

CHAPTER VI
EMERGENCY ACTION PLANS

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CHAPTER VI EMERGENCY ACTION PLANS

6-1 PURPOSE AND SCOPE

This chapter of the Engineering Guidelines provides the following:

1. The Commission's requirements for Emergency Action Plan (EAP) submittals and scheduling EAP exercises.
2. A basis for preparing and maintaining an effective and workable EAP in a manner consistent with Federal Guidelines.
3. Procedures and criteria for performing and reviewing the analytical studies required for an EAP.
4. A basis for preparing, performing, and evaluating EAP exercises.

Every EAP should be site-specific with individual project features and potential impacts governing the content of the plan.

6-2 REQUIREMENTS FOR EAPS AND EXERCISES

6-2.1 General Requirements for Submitting EAPs

Part 12, Subpart C of the Commission's regulations provides general requirements for EAPs at hydropower projects under the Commission's jurisdiction. Section 12.20 (a) of the Commission's regulations requires every applicant for license, licensee, and exemptee (all of which are referred to as "licensee" in this chapter) to develop and file an EAP with the Regional Engineer unless granted a written exemption in accordance with Section 12.21 (a) of the regulations.

When a licensee is not the owner of the dam nor is otherwise responsible for the maintenance, operation and monitoring of the dam, the licensee should coordinate with the owner of the dam to develop an EAP. In the event that the owner refuses to cooperate, the licensee should prepare the EAP to the best of its ability with the information available to it and provide it to the owner. If the owner indicates that it will not implement the EAP in the event of an emergency, the licensee should provide a copy of the EAP to pertinent emergency management agencies and the State agency responsible for dam safety and explain the situation to these agencies. The licensee should also advise the Regional Engineer of the owner's lack of cooperation.

In the event of competing applications for a license of an existing dam, if one of the applicants is the owner of the dam, it is that applicant's responsibility to develop an EAP. If none of the competing applicants is the owner of the dam, then it is the responsibility of the first applicant having its application on file to prepare the EAP.

The Commission has special provisions for EAPs at projects near nuclear power plants, located at federal dams, and under construction. These are discussed in Sections 6-7, 6-8, and 6-9, respectively.

6-2.2 Schedules for EAP Submittals and Exercises

The following sections describe the schedules for EAP submittals and exercise requirements:

6-2.2.1 EAPs

Filing requirements for EAPs are described in Part 12, Subpart C of the Commission's Regulations. A summary of the filing requirements is as follows:

1. *Unconstructed Projects* – no later than 60 days before reservoir filling.
2. *Unlicensed Constructed Projects* – the earliest of: 6 months after the date of the license application, 6 months after the Commission issues an order determining a license is required, or the date specified by the Commission or its authorized representative.
3. *Licensed Constructed Projects* – The date specified by the Commission or its authorized representative.
4. *Temporary Construction EAPs* – No later than 60 days before construction begins.

6-2.2.2 Annual Review

Licensees must conduct a comprehensive review of the adequacy of the EAP at least once a year in accordance Section 12.24 of the Commission's regulations. The EAP Status Report should indicate this review has taken place.

6-2.2.3 Agency Coordination and Exercises

The following is a summary of all requirements for agency coordination and exercises:

1. *Orientation Seminars* – There are two types of orientation seminars: *Annual Orientations* and *Exercise Orientations* (see Section 6-4.2.1).

Either an annual orientation or exercise orientation should be performed each year for each EAP. A separate annual orientation does not need to be performed during years that an exercise orientation takes place. A brief description of the annual orientation should be included in the EAP Status Report.

2. Drill – A training session and drill should be performed for each EAP annually (see Section 6-4.2.2). A separate training session and drill is not required in any year when a comprehensive exercise takes place. The EAP Status Report should include a brief description and evaluation of the training session and drill, including a list of lessons learned. The EAP Status Report should also describe all site-specific emergency equipment (e.g., sirens) and the date tested.
3. Tabletop – The Commission recommends that a tabletop exercise take place prior to a comprehensive exercise - i.e., a functional or full-scale exercise (See Section 6-4.2.3). It is beneficial to perform a tabletop exercise at least 30 days before the comprehensive exercise, so any changes to the EAP based on the tabletop exercise can be completed before the comprehensive exercise. It may be difficult to get all parties involved to participate in exercises on two separate days. For such cases it is possible, but not recommended, that the tabletop exercise takes place on the same day as the comprehensive exercise. Licensees can also consider performing tabletop exercises as part of annual orientations.

The Regional Engineer may require a tabletop exercise be performed for certain projects to enhance coordination with emergency management agencies. This is done on a case-by-case basis.

At least 90 days before performing a tabletop exercise, the licensee should submit a plan and schedule to the Regional Engineer explaining when and where the exercise will take place. Within 60 days of completing a tabletop exercise, the licensee should submit to the Regional Engineer an evaluation report of the exercise including comments from participants and any recommendations for modifications to the EAP. If both a tabletop and comprehensive exercise are being performed for a project within the same year, a single evaluation report can cover both exercises. Appendix 6-C contains a sample outline for an exercise evaluation report.

4. Functional or Full-Scale Exercise – The Commission tries to schedule at least one comprehensive exercise (i.e., a functional or full-scale

exercise) over a five year period in each river basin where there is a project required to have an EAP (see Sections 6-4.2.4 and 6-4.2.5).

At least 90 days before performing a comprehensive exercise, the licensee should submit a plan and schedule to the Regional Engineer explaining when and where the exercise will take place. Within 60 days of completing a comprehensive exercise, the licensee should submit to the Regional Engineer an evaluation report of the exercise including comments from participants and any recommendations for modifications to the EAP. Appendix 6-C contains a sample outline for an exercise evaluation report.

6-2.2.4 EAP Reprints

A completely reprinted copy of the EAP should be redistributed to all participants, including three copies to the Regional Engineer, on a five year cycle (as a maximum). The reprinted copy of the EAP should include updated inundation maps showing any changes within the inundation zones since the last reprint. The reprint should be in three ring binders or similar form to allow for updates.

The three copies provided to the Regional Engineer shall contain all information required under EAP format described in this chapter. It is acceptable and licensees are encouraged to submit reprints of EAPs on a more frequent basis.

The Regional Engineer will notify licensees of the date that reprints are due approximately one year prior to the deadline.

6-2.2.5 EAP Revisions/Annual Updates

Once notified of a significant discrepancy in the EAP that would have an adverse impact on the emergency response to a dam-safety incident (e.g., a change in how a first responder would be notified), the licensee is required to make the necessary changes to the EAP and issue revised pages, sections, maps, as appropriate, to all plan holders within 30 days. The licensee should mark all revised pages "Revised MO/DA/YEAR" and highlight the revised material.

It is beneficial to hand deliver revisions to high-priority emergency responders to ensure the changes are properly made to their EAPs. If it is not possible to hand deliver revisions within 30 days, licensees can send the revisions and follow-up that the revisions were incorporated into the EAPs during scheduled annual and exercise orientations or by phone (see Section 6-4.2.1).

Any other changes to the EAP that would not have a significant adverse impact on the emergency response to a dam-safety incident can be distributed as an annual update by the end of each year.

6-2.2.6 EAP Status Reports

There are a number of annual requirements regarding EAPs. By December 31 of each year, licensees should submit an EAP Status Report regarding these requirements to the Regional Engineer. The report should include the following:

- A statement that the licensee performed an annual review of the EAP.
- A brief description of the annual orientation, including date(s) and what was discussed.
- A brief description of the annual training and drill, including date and lessons learned.
- A brief description of the project's emergency equipment and the date tested.
- Annual updates to the EAP and, if applicable, the Radiological Emergency Response Plan. The annual updates should include any documentation of consultation between the licensee and emergency management agencies/responders which occurred during the year.
- A table indicating all parties who: (1) received EAP revisions and/or annual updates, (2) participated in the annual orientation, and (3) participated in the annual drill and/or were contacted during the call down test. Appendix 6-E contains a sample format.

6-2.2.7 Verification of Projects Exempt from Filing an EAP

Licensees of projects exempt from filing an EAP must annually perform a field reconnaissance to verify if there were any changes to upstream and downstream conditions affecting the determination that no reasonably foreseeable project emergency would endanger life, health, or property (see Section 6-6.2). The licensees should also annually verify that information is correct on the contact lists that will be used if a dam is in danger of failing or has failed (see Section 6-6.3).

By December 31 of each year, licensees of projects exempt from filing an EAP should send a letter to the Regional Engineer: (1) discussing the results of the field reconnaissance, (2) if appropriate, requesting a continuation of the exemption from filing an EAP, and (3) indicating the information on the contact lists was verified to be accurate.

6-2.2.8 Part 12.10 Reporting

Part 12.10 of the Commission’s Regulations requires licensees to report safety-related incidents to the Regional Engineer. Any activation of the EAP, including activation of the Non-Failure Emergency Condition (see Section 6-3.2.2 IV), is considered a safety-related incident. The licensee should report the incident by telephone to the Regional Engineer as soon as practicable. Afterwards the licensee should submit a written report describing the incident and emergency response according to the schedule specified by the Regional Engineer.

6-2.2.9 Table of Requirements

The following table describes the schedules for all EAP submittals and exercise requirements:

EXERCISE/SUBMITTAL	SCHEDULE	REPORTING DEADLINE
Orientation Seminar (Annual and Exercise Orientations)	Annual meeting or discussion before tabletop, functional, and full-scale exercise.	Submit information in EAP Status Report.
Drill	Annual - except during year of comprehensive exercise.	Submit information in EAP Status Report.
Tabletop Exercise	Recommend at least 30 days before comprehensive exercises or as required by the Regional Engineer.	Submit Plan & Schedule at least 90 days before exercise. Submit Evaluation Report within 60 days following exercise.
Functional/Full-Scale Exercise (Comprehensive Exercise)	Every 5 years within a river basin.	Submit Plan & Schedule at least 90 days before exercise. Submit Evaluation Report within 60 days following exercise.
EAP Reprint	Every 5 years.	Submit according to the schedule specified by the Regional Engineer.
EAP Status Report	Annual.	December 31.
EAP Revisions	Varies.	Submit revisions for significant discrepancies within 30 days of notification. Otherwise, submit revisions as the annual update with EAP Status Report.
Verification of Projects Exempt from Filing an EAP	Annual.	December 31.
Part 12.10 Notification	Following any activation of the EAP.	Provide oral report as soon as practicable after incident occurs. Submit written report as specified by the Regional Engineer.

6-3 PREPARING EMERGENCY ACTION PLANS

6-3.1 Basic Considerations for Preparing Emergency Action Plans

6-3.1.1 Purpose

There are many types of emergency events that could affect dams. Whenever people live in areas that could be flooded as a result of failure of or operation at a dam, there is a potential for loss of life and damage to property. The general purpose of these Guidelines is to encourage thorough and consistent emergency action planning to help save lives and reduce property damage in areas that would be affected by dam failure or operation.

An Emergency Action Plan, or EAP, is a formal document that identifies potential emergency conditions at a dam and specifies preplanned actions to be followed to minimize property damage and loss of life. The EAP specifies actions the licensee should take to minimize or alleviate the problems at the dam. It contains procedures and information to assist the licensee in issuing early warning and notification messages to responsible downstream emergency management authorities of the emergency situation. It also contains inundation maps to show the emergency management authorities the critical areas that require action in case of an emergency.

An **emergency** in terms of dam operation is defined as an impending or actual sudden release of water caused by an accident to, or failure of, a dam or other water retaining structure, or the result of an impending flood condition when the dam is not in danger of failure. The release of water may endanger human life or downstream property.

The effectiveness of an EAP program is enhanced by promoting a uniform format which ensures that all aspects of emergency planning are covered in each plan. Uniform EAPs and advance coordination with local and State emergency management officials and organizations should facilitate a timely response to a developing or actual emergency situation.

6-3.1.2 Scope

These Guidelines are used for preparing or revising EAPs and apply to all dams unless exempted under Part 12, Subpart C, 12.21 (see Section 6-6 for exemption requirements). Ownership and development of the floodplain downstream from dams varies; therefore, the potential for loss of life as a result of failure or operation of a dam will also vary. **Every EAP must be tailored to site-specific conditions.**

Emergency Action Plans generally contain six basic elements:

- Notification Flowchart
- Emergency Detection, Evaluation, and Classification
- Responsibilities
- Preparedness
- Inundation Maps
- Appendices

All of the elements should be included in a complete EAP. The licensee is responsible for the development of the EAP. However, the development or revision of an EAP should be done in coordination with those having emergency management responsibilities at the State and local levels. Emergency management agencies will use the information in a licensee's EAP to facilitate the implementation of their responsibilities. State and local emergency management authorities will generally have some type of plan in place, either a local Emergency Operations Plan or a Warning and Evacuation Plan.

6-3.1.3 The Six Basic Elements of an EAP

This section lists and briefly examines why there is a need for the six basic elements of an EAP. The requirements of these elements are discussed in detail in 6-3.2.2, which presents a format for uniformity among EAPs.

A. Notification Flowchart. A notification flowchart shows who is to be notified, by whom, and in what order. The information in the notification flowchart is required for timely notification of those responsible for taking emergency actions.

B. Emergency Detection, Evaluation, and Classification. Early detection and evaluation of the situation(s) or triggering event(s) that initiates or requires an emergency action is crucial. The establishment of procedures for reliable and timely classification of an emergency situation is imperative to ensure that appropriate course of action is taken based on the urgency of the situation. It is better to activate the EAP while confirming the extent of the emergency, than waiting for the emergency to fully develop.

C. Responsibilities. A determination of responsibility for EAP-related tasks should be made during the development of the plan. Licensees are responsible for developing, maintaining, and implementing the EAP. This includes notifying appropriate emergency management officials when a dam failure is imminent, a potentially hazardous situation is developing, or large releases are expected. State and local emergency management officials having statutory obligation are

responsible for warning and evacuation within affected areas. The EAP must clearly specify the licensees' responsibilities to ensure effective, timely action is taken should an emergency occur at the dam. The EAP must be site-specific, since conditions at and downstream of all dams are different.

D. Preparedness. Preparedness actions are taken to moderate or alleviate the effects of a dam failure or operational spillway release and to facilitate response to emergencies. This section identifies actions to be taken prior to any emergency.

E. Inundation Maps. An inundation map should delineate the areas that would be flooded as a result of a dam failure. Inundation maps are used both by the licensee and emergency management officials to facilitate timely notification and evacuation of areas affected by a dam failure or flood condition. These maps greatly facilitate notification by graphically displaying flooded areas and showing travel times for wave front and flood peaks at critical locations.

F. Appendices. The appendices contain information that supports and supplements the material used in the development and maintenance of the EAP.

