation of the exercise. Limitations could be the ability of responders to participate, lengthy authorization protocols, areas that may be off-limits for safety reasons, or financial constraints. The following is an example of a guideline:

No personnel may enter the switchyard at any time because it will continue to be energized.

Build Master Scenario Events List (MSEL)

The Master Scenario Events List (MSEL) developed by the planning team lists the exercise messages and key events used to fully play out the scenario. The MSEL specifies the time a message is expected to be delivered, who delivers it to whom, a message number, and a short description of the message.

Prepare Exercise Materials and Evaluator Guides

Participants should receive invitation letters describing the exercise purpose and goal; scenario descriptions pertaining to their role; and safety, health, and logistics plans. Equally important is developing the guidelines for the observers who will be evaluating actions and decisions as the exercise unfolds.

Complete Post-Exercise Evaluation

Post-exercise evaluations provide the basis for improving the plans or procedures that were tested as part of the exercise.

Appendix D.1: Guidelines for Seminars

Seminars can be used to address a wide range of topics. Although the topics may vary, all seminars share the following common attributes:

- They are conducted in a low-stress environment;
- Information is conveyed through different instructional techniques which may include lectures, multimedia presentations, panel discussions, case study discussions, expert testimony, decision support tools, or any combination thereof;
- Informal discussions are led by a seminar leader;
- There are no real-time "clock" constraints; and
- They are effective for both small and large groups.

Prior to participating in a seminar, participants should have a clear understanding of exercise objectives, which can range from developing new standard operating procedures to attaining priority capabilities. Seminars are typically conducted in a lecture-based format with limited feedback or interaction from participants.

Appendix D.2: Guidelines for Workshops

To be effective, workshops must focus on a specific issue. The desired outcome, product, or goal must be clearly defined. Workshops provide an ideal forum for the following activities:

- Collecting or sharing information;
- Obtaining new or different perspectives;
- Testing new ideas, processes, or procedures;
- Training groups to perform coordinated activities;
- Solving complex issues;
- Obtaining consensus; and/or
- Building teams.

Workshops typically begin with a presentation or briefing that conveys the background and rationale for the workshop, and specific activities and expected outcomes are delineated. . The presentation is typically followed by facilitated breakout sessions in which workshop participants break into groups for focused discussions of specific issues. Breakout sessions are used to increase participant interaction regarding the issues most relevant to their functional areas.

Ideally, breakout sessions are facilitated by someone with both subject matter knowledge and facilitation experience. If this is not possible, it is more important to have a good facilitator who can keep the discussion on track than a facilitator with subject matter knowledge. Following breakout group discussions, the groups reconvene in a plenum session to present outcomes.

Appendix D.3: Guidelines for a Tabletop Exercise

A tabletop exercise is like a problem-solving or brainstorming session. A tabletop exercise is usually not as tightly structured as a full-scale exercise, so problem statements can be handled in various ways. The facilitator can verbally present general problems, which are then discussed one at a time by the group; or they can be verbally addressed to individuals first and then opened to the group.

Another approach is to deliver pre-scripted messages to players. The facilitator presents them, one at a time, to individual participants. The group then discusses the issues raised by the message using the Emergency Operating Plan or other operating plan for guidance. The group determines what, if any, additional information is needed and requests that information. They may take some action if appropriate.

A third option is for players receiving messages to handle them individually, making a decision for the organization they represent. Players then work together, seeking out information and coordinating decisions with each other.

Participants should be provided with reference materials that could include emergency action plans, maps, and other relevant materials. The tabletop facilitator must have good communication skills and be well-informed of applicable plans and organizational responsibilities.

Appendix D.4: Guidelines for Games

Games are hypothetical situations steered by player actions. Games explore the consequences of player decisions and actions. Therefore, they are excellent tools to use when validating or reinforcing plans and procedures, or evaluating resource requirements.

Games have the following common characteristics:

- Play unfolds contingent on player decisions;
- They encourage a competitive environment;
- They provide rapid feedback;
- They improve teamwork;
- They foster an environment to practice group problem solving;
- Group message interpretation is tested;
- Interagency coordination is assessed;
- Senior officials become familiar with individual responsibilities;
- Players explore potential future scenarios; and
- Consequences of player actions are demonstrated.