6-3.1.4 Coordination

It is vital that the development of the EAP be coordinated with all entities, jurisdictions, and agencies that would be involved with a dam failure and/or flooding as a result of large operational releases, or that have statutory responsibilities for warning, evacuation, and post-flood actions. Coordination with upstream and downstream dam owners is also important to determine what could be done to mitigate effects resulting from an emergency. The finished product should be user-friendly as it realistically takes into account each organization's capabilities and responsibilities.

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

The tasks and responsibilities of the licensee and the emergency management officials that would be implemented during a dam emergency incident should be clearly stated and be as compatible as possible.

To facilitate compatibility, the licensee should coordinate emergency response actions with the local emergency management officials who have the responsibility to provide a timely warning and evacuation notice to populations at risk. This should help prevent over, or under, reaction to the incident by various organizations.

Coordination with emergency management officials is enhanced through a licensee's EAP exercise program. A detailed discussion of coordination through exercises is in Section 6.4.

6-3.1.5 Evacuation

State and local officials who are charged with the safety of the public who live in areas that would be inundated by failure of a dam or flood releases are responsible for evacuation planning and implementation during a dam emergency. The licensee should not usurp the responsibility of the local authorities responsible for evacuation. However, there may be situations where recreational facilities, campgrounds, or residences may be located below a dam where local authorities would not be able to issue a timely warning. In such cases, the licensee should coordinate with local emergency management officials to determine who will warn these people and in what order. Evidence of coordination between the licensee and the alerting agencies should be provided in the EAP.

6-3.1.6 Emergency Duration, Security, Termination, and Follow-up

An EAP needs to address who in the licensee's organization issues status reports during the emergency, when and how a declared emergency will be terminated, what security provisions shall be maintained at the dam, and plans for a follow-up evaluation and report.

- A. Emergency Duration. Emergency situations that occur at a dam will require that status reports and situation assessments be provided by the licensee to appropriate organizations throughout the duration of the incident.
- B. Security Provisions. An Emergency Action Plan should consider security provisions at, and surrounding, the dam during emergency conditions in order to protect the public and permit effective performance of emergency response actions. This will require coordinating with local law enforcement agencies.
- C. Emergency Termination. There are two conditions requiring a termination of the emergency. One has to do with emergency conditions at the dam and the other is related to the evacuation and disaster response. The licensee is usually responsible for making the decision that an emergency condition no longer exists

at the dam. The EAP should clearly designate the responsible party. The applicable State or local emergency management officials are responsible for termination of the evacuation or disaster response activities.

The licensee and State and local officials should agree on when it is appropriate to terminate an emergency. The licensee should cooperate with State and local officials to determine if a news release is appropriate which can be used by the media for broadcast to the general public notifying them of termination of the emergency condition. Such news releases are expected to be a supplement to other methods of notifying the public that the emergency has been terminated.

D. Follow-up Evaluation. Following an emergency, an evaluation and review should be conducted by the licensee that includes input from all participants. The following should be discussed and evaluated in the after-action review:

- Events before, during, and following the emergency;
- Significant actions taken by each participant, and what improvements would be practicable for future emergencies; and
- All strengths and deficiencies found in procedures, materials, equipment, staffing levels, and leadership.

The results of the after-action review should be documented in an evaluation report chaired by the licensee and used as a basis for revising the EAP.

6-3.1.7 Maintaining the Emergency Action Plan

After the EAP has been developed, approved, and distributed, the job is not done. Without periodic maintenance, the EAP will become out-dated, lose its effectiveness, and no longer be workable. If the plan is not exercised (verified), those involved in its implementation may become unfamiliar with their roles and responsibilities, particularly if emergency response personnel change. If the plan is not updated, the information contained in it may become outdated and useless. Requirements for updating EAPs are in Section 6-2.2.5.

6-3.1.8 Document Security

For security reasons, it is important to limit information provided to the public and to tightly control distribution of information considered to be “sensitive”. Licensees should control the dissemination of technical information such as engineering details (text and drawings) specific to the dam, potential modes of failure, facility details, etc. This can be done by keeping specific engineering details in controlled EAP copies, while removing such details from copies distributed to outside agencies that have no specific need for the information.

With this process, it is possible to have different versions of the EAP. One version would contain the information described in these guidelines and be for the licensee's and Commission's use. Another version could be stream-lined for emergency management agencies to contain only information they need to respond to an emergency. The stream-lined version(s) should be coordinated with agencies to ensure they have enough information to perform their duties. For example, the National Weather Service may need additional information not required by other agencies, such as the dambreak analysis and engineering drawings of the structures. Licensees should go over the contents of the EAP with emergency response agencies during annual orientations or other meetings/exercises.

6-3.2 EAP Format

6-3.2.1 The Format

A format is provided in these Guidelines to ensure all six basic elements are included in an EAP, to provide uniformity, and to encourage thorough and consistent emergency action planning for levels of preparedness that may save lives and reduce property damage in areas affected by dam operation or failure. It is important that the EAP satisfies both licensee and regulatory requirements.

It is necessary that all EAPs within a given jurisdiction be similar and consistent to eliminate confusion when activating any EAP. To the extent possible, an EAP should be organized in the format that is most useful for those involved in the plan. The EAP should be user-friendly so that it will actually be used during EAP exercises and actual emergency events. Development of an EAP should consider the elements described on the following pages to ensure all aspects of emergency action planning are covered. If there are deviations in the EAP format from what is described in these guidelines, the licensee should notify the Regional Engineer in the EAP Status Report that the changes were discussed and mutually agreed upon by the users of the EAP.

During annual orientations or other meetings/exercises, licensees should review the EAP with representatives of emergency response agencies. The parties can discuss what portions of the plan are necessary for the agencies and if any changes to the plan would improve the overall efficiency of the plan.

The EAP is a living document and should be submitted in a loose-leaf binder so that outdated pages (or the entire EAP) can be easily removed and replaced with updated information, to ensure a complete, current, and workable plan. It is also beneficial to place the date of the EAP or current revisions on each page.

The format for an EAP appears below:

EAP FORMAT

Title Page/Cover Sheet

Verification Form

Table of Contents

- I. Notification Flowchart
- II. Statement of Purpose
- III. Project Description
- IV. Emergency Detection, Evaluation, and Classification
- V. General Responsibilities Under the EAP
 - A. Licensee Responsibilities
 - B. Responsibility for Notification
 - C. Responsibility for Evacuation
 - D. Responsibility for Termination and Follow-Up
 - E. EAP Coordinator Responsibility
- VI. Preparedness
 - A. Surveillance
 - B. Response During Periods of Darkness
 - C. Access to Site
 - D. Response During Weekends and Holidays
 - E. Response During Periods of Adverse Weather
 - F. Alternative Systems of Communication
 - G. Emergency Supplies and Information
- VII. Inundation Maps
- VIII. Appendices
 - A. Investigation and Analyses of Dambreak Floods
 - B. Plans for Training, Exercising, Updating, and Posting the EAP
 - C. Site Specific Concerns
 - D. Documentation

The format separates an EAP into two distinct sections: the basic EAP and the Appendices. Together, these sections constitute a complete EAP.

A. The Basic EAP. Sections I through VII of the format constitute the basic Emergency Action Plan. That is, they contain information that should be used by all parties during an actual emergency. For example, the licensee will use the notification flowchart to issue its emergency warning to the appropriate officials in a prioritized order. Similarly, the emergency management officials should use the flowchart to contact other officials or the licensee, as needed, throughout the emergency. As a second example, both the licensee and the emergency management officials will use the inundation maps extensively in fulfilling their responsibilities.

It must be remembered that the responsibilities of the State and local emergency management authorities and other organizations in the jurisdictions affected by a dam failure or flooding as a result of operation of a dam are not included in an EAP. Information unique to State and local emergency management authorities, and any other organizations who would have responsibilities for the warning and evacuation of populations at risk, would be included in the portion(s) of the appropriate jurisdiction's Emergency Operations Plan dedicated specifically to warning and evacuation of populations placed at risk as a result of dam failure or flooding due to large operational releases. However, the information in the EAP must be coordinated with the appropriate authorities since they will depend on and use the information in the licensee's EAP to help them carry out their responsibilities.

B. The Appendices. The Appendices are also an important element which completes the EAP. However, the information contained in the Appendices is not necessarily needed by all parties during an actual emergency. They typically contain support materials used in the development of the basic EAP. More specifically, the Appendices focus on such important issues as those that specifically address maintenance requirements for the EAP and dambreak investigations and analyses, among others. This information may be directly applicable to the actions of the licensee and possibly some of the emergency management parties, but may not be critical to the actions and activities of other parties during an actual emergency.

6-3.2.2 Format Items Defined

This section follows the heading and numbering of the format and describes in detail each element of an EAP.

Title Page/Cover Sheet/Verification Form

An EAP document's cover identifies it as an Emergency Action Plan and specifies the dam for which it was developed. Since each dam must have its own EAP with

its own specific procedures to be followed, title pages or cover sheets are essential, so personnel can be sure that they are using the right EAP for the circumstances. To assist State and federal dam safety personnel, include the **National Inventory of Dams number** unique to each dam on the title page.

Following the title page, a verification form should be included. This form should be signed by the licensee and indicate that the licensee has read the document, knows the contents, and finds all statements to be true and correct. A sample title page and verification form is included in Appendix 6-B.

Table of Contents

List all major items in the Table of Contents, including flow charts, figures, tables, etc. A sample table of contents is included in Appendix 6-B.

I. Notification Flowchart

The EAP should begin with one Notification Flowchart that clearly summarizes the following information and is applicable to each of the emergency classification levels considered (See Section 6-3.2.2 IV):

- Who is responsible for notifying each licensee representative(s) and/or emergency management official(s).
- What is the prioritized order in which individuals are to be notified.
- Who is to be notified.

The notification flowchart should include contact information necessary to reach emergency responders at all times. For parties that are contacted directly, the flow charts should include individual names and position titles, office and home telephone numbers, alternative contacts and means of communication (e.g., radio, cell phone).

In many cases, emergencies are reported to local emergency dispatch centers that are operated 24 hours a day, 7 days a week. These dispatch centers are then responsible for notifying all pertinent emergency responders. If an emergency dispatch center is on the flow chart, consideration should be given if the caller could be outside the dispatch center call range (e.g., 911 calls made at the dam would go to a different jurisdiction than where the impacts would occur.) It may be necessary to include back-up information for contacting emergency responders directly.

The number of persons to be notified by each responsible individual on the notification flow chart should be governed by what other responsibilities the

person has been assigned. It is usually recommended that individuals not be responsible for contacting any more than three or four other parties.

The notification list should consider the following:

- Licensee.
- Emergency dispatch centers.
- Local emergency management officials and other organizations.
- Appropriate federal and State emergency management agencies.
- Residents and property owners that are located immediately downstream of the dam within the boundary of potential inundation where available warning time is very limited.
- Operators of upstream and downstream dams.
- Managers and operators of recreation facilities.
- National Weather Service
- News media.¹
- Others, as appropriate.

Although the list is not all inclusive, nor a prioritization of those entities listed, both the licensee and the local, State, and Federal emergency management authorities are typically given top priority in the notification flowchart.

The Notification Flowchart should be easy to follow for each emergency classification level (see Section 6-3.2.2 IV). A single flowchart that represents all levels is preferred, for the sake of effectiveness and simplicity. However, under certain conditions for clarity it might be necessary to develop a flowchart for each classification level. Color coding (i.e. using different colored lines to trace the proper sequence of notification under various emergency classification levels) may prove helpful. If necessary, narrative information supplementing the flowchart may be provided on the page following the flowchart.

NOTE: Information is typically exchanged both up and down the notification flowchart. During emergencies, licensees and emergency responders can also

¹ The news media, including radio, television, and newspapers, should be utilized to the extent available and appropriate. Use of news media should be preplanned to the extent possible by the licensee or emergency management officials. Notification to the news media may be by the licensee or emergency management officials depending on the type of emergency. Notification plans should define emergency situations for which each medium will be utilized and should include an example of a news release that would be the most effective for each possible emergency. The use of Joint Information Centers comprised of representatives from each organization involved in the management of an incident will ensure a coordinated release of public information. Information for media ordinarily should not be relied upon as the primary means of warning.

coordinate information at Emergency Operations Centers or through periodic status reports via conference calls.

Copies of the flowchart should be readily available to each individual having responsibilities under the plan, and should be kept up-to-date through exercises and revisions.

A sample Notification Flowchart is shown on the next page.

NOTE: *This is only a sample flowchart. A flowchart should be tailored to the specific needs and notification priorities of the dam to which it applies.*

II. Statement of Purpose

Following the Notification Flowchart, briefly state the purpose and scope of the EAP. Two examples of a statement of purpose are shown below.

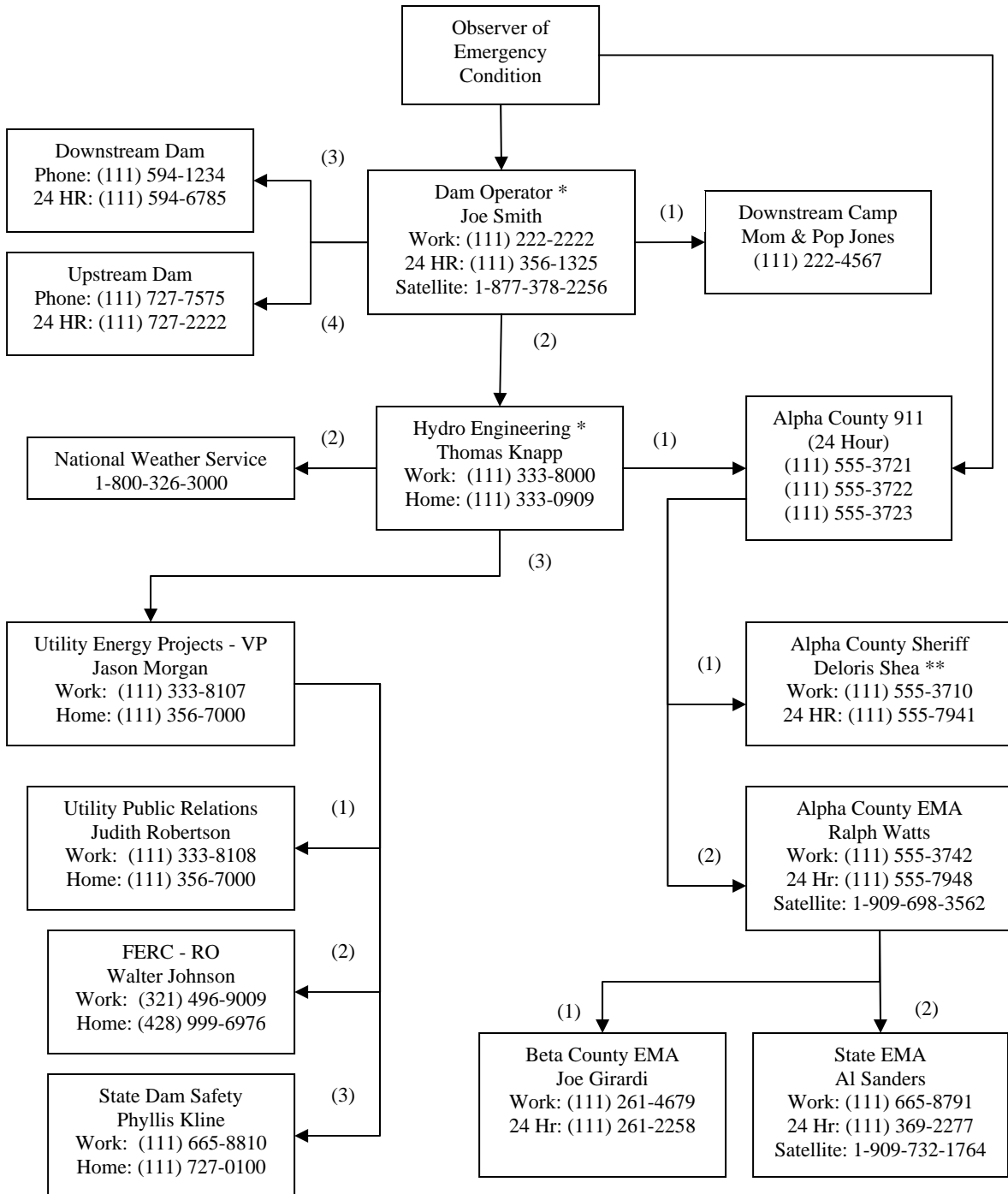
Example 1: "This plan defines responsibilities and provides procedures designed to identify unusual and unlikely conditions which may endanger Beta Creek Dam in time to take mitigative action and to notify the appropriate emergency management officials of possible, impending, or actual failure of the dam. The plan may also be used to provide notification when flood releases will create major flooding."

Example 2: "The purpose of this Emergency Action Plan (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."

III. Project Description

Provide a description of the project and its location. Include a project vicinity map and a simple drawing showing project features. List and briefly describe any significant upstream or downstream dams. List and briefly explain the impacts to downstream communities potentially affected by a dam failure or by flooding as a result of large operational releases. List and highlight critical site-specific concerns (i.e., critical operating procedures and material stockpiles) and refer the reader to more specific information contained in Appendix C of the EAP document. The licensee should limit design information and site-specific concerns in EAP copies that are distributed to outside agencies if the agencies have no need for the information (see Section 6-3.1.8 on Document Security).

SAMPLE NOTIFICATION FLOWCHART



* Utility Personnel should refer to pg. V-8 of EAP for Sample Warning Messages

** Sheriff will call Dam Operator if 911 is notified by non-Utility observer

IV. Emergency Detection, Evaluation, and Classification

The EAP document should include a discussion of procedures for timely and reliable detection, evaluation, and classification of an existing or potential emergency condition.

The conditions, events, or measures for **detection** of an existing or potential emergency should be listed. Data and information collection systems (early warning system hardware, rule curves or other information related to abnormal reservoir levels, inspection/monitoring plan, inspection procedures, instrumentation plan, etc.) should be discussed. The process that will be used to analyze incoming data should also be described.

Procedures, aids, instruction, and provisions for **evaluation** of information and data to assess the severity and magnitude of any existing or potential emergency should be discussed.

Emergencies are classified according to their severity and urgency. An emergency **classification** system is one means to classify emergency events according to the different times at which they occur and to their varying levels of severity. The classification system indicates the urgency of the emergency condition.

Declaration of an emergency can be a very controversial decision. The issue should not be debated too long. An early decision and declaration is critical to maximize available response time.

Some locations may require only two emergency classifications, while others may require more. For the purpose of these EAP Guidelines, **two dam failure emergency classifications** and one **non-failure emergency classification** are provided:

- Failure is Imminent or Has Occurred (Condition A)
- A Potential Failure Situation is Developing (Condition B)
- Non-failure Emergency Condition (Condition C)

Emergency classifications should use terms agreed to by the licensee and emergency management officials in order for the system to work and to ensure organizations understand terminology and respond appropriately to the event. For example, some parties may prefer having an increasing scale when describing an emergency (Level 1 – Non-failure Emergency Condition, Level 2 – Potential

Failure Situation is Developing, etc.). Others may prefer giving Condition C a different title such as “Unusually Large Spillway Release”.

Titles for emergency classifications should be chosen carefully by the organizations that will use them so that everyone will understand what each classification level means when notifications are issued and received. It is important that all EAPs within a given jurisdiction be similar and consistent to eliminate confusion when activating any EAP. If an EAP uses different classifications than those described in these guidelines, the licensee should notify the Regional Engineer in the EAP Status Report that the changes were discussed and mutually agreed upon by the users of the EAP.

The definitions of the three conditions are as follows:

- **Failure is Imminent or Has Occurred (Condition A)**

Generally, this situation should convey the impression that "time has run out" with respect to the failure of the dam or water retaining structure. This is a situation where a failure either has occurred, is occurring, or obviously is just about to occur. The question is often asked, "how much time is available when failure is considered to be imminent?" It is impossible to determine how long it will take for a failure to occur or for a complete breach to occur once failure begins. **Therefore, once a licensee determines that there is no longer any time available to attempt corrective measures to prevent failure, the "failure is imminent or has occurred" warning should be issued.** Emergency management agencies, for evacuation purposes, should conservatively interpret the phrase "failure is imminent" to mean that the dam is failing. It should not be assumed that there is any time lag between "failure is imminent" and "failure has occurred" scenarios. Therefore, "failure is imminent" and "failure has occurred" should conservatively be interpreted as essentially the same condition for evacuation purposes.

- **Potential Failure Situation is Developing (Condition B)**

Generally, this situation should convey the impression that "some amount of time" is still available for further analyses/decisions to be made before failure of the dam or water retaining structure is considered a foregone conclusion. This is a situation where a failure may eventually occur, but pre-planned actions taken during certain events (such as major floods, earthquakes, evidence of piping, etc.) may moderate or alleviate failure. Even if failure is inevitable, more time is generally available than in a

“failure has occurred” situation to issue warnings and/or take preparedness actions.

Is the time frame for this situation in hours, days, or weeks? When a situation is observed that may lead to a failure if left unattended, but there is no immediate danger, the licensee should issue a warning that a "potential failure situation is developing". The licensee should assess the situation and determine the urgency of the emergency situation. Based on the licensee's assessment (and as a result of prior coordination with the appropriate authorities), the authorities should be placed on alert and it is up to the authorities to determine the appropriate course of action.

If it appears that a situation may take days or weeks before it could develop into a failure situation, the local authorities may decide on one course of action. Periodic status report updates from the licensee are important because when it appears that the situation is continuing to worsen at the dam, in spite of the actions being taken to moderate or alleviate failure, the local authorities may decide to change their course of action. Depending on the location of downstream residents with respect to the dam and the estimated warning time available, the evacuating agencies should consider the prudence of early evacuation, or heightened awareness, of certain downstream areas until the emergency has passed.

To assist the evacuating agencies in selecting their appropriate course of action and to provide a proper transition from “potential failure situation is developing” to “failure is imminent or has occurred”, the licensee should clearly communicate their assessment of the situation to the agencies. The licensee should consider placing the agencies on an initial alert and provide periodic updates on the situation as it develops so that the agencies can assess when they should implement their evacuation procedures. For example, a licensee could issue an initial warning and periodic updates on the reservoir level as it rises during flood conditions and eventually overtops an embankment dam. As the reservoir rises, "a potential failure situation is developing" warning should be implemented with periodic updates on how much time is available before the embankment overtops. Immediately before the embankment overtops, a "failure is imminent or has occurred" warning should be issued.

- **Non-Failure Emergency Condition (Condition C)**

Non-failure emergency conditions are more common than the failure emergency conditions and are the most likely reason for using an EAP. Generally, this situation should be used when there is no danger of dam

failure, but flow conditions are such that flooding is expected to occur downstream of the dam. An example of a non-failure condition is when a licensee must open gates which, when operated, affect low lying structures and boat docks. Use of the EAP can provide an early warning to downstream areas during flood conditions or large spillway releases. **If this condition is initiated, it is important that all parties are made to understand the dam is NOT in danger of failing.**

Based upon the severity of the flooding, local site conditions, consultations with local emergency response agencies, and standard operating procedures used at the dam, the EAP may not need to be activated during a non-failure emergency condition. However, it may become necessary to fully activate the EAP if conditions escalate to levels agreed to beforehand by all involved participants. An important application of the EAP is when there is a flood occurring on the river system, but there may be no apparent threat to the integrity of the dam. In this situation, natural flooding is expected or is in progress upstream from the dam site and an impending or actual release of water to downstream areas will result from unusually large spillway releases or passage of unusually large flows at dams having uncontrolled spillways.

The licensee provides an important public service by notifying the appropriate agencies of the expected release or passage of flood waters below the dam. While the amount of flooding may be beyond the control of the licensee, information on the amount of releases from the dam is very helpful to the authorities in reaching any decisions on the need for evacuation. Site specific concerns will dictate the level of notification necessary during a non-failure emergency condition.

V. General Responsibilities Under the Plan

The plan should specify the person(s) or organization responsible for the maintenance and operation of the dam and the persons or groups responsible for implementing various phases of the EAP. Some specific responsibilities to be considered are discussed below.

A. Licensee's Responsibilities. The duties of the licensee or owner's designated representatives under the EAP should be clearly described. Suggested information for this section includes, but is not limited to, the following:

The operators should be advised of the importance of the Emergency Action Plan and why the EAP is necessary. The operators' duties under the EAP should be

described. Include pointers on how to communicate the emergency situation to those who need to be contacted along with samples of typical communications.

Specific actions operators are to take after implementing the EAP notification procedures should be described. For example, opening spillway gates, especially if a certain sequence is desired, and opening/closing water intakes, as appropriate. Instructions for the operation of the project during the anticipated emergency should be provided.

The chain of command should be described. Officials and alternates of the licensee that must be notified should be designated and a priority of notification determined. Notification of supervisory personnel on the licensee's staff is desirable, if time permits. Advice may be needed concerning predetermined remedial action to delay, moderate, or alleviate the severity of the emergency condition. The responsibilities required by the EAP should be coordinated with appropriate levels of management to ensure full awareness of organizational capabilities and responsibilities. EAPs must always be developed as a result of coordination and consultation with other entities and agencies that will be affected by a failure of a dam, or large operational releases, or have statutory responsibilities in warning and evacuation.

B. Responsibility for Notification. The person(s) authorized to notify State and local officials should be determined and **clearly identified** in the EAP. If time allows during an emergency situation, onsite personnel should seek advice and assistance. However, under certain circumstances, such as when failure is imminent or has occurred, the responsibility and authority for notification may have to be delegated to the dam operator or a local official. Such situations should be specified in the EAP.

This section may contain sample messages that can be used to help describe the emergency situation to the emergency management personnel, such as:

“This is identify yourself; name, position .

We have an emergency condition at the Wolf Creek Dam that is located two miles south of Union.

Briefly explain what is occurring at the dam (e.g., water levels are close to the top of the embankment, a sinkhole appeared on the dam)

We are currently activating Condition Indicate letter of our Emergency Action Plan because explain why (e.g., there is a potential failure situation developing) .

Please reference your copy of Wolf Creek Dam Emergency Action Plan and the enclosed inundation maps. Maps Indicate Sheet Nos. apply to your jurisdiction.

We will keep you updated on the situation, whether the situation is resolved or gets worse. We will try to call you within the hour to give you an update.

If you need to contact me, my phone number is give phone number . My name and phone number are also in the EAP.”

Different messages can be developed for each emergency classification. For example, a sample message for Condition A would include the estimated time the dam failed and which inundation zone would apply (fair weather or flood). It may be beneficial to put the sample messages next to the notification flowcharts instead of this section for ease of use during an emergency.

Emergency management agencies will likely establish an Emergency Operations Center to serve as the main distribution center for warning and evacuation activities. Most emergency management agencies operate under the Incident Command System which also calls for the creation of an Incident Command Post near the scene of an emergency. (See Appendix 6-A for suggested reading on the Incident Command System.) During an emergency, it is beneficial that a representative of the licensee goes to the Emergency Operations Center and, if necessary, the Incident Command Post to help agency personnel understand project specific information and inundation maps.

The availability of specific local resources should be determined through discussion with local agency personnel. Proper coordination and communication among onsite technical personnel at the dam, public information officer(s), and emergency personnel at the Emergency Operations Center is critical to a successful EAP. Thorough verification during comprehensive EAP exercises will greatly assist in providing this smooth interface.

The accurate and timely dissemination of emergency public information is very important to the overall success of an EAP. The person who is responsible for disseminating information to the media and the public on a periodic basis throughout the emergency should be designated. If resources are available, an exclusive public information officer should be identified to disseminate all media briefs. Also, means for keeping local authorities advised of continuing conditions at the dam should be described. The use of Joint Information Centers comprised

of representatives from each organization involved in the management of an incident will ensure a coordinated release of public information.

Licensees should develop procedures for dissemination of *dam specific* information to the media in anticipation of questions the media may have about the incident as it applies to the dam. A procedure like this should, in effect, help minimize the potential for dissemination of misinformation and spreading of false rumors.

Throughout the United States, the National Weather Service (NWS) and/or other agencies have the general responsibility for issuing flood warnings. Include the appropriate agency having this responsibility on the notification chart so that its facilities can enhance warnings being issued.

C. Responsibility for Evacuation. Warning and evacuation planning are the responsibilities of local authorities who have the statutory obligation. Under the EAP the licensee is responsible for notifying the appropriate emergency management officials when flooding is anticipated, a dam failure is imminent or has occurred, or a potentially hazardous situation is developing.

This section should briefly explain the agencies that would be responsible for evacuation from a dam failure. The section can reference pertinent Emergency Operations Plans (EOPs) prepared by state and local emergency management agencies for more detailed information on evacuation procedures and protocols.

Licensees should not assume, nor usurp, the responsibility of government entities for evacuation of people. However, there may be situations in which routine notification and evacuation will not suffice, as in the case of a resident located just downstream of the dam or a campground that would be inundated within minutes of a dam failure. In these cases, the licensee should arrange to notify that person or campground directly. **This procedure should be coordinated with the appropriate public officials prior to an emergency situation developing.** Section 6-5 describes other procedures for dealing with high risk areas downstream of dams.