A major variable in games is whether the consequences of player actions are scripted or random. After each player action or move, the controller presents the outcome. Depending on the game's design, this outcome can be either pre-scripted or decided after play. Identifying critical decision-making points is a major factor in the success of games because players make their evaluated moves at these crucial points.

Due to the usual limitation on the number of players, planners are encouraged to open the exercise to observers, if possible. Observers are asked not to participate in discussions and strategy sessions, but can be tasked to make notes and report back to controllers with feedback.

Appendix D.5: Guidelines for Drills

A drill is a coordinated, supervised activity used to validate a specific operation or function in a single agency or organization. A drill is useful as a stand-alone tool, but a series of drills can also be used to prepare several agencies or organizations to collaborate in a full-scale exercise.

Drills typically include the following attributes:

- They have a narrow focus;
- Results are measured against established standards;
- They provide instant feedback;
- They involve a realistic environment;
- They are performed in isolation; and
- Players become prepared for exercises that are larger in scope.

Clearly defined plans, policies, and procedures need to be in place prior to the drill. Personnel need to be familiar with those plans and policies, and trained in the processes and procedures to be drilled.

The drill begins when controllers and evaluators are properly stationed. If no safety issues arise, the drill continues until the process is complete, time expires, or objectives are achieved.

During the simulated incident, players must know that they are participating in a drill and not an actual emergency. Controllers ensure that participant behavior remains within predefined boundaries and that entities not involved in the drill (e.g., site security and local law enforcement) are not unnecessarily mobilized.

Evaluators observe behaviors and compare them against established plans, policies, procedures, and standard practices (if applicable). Safety controllers ensure that all activity takes place within a safe environment.

Appendix D.6: Guidelines for Functional Exercises

The functional exercise makes it possible to test the same functions and responses that would be tested in a full-scale exercise, without the high costs or safety risks. Functional exercises are lengthy and complex, requiring careful scripting and planning.

The functional exercise is well-suited to assess the following attributes:

- Direction and control of emergency management;
- Adequacy of plans, policies, procedures, and roles of individual or multiple functions;
- Individual and system performance;
- Decision making process;
- Communication and information sharing among organizations;
- Allocation of resources and personnel; and
- Overall adequacy of resources to meet the emergency situation.

The functional exercise is more likely to be successful if the participants receive a briefing that covers an overview of objectives, how the exercise will be carried out, the time period to be simulated, and ground rules and procedures. The exercise formally begins with the presentation of the narrative.

The action begins as simulators communicate messages to players, and players respond as they would in a real emergency. The players then make requests of simulators, and simulators react convincingly. This ongoing exchange takes place according to the carefully sequenced scenario of events that governs what takes place, when each event occurs, and the messages used to inform the players. The players should be able to decide among the full range of responses normally available to them during an emergency. Their ability to make decisions, communicate, or otherwise carry out their responsibilities should not be constrained by the exercise situation.

Functional exercises can depict events and situations that would actually occur over an extended period of time (one or more weeks). In order to include multiple phases of the emergency (preparation, response, recovery, and mitigation) in a two-day exercise, it would be necessary to stop the exercise periodically and advance the time by a number of hours or days. These skip-time transitions should be kept to the minimum necessary to cover the scope of the exercise. They can usually be planned to coincide with a natural break point.

To the extent possible, the functional exercise should take place in the same facility and operational configuration that would occur in a real emergency.

Appendix D.7: Guidelines for Full-Scale Exercises

Full-scale exercises are interactive exercises designed to challenge the system under review in a highly realistic and stressful environment. The realism of the full-scale exercise can be conveyed through on-scene actions and decisions, simulated "victims," use of communication devices, equipment deployment, and allocations of resources and personnel.

Full-scale exercises require a significant investment of planning, time, effort, and resources. It may take 1 to 1½ years to develop a complete exercise package. Despite the intensive effort involved in the planning and implementation phases, full-scale exercises are valuable because they enable an organization to evaluate its ability to perform many functions at once. They are also effective at pinpointing resource and personnel capabilities, revealing planning and resource shortfalls, and testing inter- and intra-organizational coordination.