D. Responsibility for Duration, Security, Termination, and Follow-Up. Licensees should designate at least one person for on-site monitoring of the situation at the dam and keep local authorities informed of developing conditions at the dam from the time that an emergency starts until the emergency has been terminated.

Provisions for security measures at the dam during the emergency should be specified.

This section should explain how the licensee and State and local officials will coordinate to terminate an emergency. The applicable State or local emergency management officials are responsible for termination of the disaster response activities.

A follow-up evaluation after an emergency by all participants should be specified. The results of the evaluation should be documented in a written report.

E. EAP Coordinator Responsibility. The licensee should specify the designated EAP coordinator who will be responsible for EAP-related activities, including (but not limited to) preparing revisions to the EAP, establishing training seminars, coordinating exercises, etc. This person should be the contact if any involved parties have questions about the plan.

VI. Preparedness

Preparedness actions are taken to prevent a dam failure incident, or to help reduce the effects of a dam failure or operational spillway release and facilitate response to emergencies. A few of the preparedness actions that a licensee may take include providing emergency flood operating instructions, and arranging for equipment, labor, and materials for use in emergency situations.

The EAP should describe preparedness actions taken both prior to and following the development of emergency conditions. Preparedness actions involve the installation of equipment or the establishment of procedures for one or more of the following purposes:

- Preventing emergency conditions from developing, if possible, or warning of the development of emergency situations.
- Facilitating the operation of the dam to limit impacts in an emergency situation.
- Minimizing the extent of damage resulting from any emergency situations that do develop.

The need for **timely** action in an emergency situation cannot be overemphasized. The EAP should contain a discussion of provisions for surveillance, and evaluation of an emergency situation and should clearly indicate that emergency response procedures can be implemented in a timely manner. An important factor in the effectiveness of the EAP is the prompt detection and evaluation of information obtained from instrumentation and/or physical inspection procedures.

In the EAP, discuss the time factor from the actual occurrence of an emergency to awareness of the emergency, and its effect on the workability of the EAP. **Timely implementation of the EAP and coordination and communication with downstream local authorities are crucial elements in the effectiveness of emergency response to the incident.**

There are several types of preparedness actions that should be considered when developing an EAP. These actions include:

- Surveillance
- Response during periods of darkness
- Access to the site
- Response during weekends and holidays
- Response during periods of adverse weather
- Alternative systems of communication
- Emergency supplies and information

The following sections discuss each of these actions:

A. Surveillance. The EAP should contain a discussion of provisions for surveillance, detection and evaluation of an emergency situation and should clearly indicate that the EAP can be implemented in a timely manner.

When a dam is not continuously attended and dam failure or operational releases would endanger human life or cause significant property damage, it is imperative that procedures be developed to identify conditions requiring emergency actions, and to promptly alert emergency management officials responsible for warning and evacuation of residents who would be affected in the event of an emergency at the dam. In order to be able to promptly notify responsible officials of emergency conditions, a licensee should be able to detect and evaluate developing emergency conditions. The information system must be able to deliver clear, concise, and reliable data so that the responsible official(s) may react with confidence and implement the EAP. While the EAP is being activated, personnel should visit the site to verify conditions.

For an unattended dam, a remote surveillance system that includes instrumentation and telemetering facilities at the dam site should be considered to provide a continuous reading of headwater and tailwater levels. If the licensee has an operations control center that is attended 24 hours a day, the system should include a computer at the operations center to monitor the data, and to activate an audible alarm whenever the rate of change of the headwater or tailwater over a given period of time exceeds prescribed limits. The alarm should also be activated if the headwater or tailwater elevations exceed prescribed maximum or minimum levels.

The design must be site-specific. The limits programmed in a system must account for changes in headwater and tailwater levels that would occur during normal dam operation, floods, maintenance, etc.

Monitoring of the tailwater generally is more sensitive to changes resulting from a breach of the structures than monitoring the headwater. Changes in tailwater will alert operators more quickly to site conditions and help determine whether emergency management officials should be notified. If continuous readings of both the headwater and tailwater are available, the operator can obtain a current reading at any time and check conditions at the site after an alarm is sounded.

Provisions should be made for the alarm to sound when there is an interruption of power to, and loss of communication with, the monitoring instrumentation. (When a dam tender lives close to the project, an alarm should be installed in the dam tender's house.) When power to or communication with the site is interrupted, the dam should be staffed until conditions are returned to normal. Operation of the alarms should be checked and tested periodically. For instance, annual testing of the EAP might 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 specific occupants involved. Local officials should be fully involved in the development of these special procedures.

The EAP should describe any instrumentation for monitoring the behavior of unattended dams, and explain how warning systems would be activated. Instrumentation responses should be instantaneous to facilitate immediate action by operators.

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, with a means of portable communications, be at the dam when flood conditions or signs of serious structural distress have been identified.

If a discussion of remote surveillance at the dam is not applicable, that fact should be stated in the EAP.

B. Response During Periods of Darkness. Discussion in the EAP of the response to potential or actual emergency conditions during periods of darkness should be addressed.

Actions to be taken to illuminate the spillway, operating deck, or observation of distressed areas of the dam, and other actions that will facilitate the operation of gates or other emergency equipment should be described.

Any special procedures for contacting or notifying the proper personnel, local officials, or others during a power failure should be described.

The expected response time for verifying an emergency and implementing the EAP should be discussed in detail.

Any other special instructions for the dam operators or local officials should be included.

C. Access to the Site. The description of access should focus on primary and secondary routes and means for reaching the site under various conditions (e.g., foot, boat, helicopter, snowmobile, etc.). Also discuss in detail the expected response (travel) time. Special attention should be given to access if the main access road crosses the downstream channel and could be closed by flood waters.

D. Response During Weekends and Holidays. Discussion of emergency response during weekends and holidays should be included in this section.

The actions to be taken should be described in detail. Actions should be based on the dam tender schedule for attendance during this period.

Any special procedures for contacting or notifying personnel should be described.

E. Response During Periods of Adverse Weather. Discussion of emergency response under adverse weather conditions should be included.

The actions to be taken should be described in detail. Action should be based on whether the dam is attended or unattended.

Methods of access to the site (e.g., foot, boat, snowmobile) should be described.

The expected response time should be discussed in detail.

Any other special instructions for the dam operators or local officials should be listed.

F. Alternative Systems of Communication. The description of the availability and use of alternative communications systems at the site should be included.

Alternative channels of communication to be used in case of failure of the primary system or failure of other systems immediately available should be listed.

Proper procedures for activating the alternative channels of communication should be described.

Any other special instructions should be included.

G. Emergency Supplies and Information. There are certain planning and organizational measures that can help the licensee and local officials manage emergency situations more safely and effectively. These measures include stockpiling materials and equipment for emergency use and coordinating information. Also, alternative sources of power for spillway gate operation and other emergency uses should be provided. The EAP should list the location of each power source, its mode of operation, and if portable, the means of transportation and routes to be followed. The EAP should include the name and day/night telephone numbers of each operator or other responsible person.

If any of these measures apply, they should be discussed in the EAP. Specific types of information to include when describing these emergency supplies and information follow:

1. Stockpiling Materials and Equipment. Where applicable, document:
 - Materials needed for emergency repair, and their location, source, and intended use. Materials should be as close as possible to the dam site.
 - Equipment to be used, its location, and who will operate it.
 - How the operator or contractor is to be contacted.
 - Any other people who may be needed (e.g., contractors, laborers, engineers), and how they are to be contacted.
 - Any other special instructions. If stockpiling of materials and equipment is not applicable, this should be stated in the EAP.

NOTE: *For each applicable item, include specific contacts and their business and non-business means of communication.*

2. Coordination of Information. Where applicable, describe:

- The need for coordination of information on flows based on weather and runoff forecasts, failure, and other emergency conditions. Describe how the coordination is achieved and the chain of communications, including names and day/night telephone numbers of responsible people. Coordination with the National Weather Service (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.
- Additional actions contemplated to respond to an emergency situation or failure at an unattended dam. Include periods of darkness, inclement weather, and non-business hours.
- Actions to be taken to lower the reservoir water surface elevation, if applicable. Describe when and how this action should be taken. If not applicable, that fact should be stated 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 operators or other persons responsible for contact with other owners on when and how these actions should be taken. If such actions do not apply, that fact should be stated 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 its tributaries. The EAP should provide instructions for operators or other responsible persons on when and how these actions should be taken. If such actions do not apply, that fact should be stated in the EAP.
- Any other actions to be taken. If coordination of information on flows is not applicable, this should be stated in the EAP.

3. Other Site Specific Actions.

Describe any other site-specific actions devised to moderate or alleviate the extent of possible emergencies.

VII. Inundation Maps

The main purpose of inundation maps is to show the extent and timing of expected flooding from a dam failure. The maps should highlight downstream infrastructure, developments, recreation areas, and any other significant features within the inundation zone for evacuation and rescue purposes.

Inundation maps should be developed by the licensee in coordination with the appropriate State and local emergency management agencies, since responders will rely heavily on the maps during an emergency. The purpose of this coordination is to ensure the maps contain sufficient information for the agencies to warn and evacuate all people at risk from a dam failure.

A. Preparing Inundation Maps

The Commission recommends that licensees use Geographic Information System (GIS) technology to develop the inundation maps. Some of the benefits of using GIS technology are:

- Maps can be created in formats that are interchangeable among different systems. This allows files created by a licensee to be submitted to different agencies for use in their systems.
- It makes revising maps easier for new downstream development. Base maps showing streets and structures can be updated as more current information becomes available.
- Different layers of inundation zones can be kept within GIS to show different flooding effects from varying breach assumptions, taking breaches at different structures (e.g., main dam vs. saddle dike), possible domino failures, etc.
- It allows the maps to be easily tailored depending on the user's needs.
- It allows for a general estimate of the number of people at risk from a dam failure.

The maps should make use of the most current topographic information and aerial photos available. Digital files of aerial photos and topographic maps are available through the United States Geological Survey at varying resolutions. In addition, many counties and municipalities have higher resolution digital aerial photos and topographic maps which may be available for licensee use.

Once digital files of the inundation zones are created and geo-referenced, the files can be provided to agencies or jurisdictions with GIS capabilities. The agencies can then overlay the inundation zones on layers they have access to (e.g., property plats, addresses, owner names and phone numbers). This would allow agencies better use of their own information during an emergency and greatly enhance their warning and evacuation capabilities. If licensees have GIS capabilities but the emergency management agencies do not, the licensees can offer to modify inundation maps to contain additional information provided by agencies.

Digital files of the inundation zones and cross section information should be submitted to the Commission for use in its GIS. Appendix 6-D includes requirements for submitting inundation zone files for the Commission's GIS.

B. Content of Maps

Inundation maps should clearly show inundation zones, cross section information, dams, streets, railroads, bridges, campgrounds, and any other significant features. All features should be shown using local names or terms. Printed inundation maps should be at a scale sufficient to clearly show the downstream inhabited areas within the inundation zones.

1. Inundation Zones

Inundation maps should show areas inundated under flows from a dam failure during (1) fair weather conditions (often referred to as a "sunny day") and (2) flood conditions (i.e., inflow design flood). Inundation maps also typically show normal water levels. Adding inundation zones beyond the normal flows and two dam failure zones will make the maps more confusing and is not recommended.

If there is good reason not to include both dam failure boundaries - such as the inundation boundaries are essentially the same when shown at the map scale, or the agencies only want one inundation zone - then only one boundary is adequate. The discussion supporting this conclusion should be documented and included in the Appendix of the EAP.

The lines delineating the inundated area should be drawn in such thickness or form (solid line, dashed line, dotted line) as to readily identify the inundation limits as the main features of the map but not bold enough to block houses, roads or other features which are inundated by the flood waters. The area between the inundation lines representing the water level may be shaded or colored to distinguish the area of inundation. Care should be taken to select shading or colors which will not block important features on the map. Additionally, critical features or inundated structures can be highlighted to ensure visibility.

When plotting inundation limits between cross sections used for analysis, the lines should reasonably reflect the change in water levels with consideration given to topographic patterns and both natural and manmade features.

When inundation lines enter the area of an existing lake or reservoir, they should be drawn to represent an increase in the water level of the lake or reservoir. Should the increased water level overtop a dam, the appropriate inundation lines should continue downstream of the dam to represent expected flooding.

It should be determined if the failure of a dam will cause water levels to rise at any downstream dams to such a level that the downstream dams could fail also. For example, if a downstream dam has an earth embankment that would be significantly overtopped due to the upstream dam failure, then it may be necessary that the inundation zone reflect the additional flooding from failure of the downstream dam. Many factors should be considered for these cases, such as: the expected performance of the downstream dams during high flows, the lag time between dams, and possible operation actions at downstream dams (e.g., drawdowns) that could alleviate the flood wave. Therefore, how the inundation zones are developed should be considered on a case-by-case basis.

Inundation zones should extend downstream of the dam to a point where there are no longer significant increases in water levels that could impact life or property. For some projects where it would take several days for flows to diminish, it is possible to end the maps at a point where real-time flood warning can be provided. This would require planning and coordination with the National Weather Service. The inundation maps and EAP must indicate that real-time flood warning information can be issued. Since real time data is difficult to determine, it could take significant time to model an actual failure, and there are inaccuracies in predicted flood

travel times. Therefore, relying on real-time flood warning is not encouraged.

2. Cross Section Information

The maps should include cross section information for selected areas downstream of the dam. The following information should be included for the fair weather failure and flood failure scenarios:

- Distance of cross section downstream from the dam.
- Travel times (in hours and minutes) of the leading edge and peak of the dam break flood waves.
- Expected peak water surface elevations.
- Incremental rises in water levels.
- Peak discharges.

Some communities use local flood crest levels instead of elevations to describe floods. The licensee should prepare maps using terms accepted by the emergency agencies and local residents. The licensee should also try to ensure the cross section information is useful to all responders. For example, a sheriff may prefer the maps show the expected height of water over a road instead of peak water levels and incremental rise. However, the National Weather Service may need the incremental rise and water level to issue flood warnings.

An example cross section table is as follows:

XS 1 – 0.9 Mile Downstream of Dam		
	Fair Weather	Flood
Arrival Time	20 min	32 min
Time to Peak	50 min	1 hr 10 min
Max Elevation (ft)	659.8	661.4
Incremental Rise (ft)	7.1	3.4
Peak Flow (cfs)	4,700	7,300

C. Background Information

Care should be taken not to include too much technical information on the inundation maps. Excess information will hamper the first responder’s ability to quickly glean critical information from the map. A “Notes” sheet can be submitted in addition to the inundation maps to include background information.

The “Notes” sheet can be used by dam safety personnel and, if need be, ignored by first responders.

The following background information should be included with the inundation maps, when necessary:

- Include a map index if inundation maps are shown on several sheets.
- Identify the antecedent flow conditions the maps are based on and any other pertinent dam breach information.
- Supplement the inundation maps with water surface profiles showing the elevation prior to failure, the peak water surface elevation after failure, and highlight the location of critical structures.
- Include a written description of the areas affected by the dambreak to clarify unusual conditions. Describe the specific area threatened and include information on the extent and depth of the expected flooding, relative to known landmarks and historical flood heights.
- Describe the accuracy and limitation of the information supplied on the inundation maps and how best to use the maps. The following note can be included: “Because of the method, procedures, and assumptions used to develop the flooded areas, the limits of flooding shown and flood wave travel times are approximate and should be used only as a guideline for establishing evacuation zones. Actual areas inundated will depend on actual failure or flooding conditions and may differ from areas shown on the maps.”

D. Sample Maps

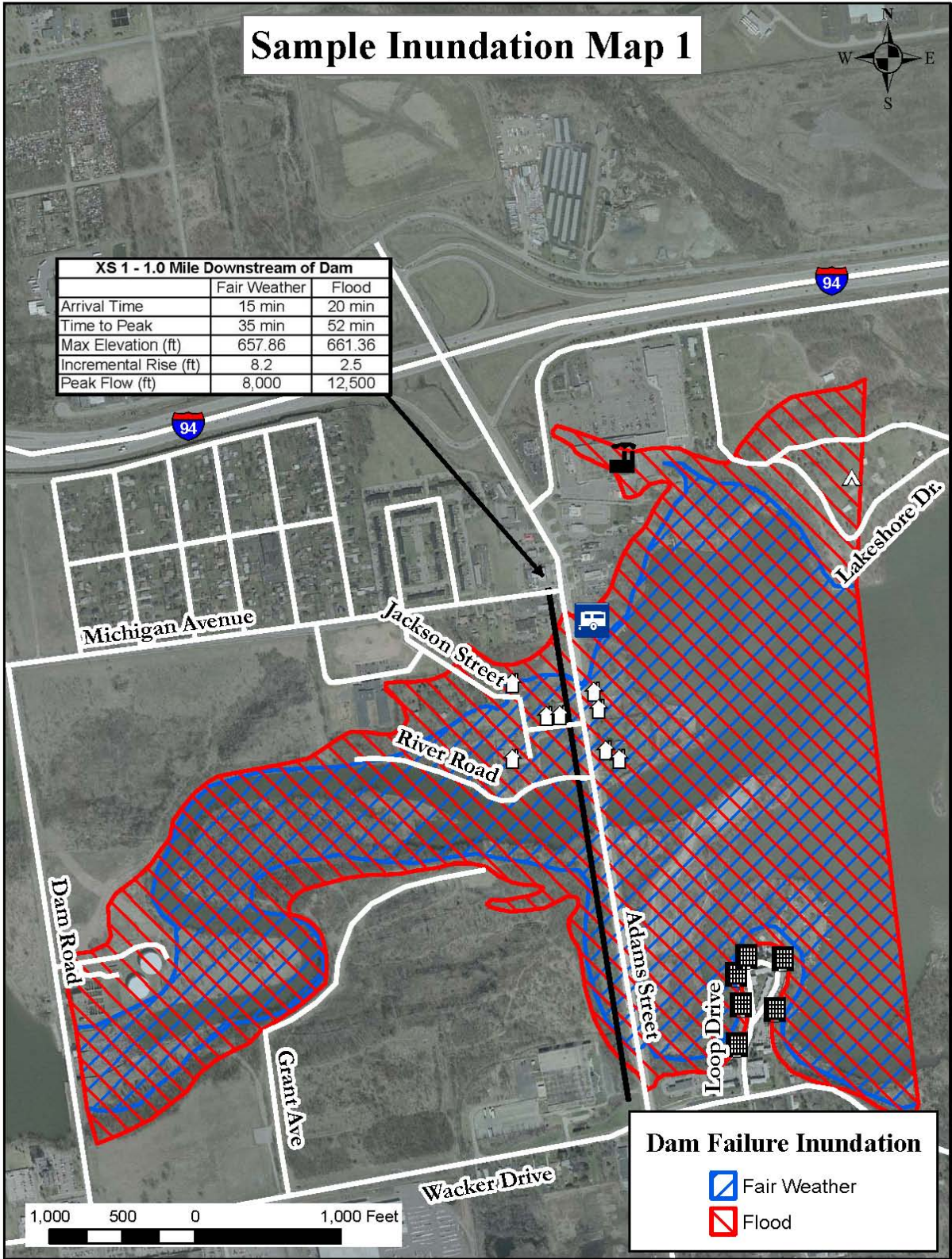
The following pages show inundation maps developed for a fictional project. Sample Inundation Map 1 was prepared by the licensee for the general use of all plan holders. The map uses a background aerial photograph as the base map. The aerial photograph clearly depicts houses, businesses, roads and bridges. The inundation map shows two inundation zones, one for the Fair Weather Condition and one for the Inflow Design Flood Condition (referred to as Flood). In addition, the map shows street names and highlights structures within the inundation zone. Finally, the inundation zone includes cross section information at a significant population center at the Adams Street Bridge.

Sample Inundation Map 2 is a modified version of Sample Inundation Map 1 created by importing the licensee’s inundation zone shapefile into the affected

Sample Inundation Map 1

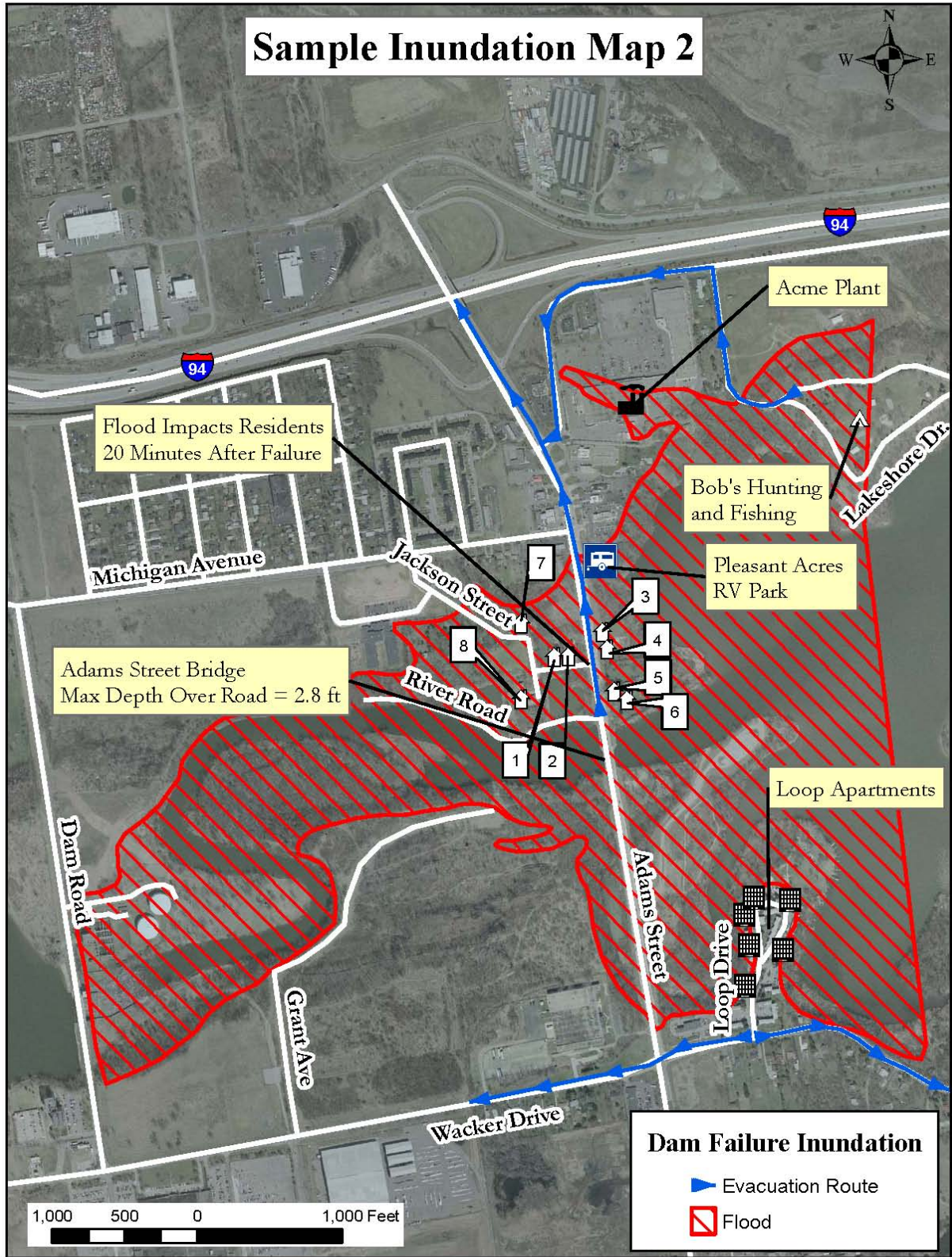


XS 1 - 1.0 Mile Downstream of Dam		
	Fair Weather	Flood
Arrival Time	15 min	20 min
Time to Peak	35 min	52 min
Max Elevation (ft)	657.86	661.36
Incremental Rise (ft)	8.2	2.5
Peak Flow (ft)	8,000	12,500



Dam Failure Inundation

-  Fair Weather
-  Flood



county's GIS. This map will be used by the local fire department responsible for evacuation. The revised map shows only the Inflow Design Flood inundation zone because there is no significant difference between the numbers of evacuees from either evacuation zone. The revised map shows numbers for each house and the names of each business in the flood zone. These coincide with a separate list of detailed information for each home and business as compiled and updated by the county – such as addresses, resident names, phone numbers, and amount of expected flooding. The fire department found the cross section information on the original inundation map to be too technical. Instead, the revised map gives a basic description of the amount of water expected over the Adams Street Bridge and the time before water starts impacting low-lying homes. The revised map also includes evacuation routes from the impacted areas as determined by the county.

E. Coordination

The licensee should review the inundation maps with the local jurisdictions during annual and exercise orientations (see Section 6-4.2.1). The licensee should explain the maps and the effects from a dam failure, using non-technical language. It is often beneficial to bring photos of structures at major cross sections and explain the expected water levels on these structures from a dam failure. The licensee should explain that the inundation zones and travel times are approximate and may vary depending on an actual failure.

The licensee should try to ensure that the local emergency managers understand the maps including the terms used, the area that would need to be evacuated, and how much time they would have to evacuate the residents in case of a dam failure. The licensee should also confirm the maps contain accurate and sufficient information for the emergency responders to perform their jobs.

The licensee and emergency managers should review if any new developments, buildings, or recreation areas were recently constructed within the inundation zones or if there was a change in the use of existing structures (e.g., if a previously vacant building now has residents). It is important that the emergency managers are aware of all developments that could potentially be impacted by a dam failure, since they are responsible for evacuations. The licensee and emergency management personnel can review GIS data to ensure each has the latest available information. If new streets, campgrounds, bridges, etc. are not shown on the maps, it may be necessary to hand draw the new information on the maps until the maps are updated.

F. Updating Maps

If there are significant changes to downstream development (e.g., new streets, bridges, subdivisions) that are not shown on the inundation maps and more-current base map information is available, the inundation maps should be updated. At a minimum, maps should be updated and reprinted during the EAP reprint cycle every five years (see Section 6-2.2.4).

G. Population at Risk

Information from the U.S. Census Bureau on GIS inundation maps can be applied to estimate the number of people at risk from a dam failure. This information may be useful to first responders to determine if they have adequate resources for evacuating the residents.

For sparsely-inhabited inundation zones, individual structures can be counted from aerial photographs and multiplied by the average household size for the county or census block. For larger towns and cities, the digital inundation zone can be overlaid on the census blocks. Then the percentage of census block covered by the inundation zone can be multiplied by the population in the census block (an area-weighted average).

These procedures give general estimates for the population at risk. A physical survey would be a more exact method to determine the number of people that could be impacted by a dam failure.

VIII. Appendices

Following the main body of the EAP (the basic EAP) an appendix section should be included that contains information that supports and supplements the basic EAP.

Listed below are some of the specific topics that should be covered in the appendices accompanying the EAP:

- Investigation and Analyses of Dambreak Floods
- Plans for Training, Exercising, Updating, and Posting the EAP
- Site Specific Concerns
- Documentation

These topics are described in detail below:

A. Investigation of Analysis of Dam Break Floods. This appendix should identify and briefly describe the method and assumptions selected to identify the potentially inundated areas. This appendix should also include a description of the possible limitations on the accuracy of the study (e.g., computer generated elevations are expected to be within a certain accuracy).

Several factors usually have to be evaluated whenever dam failures are postulated. The type of dam and the mechanism which could cause failure require careful consideration. Size and shape of the breach, time of breach formation, hydraulic head, and storage in the reservoir contribute to the dam failure hydrograph. Most of the methods for estimating dam break hydrographs require the selection of these parameters. There are also several available procedures for routing dam failure hydrographs to determine information on areas inundated by the flood as it travels downstream. Chapter II of the Commission's Engineering Guidelines discusses in detail the procedures for estimating the consequences of a dam failure.

Several different assumptions on inflow conditions should be made regarding the appropriate conditions prevailing at the time of a dam failure in order to ensure that the EAP includes all communities that need to be notified. A "fair weather" dam failure (reservoir at normal full pool elevation, normal stream flow prevailing) is generally considered to have the most potential for loss of human life, primarily due to the element of surprise. A failure at the inflow design flood is considered to show the upper limit of inundation.

Many methods for developing the dam failure hydrograph and routing dambreak flows downstream are available. Many Federal agencies have developed dambreak computer programs that are available upon request. They may be obtained from the National Weather Service, Bureau of Reclamation, Natural Resources Conservation Service, Corps of Engineers, Tennessee Valley Authority, U.S. Geological Survey, and Federal Emergency Management Agency. Models that use unsteady flow and dynamic routing method such as HEC RAS are preferred.