The full-scale exercise begins in a fashion similar to the functional exercise; whether it is announced or "no notice" depends in part on the objectives. The exercise designer will decide how and when the exercise is to begin. The trigger may simply be a call from dispatch, a radio broadcast, or a telephone call from a private citizen. The beginning of the exercise should be as realistic as possible for each participant (meaning, personnel should receive notification through normal channels).

All decisions and actions by players occur in real time, and generate real responses and consequences from other players. The exercise messages may be scripted or visual and involve staged scenes, props, and role-playing victims.

The activity during the exercise is at a very high level. Therefore, great care must be given to developing, implementing, and monitoring health and safety plans. This high level of activity also suggests that multiple observers must be on hand to record and assess decisions, outcomes, conflicts, resource use, and the effectiveness of the plans or protocols being tested.

Appendix E: Potential Crisis Management Incidents

The following are examples of the types of incidents that could serve as the reason for developing an emergency action plan, response plan, and continuity plan; and conducting exercises to test the effectiveness of those plans.

Attack: A hostile (cyber or physical) action aimed at disrupting or destroying operational capability and/or causing significant damage to a facility.

Breach or Failure: Any condition characterized by total or partial loss of the capability to impound water.

Controlled Breach: A planned (non-emergency) breach of an impounding structure, possibly carried out to remove a facility from service or to make major repairs.

Cybersecurity Incident: Any denial of service attack incidents, identification of malicious code, unauthorized access, and/or inappropriate usage of information systems.

Earthquake: Operations and structural performance are affected by a nearby seismic event.

Emergency Action Plan Activation: Implementation of the emergency action plan (or emergency actions) in part or whole.

Emergency Condition: Any event or circumstance that clearly compromises the structural integrity of a facility and could lead to breach or failure. For example: water has overtopped a dam or dike.

Equipment Malfunction: Failure of mechanical or electrical equipment to perform the functions for which they were intended.

Excessive Release: Reservoir discharge that exceeds downstream capacity and/or causes downstream damage.

Facility Mis-Operation: Unintentional operator error affecting the operations of a facility.

Lock Closure: Unscheduled or scheduled interruption of partial or total navigation traffic through a facility.

Physical Security Incident: Any breach in access control systems such as fences, doors, gates, locks, and security zones.

Regulatory Action: The regulatory agency has determined that an unsafe condition exists or the facility does not meet applicable design criteria (e.g., inadequate spillway capacity), and requires action to be taken by the owner (e.g., reservoir restriction and/or safety modification).

Reservoir Incident: Any event in a reservoir that may impact the structural/functional integrity of a facility. . For example: landslides.

Sabotage: A deliberate action aimed at weakening or destroying operational capability through subversion, obstruction, disruption, and/or destruction. .

Security Posture Modification: Any change of security activities and protocols in response to specific threat reports.

Significant Inflow Flood: Operations and structural performance are affected by significant inflow flood.

Significant Inflow of Ice and Debris: Operations and structural performance are affected by significant inflow of ice and debris.

Structural Modification: Modifications to improve the safety and/or operational characteristics of a facility.

Suspicious Activity: Any indication that surveillance activity (such as elicitation of inappropriate information, suspicious photography, attempted intrusion, steady observation, etc.) could be taking place.

Unsafe Condition: Any developing or occurring event or circumstance that may adversely affect the structural integrity of a facility, but is considered controllable through the appropriate remedial actions. For example: the water level of a reservoir reaching unsafe levels; any developing downstream erosion or settlement; any unusual leakage; etc.

Unsatisfactory Condition Report: The findings of any inspection, assessment, or investigation that identify unsatisfactory or unsafe conditions at a facility.

Unusual Observation: An unusual situation is detected, but there is no indication that the structural/functional integrity of a facility may be immediately compromised. For example: observations of damage, deterioration, or signs of distress; instrumentation readings reaching predetermined limits; signs of piping, slumping, unusual cracks, or sinkholes; any obstruction in the spillway; etc. .

Vandalism/Theft: The willful or malicious destruction/defacement of public or private property, or the removal of personal property with the intent to deprive the rightful owner of it.

Vessel Allision/Collision/Grounding: Any event involving vessel impacts on other vessels, structures, or operating equipment at a facility.