Sensitivity analyses (i.e., varying the breach parameters such as breach width and time to failure for the various flood inflow conditions) are recommended in order to fully investigate the effect of a failure on downstream areas. Usually, an assumed failure during "fair weather" conditions results in the worst-case condition for EAP planning purposes since a failure during flooding conditions would occur when people are "on-alert". When it is not obvious whether the notification list would be appropriate for a failure during major flood conditions, the sensitivity analysis should be performed. The sensitivity analysis should vary

key assumptions to identify their effect on various failure scenarios in order to select the most appropriate failure mode for developing the EAP. The sensitivity analysis is included for two primary reasons:

1. A sensitivity analysis should be performed when it is not obvious that failure during a "fair weather" condition would constitute the worst-case condition. For example, situations occur where failure during a "fair weather" condition will not result in a hazard to downstream life and property. In this situation, a failure during flood flow conditions should be investigated to determine if notification procedures are necessary in the event of an emergency. In addition, if a failure during a flood condition will result in a different notification list or priority of notification from that considered appropriate for a "fair weather" failure, the EAP should be modified accordingly. This condition often occurs in sparsely populated areas. A sensitivity analysis is necessary in this case to ensure that all structures that could realistically be impacted are included on the inundation map and all necessary local officials are included in the notification procedures. However, as indicated above, in many cases only one failure scenario, whether it be a "fair weather" failure or a failure during a flood condition, requires analysis since the notification list and the priority for notification usually remains the same regardless of the antecedent condition investigated. In all cases, practical considerations should govern in conducting dambreak analyses since the ultimate goal is to develop the best workable EAP.
2. A sensitivity analysis is also necessary when a licensee desires to demonstrate that a failure under any foreseeable failure scenario would not constitute a hazard to life and/or property, and an exemption from EAP requirements may be justified. In requesting such an exemption, a supporting sensitivity analysis is required.

The need to consider the domino effect should be made on a case-by-case basis. If the assumed failure of a dam would cause the failure of any downstream dams, the licensee has the responsibility to consider the domino effect in routing of the flood wave downstream. The flood wave should be routed to a point where it no longer presents a hazard to downstream life or property, which includes downstream dams. The licensee, after assuming a hypothetical failure of its dam, should make an engineering judgment regarding the potential for failure of the downstream dams. The licensee should then consider if as a result of the failure of the dam being investigated, it would be prudent to consider failure of any downstream dams during the routing of the dambreak flood wave. The licensee may coordinate with the FERC Regional Office staff to decide whether downstream dams should be considered to fail from the domino effect. Coordination of such

studies with other downstream dam owners should be undertaken by the licensees, where feasible.

B. Plans for Training, Exercising, Updating, and Posting the EAP. Plans should be developed for the annual training of project operators and other responsible personnel, for conducting periodic EAP exercises, for ensuring timely updating of the EAP, and for posting the Notification Flowchart. New personnel should be trained immediately when they become responsible for EAP activities.

1. Training

Training of people involved in implementation of the EAP should be conducted at least annually to ensure that they are thoroughly familiar with all elements of the EAP, the availability of equipment, and their responsibilities and duties under the plan.

Technically qualified personnel should be trained in problem detection and evaluation and appropriate remedial (emergency and non-emergency) measures. This training is essential for proper evaluation of developing situations at all levels of responsibility which, initially, is usually based on onsite observations. A sufficient number of people should be trained to ensure adequate coverage at all times.

A training plan could be included in the appendices to the EAP. Exercises simulating emergency conditions are excellent mechanisms for ensuring readiness. Cross-training in more than one responsible position for each individual is advisable in order to provide alternates. A careful record by roster should consist of training completed and refresher training conducted.

For projects where there is little time for warning people immediately downstream of the dam, licensees may need to help emergency management agencies provide public education. The training plan should discuss any measures that will be taken during the year for educating downstream residents on what they should do during an emergency. Section 6-5 discusses possible public education measures.

2. Exercising.

A proposed exercise schedule and the plans for the EAP exercise program should be included in this portion of the appendices. It should also discuss plans for conducting an Evaluation of the exercise (both annual drills and

periodic comprehensive exercises) and plans for updating the EAP based on the comments from the Evaluation.

This section should also include a form that can be used to document actions taken during any actual emergencies.

The state of training and readiness of key personnel responsible for actions during an emergency should be a part of any exercise to make sure that they know and understand the procedures to be followed and actions required.

Any special procedures required for night time, weekends, or holidays should be included. The exercises should involve an annual drill, as well as periodic tabletop and functional exercises. Testing of remote sensing equipment at unattended dams should be included.

It is important to coordinate and consult with State and local emergency management officials and other organizations when developing a comprehensive EAP exercise program in order to enhance the realism of the exercises. Their involvement will greatly improve the close coordination necessary for a successful execution of emergency procedures during an actual emergency. The exercises should include participation by both the licensee and the affected State and local emergency management officials. The exercises should be evaluated both orally and in writing and the EAP should be revised to incorporate the suggested improvements.

3. Updating.

All aspects of the EAP are subject to periodic review and updating in accordance with the Guidelines and the specific and detailed instructions contained in Section 12.24 of the Commission's Regulations. Filing requirements for updates are further discussed in Section 6-2.2.5.

4. Posting of the Notification Flowchart.

An up-to-date copy of the Notification Flowchart should be posted in prominent locations at the dam site and local Emergency Operations Center (essential for unattended dams), as appropriate.

The flowchart should be posted at appropriate phones and radio transmitters at the dam, powerhouse (if applicable), and any other desirable locations. The locations of the posted flowcharts should be indicated in the EAP. Posting requirements for cellular phones present a unique problem. If cellular phones are to be used in an emergency, all users should be familiar

with the locations of the flowchart. Otherwise, pocket-sized or some other convenient form of flowchart should be carried by all cellular phone users.

A copy of the complete, up-to-date EAP should also be available to personnel at the dam and to local officials. The location of each copy should be stated in this section of the EAP. Consideration should also be given to having a copy of the EAP at the residences of key personnel.

C. Site Specific Concerns. Each dam and downstream area is unique. As a result, each EAP is unique. This section of the appendices should provide a discussion of any site specific concerns that provide valuable information affecting the EAP. The EAP should emphasize where appropriate structural drawings, flood data, etc. are maintained on-site. Quick access to this information is crucial during emergency events.

D. Documentation.

Include the most recent documentation of consultations with Federal, State and local agencies, including public safety and law enforcement bodies. Copies of the actual documentation sheets should be submitted to the Regional Engineer. All other copies of the EAP need only contain general statements pertaining to the documentation (e.g. a list of agencies involved, a statement that up-to-date documentation is on file, a statement that necessary coordination meetings have been held, etc.).

Include any memorandums/letters of agreement between the licensee and agencies regarding emergency procedures (e.g., if there is an agreement that the licensee will warn residents living directly downstream of the dam).

Include letters of acknowledgment from the contacted agencies indicating the agencies reviewed the plan and understand their responsibilities for alerting and/or evacuating the public in those areas within their jurisdictions.

Documentation should be updated on an annual basis to ensure that all participants have received the updates to the EAP and have the most up-to-date EAP on file. Remove older/obsolete documentation, as necessary.

6-4 EMERGENCY ACTION PLAN EXERCISES

6-4.1 General

The Federal Emergency Management Agency (FEMA) in its Exercise Design Independent Study Guide, IS-139, March 2003, defines an exercise as “a focused practice activity that places the participants in a simulated situation requiring them to function in the capacity that would be expected of them in the real event.” FEMA states the purpose of the exercise is “to promote preparedness by testing policies and plans and training personnel.”

Training and exercises of EAP procedures should be regularly performed to test the operational readiness, timeliness, and responsiveness of key licensee personnel responsible for actions during an emergency. Comprehensive, in-depth exercises of EAP procedures, which include active participation by State and local emergency preparedness agencies along with the licensee's personnel, are also necessary. Comprehensive exercises not only reveal the strengths and weaknesses in the EAP itself, but reveal gaps in available resources, improve coordination requirements, clarify roles and responsibilities, improve individual performance, and achieve public recognition of the EAP.

6-4.2 Types of Exercises

FEMA has identified five elements, or types of exercises, that constitute an exercise program, with each one building on the concepts of the previous exercise. It is advisable to build an exercise program upon competencies developed from simpler exercises to achieve greater success with the more complex exercises. This means that emergency exercises should be developed and conducted in an ascending order of complexity. Also, sufficient time should be provided between each exercise to learn and improve from the experiences of the previous exercise. The five exercise types, listed from simplest to most complex, are:

- Orientation Seminar
 - Drill
 - Tabletop Exercise
 - Functional Exercise
 - Full-Scale Exercise
- ←— Comprehensive Exercises

Functional and full-scale exercises are considered **comprehensive exercises**. Comprehensive exercises test, among other things, the licensee's warning and notification procedures, the State and local agencies response to the notification, their knowledge of the EAP inundation maps, and the cooperative spirit of the licensees and emergency preparedness agencies in a stress-induced environment.

The involvement of State and local emergency preparedness officials in a comprehensive exercise is necessary to perfect the close coordination and cooperation that is necessary for a successful execution of an EAP in an actual emergency.

Briefly stated, the licensee has the responsibility to provide warning and notification of a dam failure to the agencies, and the emergency preparedness agencies have the responsibility to provide for evacuation of the affected areas. The licensee must assume that if an emergency preparedness agency is notified of an emergency, the agency will respond appropriately. However, to ensure that everyone carries out their responsibilities, coordination, training and practice are necessary ingredients of a workable EAP.

The comprehensive exercise is intended to bridge the gap between the warning and notification issued by the licensee and the evacuation response of the emergency preparedness agencies. It is important that both the licensees and emergency preparedness agencies understand the total picture so that both parties can make the necessary changes to their plans. This will result in a smooth, confident response should an emergency situation occur.

The following sections describe the five types of exercises and describe how the exercises relate to the Commission's EAP program. Of the five types of exercises, tabletop, functional, and full-scale exercises are considered higher level exercises because of their complexity. These guidelines include detailed information on preparing for and performing higher level exercises based on FEMA manuals.

6-4.2.1 Orientation Seminar

An orientation seminar is a face-to-face meeting that involves bringing together those with a role or interest in an EAP (i.e., licensee and State and local emergency management agencies) to discuss the project and EAP. There are two types of orientation seminars - *annual orientations* and *exercise orientations*, as explained below.

A. Purpose of Exercise

The purpose of the orientation seminar is to enable each participant to become familiar with the EAP and the roles, responsibilities, and procedures of those involved. It is an opportunity to exchange information and ensure the EAP remains current and workable.

B. Participation

The orientation seminar involves licensee personnel and emergency management agencies.

C. Requirements

Annual orientations are face-to-face meetings between licensees and primary emergency management agencies whose jurisdictions would be quickly inundated (i.e., within the first 2-3 hours) or have significant impacts from a dam failure (i.e., many people would need to be evacuated). As the name implies, these meetings should take place at least once a year.

Exercise orientations are discussions performed at the beginning of tabletop, functional, and full-scale exercises to ensure all participants understand the EAP and their role during an emergency. Separate annual orientations do not need to be performed in the years that an exercise orientation takes place.

D. Where to Conduct Exercise

Annual orientations can be done on a one-on-one basis, where the licensee visits an individual agency office. Alternatively, if a dam failure would significantly impact several jurisdictions, several parties could meet at one time and location. Licensees can also consider combining annual orientations for several dams within a river basin into one meeting.

Exercise orientations typically take place in a round table or classroom style setting immediately before tabletop, functional, and full scale exercises.

E. Conducting the Exercise

The following list includes possible discussion topics during annual and exercise orientations:

1. Describe the project, possible effects of a dam failure, and EAP (especially the flowchart and inundation maps). Section 6-3.2.2 VII includes suggestions for preparing and explaining inundation maps.
2. Discuss any recent development along the river and verify if the information on the inundation maps is adequate.

3. Discuss how emergency management agencies will implement their evacuation plan and if all affected residents can be warned and evacuated in a timely manner.
4. Discuss emergency equipment at the project (e.g., sirens, back-up communication equipment).
5. Explain the difference between the conditions of notification (e.g., failure is imminent, potential failure situation is developing, non-failure). Have the agencies explain how they would react to each condition.
6. Get feed-back from the emergency management agencies on whether the EAP is understandable and useful. If not, discuss what can be modified.
7. Discuss how parties will coordinate and exchange information throughout emergencies.
8. Discuss results from recent annual drills or higher-level exercises.
9. Hand-deliver annual updates or revisions such as changes in organizations, personnel, phone numbers, emergency response responsibilities, or other site specific information. Ensure previous updates have been incorporated into the agencies' plans and superseded information has been replaced.
10. Request the agencies to notify the licensee of any changes to key personnel immediately.
11. Review what parts of the EAP are necessary for particular agencies. Portions of the plan that don't apply to particular agencies can be retained by that agency in a separate folder or removed at their option.
12. Go over schedules for future exercises.

F. Reporting Requirements

The annual EAP Status Report should briefly describe the orientation seminar. The EAP Status Report is further discussed in Section 6-2.2.6.

6-4.2.2 Drill

A drill tests, develops, or maintains skills in a single emergency response procedure. An example of a drill is an in-house exercise performed to verify the validity of telephone numbers and other means of communication along with the licensee's response.

A. Purpose of Exercise

The purpose of the drill is to ensure licensee personnel are fully cognizant of the procedures and actions required during an emergency, and that emergency procedures and equipment work properly.

B. Participation

The drill should include all operations staff, any personnel that work at the dam, and other licensee staff involved with the EAP. During the drill, licensee personnel should call all organizations on the notification flow chart to verify phone numbers and other means of communication are accurate.

C. Requirements

Each licensee is required to conduct an annual EAP training session and exercise known as the in-house drill to test the state of training and readiness of key licensee personnel responsible for actions during an emergency. The licensee should conduct an annual drill for each of its EAPs. It is acceptable for an annual drill to concurrently test the EAP for several dams when an overlap in notification is involved. No separate drill is required in any year when a comprehensive exercise takes place.

D. Conducting the Exercise

The drill should simulate an emergency condition. The licensee staff member responsible for conducting the test should first develop a realistic scenario under which the EAP would be implemented. Then participants should be questioned on how they would react to certain situations up to and including enacting the EAP. Preferably, the scenario should be varied from year-to-year. Any special procedures required for nighttime, weekends, and holidays should also be considered when developing the scenario.

During a drill, participants should perform a call down test - contacting the organizations that would be involved in an emergency to ensure that telephone numbers and any other means of communication listed on the notification flow

chart are accurate. During this call, participants can verify the contact information is correct, agency personnel are familiar with the EAP, and all parties know what they would do during an actual emergency. Beforehand, the licensee should try to ensure that any outside party being contacted is aware the call will be part of a drill. Furthermore, during the drill, the outside parties should again be informed the call is part of a drill and is not an actual emergency.

Licensees are encouraged (not required) to consider the merits of a surprise in-house drill versus a planned one. The licensee at the time it implements a "surprise" drill should advise its employees that the drill is a test and not an actual emergency. While a planned drill will allow participants to rehearse their roles in the EAP, a surprise drill can be more educational because it is likely to expose basic flaws in the EAP.

Testing of remote sensing equipment at unattended dams and emergency notification equipment such as sirens and two-way radios should be performed at least once a year. Equipment tests do not necessarily have to be performed on the same day as other drill activities. However, the tests are considered part of the drill and should be reported on in the EAP Status Report.

E. Follow-up

Immediately following the drill, the licensee should assess (evaluate) the results with all involved participants. The responses to the emergency scenario at all levels should be reviewed. The purpose of this evaluation is to identify deficiencies in the EAP, including notification, priorities, responsibilities assigned, etc.

The licensee should prepare a brief report describing the drill, evaluation, and any lessons learned. If the drill indicates changes should be made to the EAP, the document should be revised and the revisions disseminated to all involved parties. It is recommended that revisions and updates be hand-delivered to significant emergency management agencies.

F. Reporting Requirements

The EAP Status Report should include a brief report describing the drill, evaluation, and any lessons learned. The report should also describe the project's emergency equipment and the date tested. The EAP Status Report is further discussed in Section 6-2.2.6.

6-4.2.3 Tabletop Exercise

The tabletop exercise involves a meeting of the licensee and the State and local emergency management officials in a conference room environment. The exercise begins with the description of a simulated event and proceeds with discussions by the participants to evaluate the EAP and response procedures. The exercise provides opportunities throughout the exercise to stop and discuss what actions and responses would be appropriate.

A. Purpose of Exercise

The purpose of the tabletop exercise is to familiarize participants with roles, procedures, responsibilities, and personalities of the licensee and the emergency management agencies. The exercise should identify needed improvements in the EAP, identify needed improvements in the emergency management system and the licensee's organization, identify needed training/personnel deficiencies, and identify areas requiring additional coordination.

B. Participation

The tabletop exercise involves the various levels of the licensee and State and local emergency management personnel that would be involved in an actual emergency. The exercise should also include other representatives of localities that could be affected by a dam failure, such as elected officials and campground owners. Also, representatives from the National Weather Service should be invited since they are responsible for initiating Flood Warnings.

The individuals involved in the exercise should be those people who are responsible for the coordination and implementation of the EAP. They should be those individuals from the licensee and agencies that would be most active during a disaster.

C. Requirements

The Commission recommends that tabletop exercises be performed prior to comprehensive exercises. It is beneficial that they take place at least 30 days prior to the comprehensive exercise so any changes to the EAP based on the tabletop exercise can be completed before the comprehensive exercise. It may be difficult to get all parties involved to participate in exercises on two separate days. For such cases it is possible, but not recommended, that the tabletop exercise takes place on the same day as the comprehensive exercise. Licensees can also consider performing tabletop exercises during annual orientations.

The Regional Engineer may require a tabletop exercise be performed for certain projects to enhance coordination with emergency management agencies. This is done on a case-by-case basis.

D. Preparation

The process of developing a tabletop, functional, or full-scale exercise involves similar steps which largely differ in the level of complexity and realism desired. This involves **assessing the needs** for an exercise, **defining the scope** of an exercise, writing a **statement of purpose**, writing **objectives**, writing a **narrative**, developing a **master sequence of events list (MSEL)**, and writing **problem statements** for a tabletop exercise or **messages** for a functional or full-scale exercise. Greater realism and attention to detail are necessary for the development of the functional exercise than for the tabletop, with an even greater amount of detail needed for the full-scale exercise. These steps are briefly discussed below, with allowances needing to be made as to the level of detail desired in relation to the type of exercise being designed.

The first step in the process of developing an exercise is to **assess the needs** of the exercise by identifying those areas most in need of an exercise.

In **defining the scope** of an exercise, six components need to be addressed in the developmental stage: (1) the types of licensee and emergency management agency activities or procedures you want to exercise; (2) the parties to be involved; (3) the kinds of personnel involved; (4) the degree of realism desired; (5) the hazard or the selection of a high priority problem; and (6) the geographical area where the problem could occur.

The **statement of purpose** is then developed. It should clearly and concisely explain why the exercise is being conducted. At this point, the exercise should be announced, the necessary coordination should be accomplished, and the date and location should be established.

The next step in developing an exercise is writing **objectives**; that is, defining what should be accomplished by conducting the exercise. The needs assessment, scope, and purpose statement should be examined very closely during objective writing to address expected benefits of the exercise and what emergency actions are to be exercised. Exercise objectives should be specific and realistic, yet challenging, results-oriented, and measurable.

The next step is to prepare a **narrative**. A narrative (or scenario) is a short written story that sets the scene for the exercise. The job of the narrative is to get the exercise participants into the exercise as if they were confronting a real situation.

Simply put, the narrative is an account composed of a few paragraphs that provides background information to the exercise participants. The narrative should be written so that it helps participants to understand the exercise and reflect a sense of concern, urgency, and excitement.

While setting the scene for the simulated emergency and providing some specific information, the narrative should NOT provide participants with ALL the information necessary to respond to a situation. Participants will gather additional details during the exercise as the events unfold. Obviously, the narrative should NOT suggest possible responses to the simulated emergency.

The **MSEL** consists of a list of **major events** and **detailed events** that would happen during the exercise. The **major events** itemize the events from the beginning of the exercise to the conclusion that will require a response by the licensee or the emergency preparedness agencies. The **detailed events** itemize the details for each major event. The **messages** or **problem statements** are developed from the major and detailed events. Details of the exercise are transmitted to the participants through the messages or problem statements. These provide sufficient information to the participants so that they will be able to respond with an action or decision.

E. Conducting the Exercise

The methodology of tabletop exercises is by an open-ended discussion in a meeting format through a facilitator. The discussion is allowed to be interrupted by questions and participant comments. The effectiveness is determined by feedback from participants and the impact this feedback has on evaluating and revising policies, plans, and procedures. There is no utilization of equipment or deployment of resources.

The facilitator begins the tabletop session by reading a "narrative" (or scenario) which sets the scene for the simulated event. The narrative briefly describes what has happened and what is known up to the time of the exercise. Following the narrative, the facilitator will typically pose problem statements and ask participants to explain how they would react. The following are issues often discussed during the tabletop exercises:

- What actions do the dam operators take?
- What do operators of other dams on the river need to know?
- Who implements the EAP?
- Who has primary notification responsibility?
- What actions would each of the primary players take?

- Is the priority of calls on the notification flowchart appropriate?
- What are each emergency management agencies' actions, responsibilities, and considerations with regard to evacuations?
- Where will shelters be set up?
- Where will the Emergency Operations Center be set up?
- What evacuation routes are available?
- Who determines if outside assistance is needed?
- Are adequate resources available? If not, where can they be gotten?
- Who is providing public information and how?

A sophisticated form of the tabletop exercise provides the participants with "messages" as a stimulus for responses. The "messages" communicate detailed events to the participants as the exercise progresses. The purpose of the "messages" is to provide sufficient information to the participants so that they will respond with an action or a decision. New (or updated) messages are interjected throughout the exercise to evoke responses. The flow of the exercise depends on the quality of the messages and upon their precise timing in the exercise.

A facilitator for a tabletop exercise (or a controller for a functional or full-scale exercise) monitors the pace and flow of the exercise by introducing the scenario narrative and messages into play. Facilitators may also include individuals from the licensee's organization and the emergency preparedness agencies. The facilitator must be able to stimulate discussion, making sure that no one participant dominates the exercise. The facilitator leads the conduct of a tabletop exercise and makes sure every participant responds to at least one message during the exercise.

If there are residences, businesses, campgrounds, and recreation areas located in close proximity downstream of a dam, the timing of emergency responses is critical. The facilitator can have participants discuss the detailed steps they would take - from determining a problem at the dam through evacuations - and get them to estimate how long it would take to accomplish each step. These estimates can be used to establish the total response time, which can be compared to information from the inundation maps to determine if people can be warned and evacuated in time.

During the exercise, the facilitator or evaluators from the licensee's organization should note all issues being raised by the participants, especially those that will require follow-up actions. At the conclusion of the exercise, the facilitator should go over the notes and discuss with the participants how items will be addressed.

F. Benefits

The advantages of a tabletop exercise are that there is modest commitment in terms of time, cost and resources. It provides an effective method of reviewing plans, implementing procedures and policies, and it serves as an educational device to acquaint the licensee and key agency personnel on emergency responsibilities and procedures. It also acquaints licensee and emergency response personnel with each other on a personal basis.

The disadvantages of a tabletop exercise are that it lacks realism, and does not provide a true test of participants' capabilities. It provides only a limited exercise of plans, procedures, and participants' staff capabilities.

G. Follow-up

Once the exercise is completed it is necessary to evaluate the results of the exercise. The purposes of evaluating the exercise are to identify:

- needed improvements in the EAP
- needed improvements in the licensee's organization and the emergency management system,
- needed training/personnel deficiencies,
- whether the exercise has achieved its objectives, and
- areas requiring additional coordination.

The outcome of an exercise consists of individual improvement through training and EAP improvement through follow-up. Without evaluation, needed improvements will not be identified, improvements will not be made, and the exercise will not be as worthwhile.

Evaluation begins in the early stages of exercise development when the objectives are planned. The evaluation will determine if the exercise objectives were met. If the objectives were met, the exercise was successful.

Oral and written evaluations should be performed immediately after the exercise. The evaluation is a debriefing of the participants. It is a time to gather and share information about what happened during the exercise, to describe what went right, and identify what went wrong.

The oral evaluation is performed as a group discussion led by the facilitator. To minimize the defensiveness of the participants and maximize the sharing of information, the oral evaluation should be structured to give each participant an opportunity to share their observations and to encourage the participants to report

on both what went well and what went poorly. Each participant should typically be allotted a reasonable length of time to present their observations in order to prevent one participant from monopolizing the discussion.

After the oral evaluation is completed, written evaluation forms should be distributed for any additional comments by the participants. Both the oral and written evaluations should be used to strengthen the evaluation report data.

The licensee should prepare a brief written report that is based on observations and recommendations that come out of the evaluation, as well as the reports of the designated evaluators. Data needed for an evaluation report include one's own observations, the participants' debriefing comments, the participants' written evaluations, comments from the facilitator, any subsequent clarification or discussion with participants, and exercise plans, objectives, expected actions, and procedures. Appendix 6-C includes a suggested format for the evaluation report.

Follow-up is the final and critical stage of the exercise process and follow-up recommendations are the purpose of the evaluation report. Follow-up is the process of implementing the recommendations.

H. Reporting Requirements

At least 90 days before performing a tabletop exercise, the licensee should submit a plan and schedule to the Regional Engineer explaining when and where the exercise will take place.

Within 60 days of completing a tabletop exercise, the licensee should submit to the Regional Engineer an evaluation report of the exercise including comments from participants and any recommendations for modifications to the EAP. If both a tabletop and comprehensive exercise are being performed for a project within the same year, a single evaluation report can cover both exercises.

6-4.2.4 Functional Exercise

The functional exercise simulates a dam failure and other specified events in a stress-induced environment with time constraints. The participants “act out” their actual roles in a simulated emergency. **Conducting a functional exercise should be a major goal of every exercise program.** It offers the opportunity to test participants’ responses in a full simulation under "real-life" conditions, but without a field deployment of resources.

A functional exercise is considered a “comprehensive exercise”.

A. Purpose of Exercise

The functional exercise is designed to evaluate the following factors under simulated conditions that provide realism and stress:

- the capabilities and responses of the licensee and emergency management personnel.
- the workability of the information in the EAP.
- coordination between the licensee and emergency management personnel.
- individual and system-wide performances.

B. Participation

The functional exercise involves the various levels of the licensee and State and local emergency response personnel that would be involved in an actual emergency. The exercise should also include other representatives of localities that could be affected by a dam failure, such as elected officials and campground owners. Also, representatives from the National Weather Service should be invited since they are responsible for initiating Flood Warnings.

The individuals involved in the functional exercise should be those people who are responsible for the coordination and implementation of the EAP. They should be those individuals from the licensee and agencies that would be most active during a disaster.

A functional exercise can involve policy, coordination, and operational response personnel of the licensee and involved emergency management agencies. It is sometimes difficult (because of busy schedules or other commitments) to get policy-level personnel involved in a functional exercise, but their presence is beneficial. The licensee should attempt to involve key personnel so that the appropriate level of importance is understood by management.

C. Requirements

The Commission tries to have at least one comprehensive (i.e., functional or full-scale) exercise over a five year period in each river basin where there is a project required to have an EAP. This schedule is meant to ensure that licensee personnel and local emergency management agencies in each river basin do not have excessive lengths of time between exercises. If there are several dams owned by different organizations within a river basin or a licensee owns dams in adjacent basins, the following methods can be used to avoid excessive exercises:

1. Combining Exercises. In river basins with dams controlled by more than one dam owner, exercises can be combined to include multiple projects (See Figure 1). The exercise can be combined with other licensees or non-jurisdictional dams (e.g., U.S. Army Corps of Engineers, U.S. Bureau of Reclamation) in the same basin. Also, licensees that have projects in adjacent basins but whose failures would affect similar emergency management agencies, may choose to have a single functional exercise that includes both projects (See Figure 2).
2. Alternating Tabletop and Functional Exercises. Licensees that have projects in several river basins which overlap the jurisdictions of emergency management agencies can propose a combination of Tabletop and Functional Exercises over a five year period. For example if a licensee owns two dams in two nearby basins with many of the same emergency management agencies, the licensee may alternate functional and tabletop exercises between the two projects every five years.
3. Piggybacking on Other Functional Exercises. Emergency management agencies may have other functional exercises scheduled throughout the year for different hazards (e.g., earthquakes, terrorism) and can suggest the dam failure exercise be included. This is acceptable only if the dam failure scenario is adequately exercised. The exercise should test the warning and notification procedures for licensee personnel, the workability of the EAP, and how the emergency management agencies would evacuate downstream inundation zones. The dam owner would still be responsible for inviting all emergency management agencies affected by the dam failure to attend and preparing adequate messages to test the dam failure scenario.

Licensees with several projects in a single basin should strive to focus on a failure at a different project within the basin every five years or assume a domino failure of more than one of their dams. Licensees should have personnel from their other projects attend the functional exercise. The goal is to include as many of the licensee's personnel from different dams in the comprehensive exercise.

D. Preparation

Functional exercises should be performed after orientation seminars, drills and tabletop exercises have been conducted. If reactions to earlier exercises are good, the policy-level personnel will be more likely to participate in a functional exercise.