Appendix F: Dams Sector Councils

Dams Sector Coordinating Council Member Organizations

Allegheny Energy

Ameren Corporation

American Electric Power

Association of State Dam Safety Officials

Association of State Floodplain Managers

AVISTA Utilities

BC Hydro

Colorado River Energy Distributors Association

Consumers Energy

Dominion Resources

Duke Energy Corporation

Exelon

Hydro-Québec

Metropolitan Water District of Southern California

National Association of Flood and Stormwater Management Agencies

National Hydropower Association

National Mining Association

National Water Resources Association

New York City Department of Environmental Protection

New York Power Authority

Ontario Power Generation

Pacific Gas and Electric Company

PPL Corporation

Public Utility District No. 1, Chelan County, Washington

Salt River Project Agricultural Improvement and Power District, Arizona

Scana Corporation

Seattle City Light

South Carolina Public Service Authority (Santee Cooper)

Southern California Edison

Southern Company

Xcel Energy Corporation

Dams Sector Government Coordinating Council Member Organizations

Bonneville Power Administration
California Department of Water Resources
Federal Energy Regulatory Commission
International Boundary and Water Commission
Lenawee County Department of Emergency Management, Michigan
Nevada Division of Water Resources
New Hampshire Department of Environmental Services
New Jersey Department of Environmental Protection
North Carolina Department of Environmental and Natural Resources
Ohio Department of Natural Resources
Pennsylvania Department of Environmental Protection
Tennessee Valley Authority
U.S. Department of Agriculture, Natural Resources Conservation Service
U.S. Department of Commerce, National Weather Service
U.S. Department of Defense, U.S. Army Corps of Engineers
U.S. Department of Energy, Office of Electricity Delivery and Energy Reliability
U.S. Department of Homeland Security, Federal Emergency Management Agency
U.S. Department of Homeland Security, National Protection and Programs Directorate
U.S. Department of Homeland Security, U.S. Coast Guard
U.S. Department of Labor, Mine Safety and Health Administration
U.S. Department of the Interior, Bureau of Indian Affairs
U.S. Department of the Interior, Bureau of Reclamation
U.S. Environmental Protection Agency
West Virginia Critical Infrastructure Protection Task Force

Levee Sub-Sector Coordinating Council Member Organizations

Association of State Floodplain Managers
FM Global
Los Angeles County Department of Public Works, California
Louisiana State Police

Maricopa County, Arizona

Metropolitan Water District of Southern California

National Association of Flood and Stormwater Management Agencies

South Florida Water Management District

South La Foursche Levee District, Louisiana

Southeastern Louisiana Flood Protection Authority - East

United States Society on Dams

Yazoo Mississippi Delta Levee Board, Mississippi

Levee Sub-Sector Government Coordinating Council Member Organizations

California Department of Water Resources

International Boundary and Water Commission

U.S. Department of Agriculture, Natural Resources Conservation Service

U.S. Department of Defense, U.S. Army Corps of Engineers

U.S. Department of Homeland Security, Federal Emergency Management Agency

U.S. Department of Homeland Security, National Protection and Programs Directorate

Appendix G: Acronyms and Abbreviations

AAR	After Action Report
CIRT	Computer Incident Response Team
DHS	Department of Homeland Security
DSSP	Dams Sector-Specific Plan
DSO	Dam Safety Office
EAP	Emergency Action Plan
FBI	Federal Bureau of Investigation
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
GCC	Government Coordinating Council
GIS	Geographic Information System
HSIN	Homeland Security Information Network
HSEEP	Homeland Security Exercise and Evaluation Program
HSPD	Homeland Security Presidential Directive
ICS	Incident Command System
IT	Information Technology
JTTF	Joint Terrorism Task Force
MSEL	Master Scenario Events List
NERC	North American Electric Reliability Corporation
NFPA	National Fire Protection Association
NID	National Inventory of Dams
NIMS	National Incident Management System
NIST	National Institute of Standards and Technology
NIPP	National Infrastructure Protection Plan
NRF	National Response Framework
PFMA	Potential Failure Modes Analysis
SCADA	Supervisory Control and Data Acquisition
SCC	Sector Coordinating Council
SSA	Sector-Specific Agency
US-CERT	United States Computer Emergency Readiness Team
WMD	Weapons of Mass Destruction

Appendix H: References

ASIS SPC.1-2009 – Organizational Resilience: Security, Preparedness, and Continuity Management Systems. This document provides a management framework for the planning and decision making necessary to anticipate—and prevent, if possible—incidents that disrupt business continuity. The document is available at http://www.asisonline.org/guidelines/ASIS_SPC.1-2009_Item_No._1842.pdf.

BS 25999 – Business Continuity Management. This standard describes the elements of a management systems approach to business continuity management. It includes risk management disciplines and processes, and is available at http://www.bsigroup.com/en/Assessment-and-certification-services/management-systems/Standards-and-Schemes/BS-25999/.

Emergency Action Planning for State Regulated High Hazard Potential Dams (FEMA 608). This document provides the findings, recommendations, and strategies of the National Dam Safety Review Board Task Group on Emergency Action Planning and Response for significantly increasing the number of emergency action plans for state-regulated, high-hazard potential dams. It can be obtained from FEMA in print or on CD, and can be viewed online at http://www.fema.gov/library/viewRecord.do?id=3122.

Federal Guidelines for Dam Safety: Emergency Action Planning for Dam Owners (FEMA 64). The guidelines encourage strict safety standards in the practices and procedures used by Federal agencies or required of dam owners regulated by the Federal agencies. They address management practices and procedures, but do not attempt to establish technical standards. The document can be obtained from FEMA in print or on CD, and can be viewed online at http://www.fema.gov/plan/prevent/damfailure/fema64.shtm.

Federal Guidelines for Dam Safety: Hazard Potential Classification System for Dams (FEMA 333). These guidelines are used in conjunction with FEMA 64 to define the types of dams for which an emergency action plan should be developed. They can be obtained from FEMA in print or on CD, and can be viewed online at http://www.fema.gov/library/viewRecord.do?id=1830.

Homeland Security Exercise and Evaluation Program (HSEEP). A set of guiding principles for exercise programs, as well as a common approach to exercise program management, design and development, conduct, evaluation, and improvement planning. Exercises are a key component of national preparedness, providing elected and appointed officials and stakeholders from across the whole community with the opportunity to shape planning, assess and validate capabilities, and address areas for improvement. Additional information is available at http://www.nmdhsem.org/uploads/files/HSEEP_Revision_Apr13_Final.pdf

Homeland Security Presidential Directive (HSPD)-5, Management of Domestic Incidents. This 2003 document establishes a national approach to domestic incident management that ensures effective coordination among all levels of government, and between the government and the private sector. Central to this approach is the National Incident Management System—an organizational framework for all levels of government—and the National Response Framework—an operational framework for national incident response. Additional information is available at http://www.dhs.gov/xabout/laws/gc_1214592333605.shtm

National Incident Management System (NIMS). This system provides a consistent nationwide template to enable Federal, State, tribal, and local governments; the private sector; and nongovernmental organizations to work together to prepare for, prevent, respond to, recover from, and mitigate the effects of incidents. Additional information is available at http://www.fema.gov/emergency/nims

Preparations for Handling Emergencies and Potential Emergencies at Projects. This 2005 document issued by the Federal Energy Regulatory Commission contains very helpful information which should be considered for inclusion in an emergency action plan. The document is available at http://www.ferc.gov/industries/hydropower/safety/guidelines/eap/prep.pdf.

Presidential Policy Directive 8, National Preparedness. . The objective of this 2011 document is strengthening the security and resilience of the United States through systematic preparation for the threats that pose the greatest risk to the security of the Nation, including acts of terrorism, cyber-attacks, pandemics, and catastrophic natural disasters. The document is available at http://www.dhs.gov/xabout/laws/gc_1215444247124.shtm.

Standard on Disaster/Emergency Management and Business Continuity Programs (NFPA 1600). . The 2007 version of standard 1600—developed by the National Fire Protection Association—provides a standardized basis for disaster and emergency management planning, as well as business continuity programs in private and public sectors, by providing common program elements, techniques, and processes. The standard is available at http://www.nfpa.org/assets/files/pdf/nfpa1600.pdf. 6542