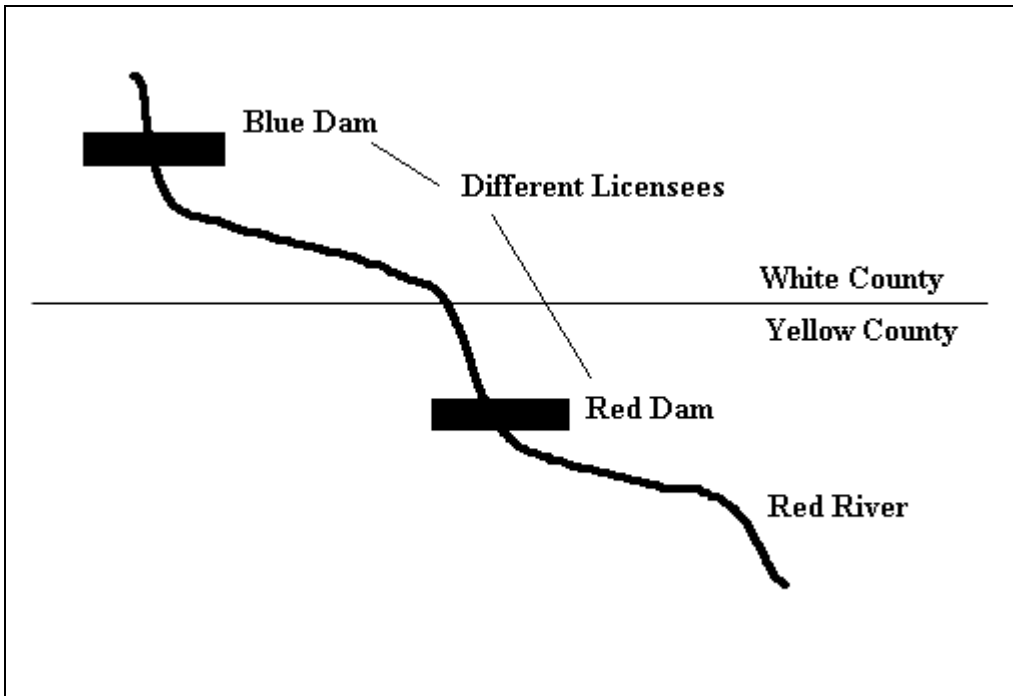


Figure 1 - Combined Functional Exercise

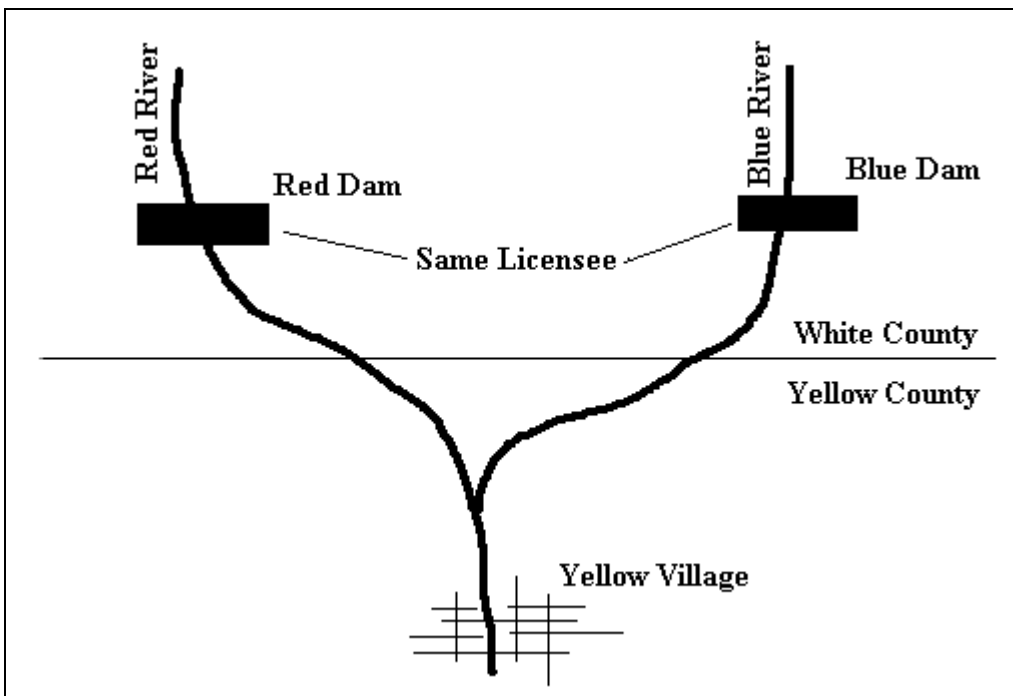


Figure 2 - Combined Functional Exercise

Simulation of a realistic emergency requires the development of objectives, a description of the situation (narrative), a master sequence of events list (MSEL), a timed sequence of messages, and communication between participants and simulators. The objectives, narrative, MSEL, and messages should be developed by an exercise team of one or more individuals. (See Section 6-4.2.3 on preparation for tabletop exercises).

Other preparation tasks for a functional exercise include assuring adequate physical facilities, organizing displays and materials, recruiting and training exercise participants, and planning for the exercise evaluation. The level of complexity needed for the functional exercise should be commensurate with the anticipated site conditions and complexity of the notification procedures.

Because these tasks are so varied and dependent upon each other's completion, it is important to plan this preparation time carefully. Milestones should be established along with responsibilities for each of the major activities of preparation.

E. Where to Conduct Exercise

The exercise should be conducted with the participants in one location or with the participants located at their own facilities. Having exercises where people are stationed where they work has the added benefit of evaluating communications through expected emergency communication links. However, there is a greater possibility to lose containment of messages (e.g., exercise messages may be confused for an actual emergency). Also, all parties will have to assemble after the exercise in one location for the evaluation session.

If possible, the licensee should encourage the activation of the Emergency Operations Center (EOC) at the State or local level, as appropriate, so that the EOC members can practice a coordinated, effective response in a time-pressured, realistic emergency situation. If the actual EOC is not activated, the exercise should bring together the policy, coordination and operational officials of the licensee and emergency management agencies into a simulated EOC.

F. Conducting the Exercise

An exercise orientation should be performed before a functional exercise to ensure all parties have a clear understanding of the effects of a dam failure and their role in the EAP.

The functional exercise begins with a narrative which sets the scene for the simulated event. Following the narrative, messages describing detailed events are

distributed to the participants. The messages should cause the participants to respond or take action.

The exercise should be conducted in a real-time environment, although compressed-time or skip time may be necessary after about an hour into the exercise to involve emergency responders further downstream. After the initial stages, momentum of the exercise is determined largely by spontaneous interaction among participants and simulators. Scenario-related events and messages of increasing complexity, threat, and pressure are interspersed in an emergency situation designed to test the participants' skills, knowledge, awareness, and ability to respond under simulated conditions.

The functional exercise is followed by an evaluation session that allows participants to evaluate their performance and lessons learned throughout the training exercise.

Apart from the actual participants in the functional exercise, there are three roles that representatives of the licensee and/or emergency preparedness agencies should fill. These are the exercise controller, exercise simulators, and exercise evaluators.

The controller's responsibilities include monitoring the sequence of events as they unfold, the flow of messages, the overall conduct of the exercise, controlling the spontaneous inputs by simulators, coordinating information among simulators, and responding to unplanned situations.

The simulators' responsibilities include sending pre-scripted messages at the scheduled time, responding to unanticipated actions by participants with spontaneous messages, and maintaining contact with the controller about the progress of the exercise.

The evaluators have the task of observing the actions and decisions of the participants during the exercise and contributing, along with the comments of exercise participants, to the formation of an evaluation report. In particular, evaluators will be looking to see how participants react to the scenario events and messages. Ideally, there should be an evaluation team with representatives from the licensee, agencies, and FERC.

G. Benefits

The functional exercise gives participants a fully simulated experience of being in a major disaster. The exercise provides the opportunity to test any functional area needed for an efficient response or recovery from an emergency. (See Section

6-4.4 for a list of the five standard functions that should be included as a minimum in the exercise.) Participants are able to assess the direction and control of the disaster management; the decision-making process, communication and information among participants, allocation of resources and staff; overall adequacy of resources to meet the disaster situation; and adequacy of current policies, plans, and procedures. The functional exercise also encourages a spirit of cooperation and coordination between the licensee, the emergency preparedness agencies, and the FERC.

H. Follow-up

A post exercise oral and written evaluation, the licensee's evaluation report and any follow-up to the recommendations in the report are vital aspects of the exercise. Appendix 6-C contains a suggested format for the evaluation report.

I. Reporting Requirements

At least 90 days before performing a functional exercise, the licensee should submit a plan and schedule to the Regional Engineer explaining when and where the exercise will take place.

Within 60 days of completing a functional exercise, the licensee should submit to the Regional Engineer an evaluation report of the exercise including comments from participants and any recommendations for modifications to the EAP.

6-4.2.5 Full-Scale Exercise

The full-scale exercise is the most complex level of exercise. It evaluates the operational capability of all facets of the emergency management system (both licensee and State and local emergency management agencies) interactively in a stressful environment with the actual mobilization of personnel and resources. It includes field movement and deployment to demonstrate coordination and response capability. The participants actively "play-out" their roles in a dynamic environment that provides the highest degree of realism possible for the simulated event. Actual evacuation of critical residents may be exercised if previously announced to the public.

A full-scale exercise is considered a "comprehensive exercises."

A. Purpose of Exercise

A full-scale exercise is intended to evaluate the operational capability of licensee and agency participants in an interactive manner over a substantial period of time.

It tests a major portion of the basic elements existing within emergency action plans and the participants' actions to implement the EAP in a stressful environment. Full-scale exercises test the mobilization of personnel and resources and the actual movement of emergency workers, equipment, and resources required to demonstrate coordination and response capabilities.

B. Participation

A full-scale exercise should include all participants that would be included in a functional exercise (e.g., policy makers, coordination personnel, and operations personnel, National Weather Service, elected officials). In addition, the exercise should include response personnel that are responsible for such things as road closures, evacuations, and medical attention during an actual emergency. The exercise may include volunteers or local residents that could be affected by a dam failure.

C. Requirements

The Commission tries to have at least one comprehensive (i.e., functional or full-scale) exercise over a five year period in each river basin where there is project required to have an EAP. Due to the complexity and expense in terms of personnel and equipment, the full-scale exercise will normally be performed at the licensee's option. The Regional Engineer may require a full-scale exercise for project-specific reasons or a lack of confidence in previously performed lower level exercises. For additional information refer to the Requirements for Functional Exercises in Section 6-4.2.4.

D. Preparation

Full-scale exercises should be the culmination of an exercise development program that has grown with the capacity of the participants to conduct exercises. This should also include an ongoing cycle of progressively more in-depth exercises and evaluations.

For agencies or local communities, full-scale exercises require considerable preparation and can often be aimed at practical tests of "first-in" responders, including police, fire, and medical personnel. They can be used to test triage (dealing with casualties) procedures, on-scene management of resources, and coordination through field command posts.

Careful consideration should be given to selecting the day, date, and time for any exercise. The inclusion of these types of considerations should be left to the agencies since they can best assess the benefits and constraints of doing so.

Ample warning should be given to the public so there is no confusion for an actual emergency.

The scope, objectives, narrative, MSEL, and messages should be developed by an exercise team of one or more individuals. (See Section 6-4.2.3 on preparation for tabletop exercises)

In any exercise, a real emergency might occur, especially during a lengthy full-scale exercise. During a real emergency, it may be necessary for some participants to leave. If possible, both the licensee and emergency preparedness agencies should ensure there are enough personnel and equipment not involved in the exercise to respond to a real emergency.

E. Where to Conduct Exercise

Because a full-scale exercise requires the mobilization of personnel and resources, careful consideration must also be given to the selection of an exercise site. The primary factor here is one of adequate space, financial capability, and support.

During the exercise, participants should make use of designated Emergency Operations Centers. Field sites should focus on areas that could be impacted by a dam failure.

F. Conducting the Exercise

A full-scale exercise adds a field component that interacts with a functional exercise through simulated messages. Other major components of a full-scale exercise include testing the deployment of seldom-used resources; involving policy, coordination, operational, and field response personnel and resources; and testing a major portion of emergency action plans, resources, and capabilities.

Full-scale exercises add an integration and coordination component to the functional exercise. They do not substitute for simulation; instead, they complement it. Events and messages may be complex and detailed. Many of the messages will be pre-scripted and scheduled, while others may be dynamically input by controllers in response to the flow of the exercise.

As with the functional exercise, the controller is responsible for assuring that the exercise starts on schedule. Simulators and evaluators should keep a log of all significant events. Also, each participant should log its actions as much as possible. Videotaping the exercise and evaluation can be beneficial.

The safety and well being of participants and the general public is a major factor for the full-scale exercise. A safety officer should be designated to analyze and oversee the entire exercise from a safety perspective.

At the conclusion of the exercise, the participants will need to meet in one location for the evaluation session.

G. Benefits

Full-scale exercises draw media and community attention to emergency preparedness; teach by doing; test total coordination, not only among policy and coordination officials, but also field forces; test many licensee and agency emergency management functions at one time; evaluate cooperation; and point out physical resource capabilities. They can be a true test of the total emergency management system and the effectiveness of a specific EAP.

Full-scale exercises greatly expand the scope and visibility of the exercise program. A well-designed, full-scale exercise can be used to obtain a great deal of favorable media attention. In fact, a full-scale exercise of any magnitude will draw media attention whether it is sought or not. Therefore, it is wise to include the media in any exercise plans. The media can be extremely helpful in a number of ways, and it will increase realism if they are present. Alternatively, a poorly conducted exercise can create credibility problems for the licensee's entire EAP program.

H. Follow-up

At the conclusion of the exercise, the licensee should hold a meeting with all participants to evaluate the exercise, prepare and submit an evaluation report, and follow up on the recommendations in the report. Appendix 6-C contains a sample outline for an exercise evaluation report.

I. Reporting Requirements

At least 90 days before performing a full-scale exercise, the licensee should submit a plan and schedule to the Regional Engineer explaining when and where the exercise will take place.

Within 60 days of completing a full-scale exercise, the licensee should submit to the Regional Engineer an evaluation report of the exercise including comments from participants and any recommendations for modifications to the EAP.

6-4.3 Licensee's Role for Developing and Conducting Exercises

The design of an effective exercise depends on the coordination and cooperation of the licensee, the FERC, and the emergency response agencies. Ideally, the licensee should chair the exercise. It may also be appropriate for an emergency preparedness agency representative to co-chair the exercise. The licensee should take the responsibility for coordinating the design of the exercise and holding the exercise. The licensee does not necessarily have to serve as the controller or facilitator of the exercise, with the responsibility to monitor the flow of the exercise and supervise the input of messages.

As chair, the licensee should oversee the development of the exercise. It has the responsibility to coordinate the schedule for the actual exercise, including the orientation seminars, drills, tabletop exercises, etc. The licensee should advise the Regional Engineer of the plan and schedule for the exercise, including the date of each aspect of the exercise. (See Section 6-2.2.3 for reporting requirements.)

The primary function of a comprehensive exercise is to test the response of the licensee and emergency management agencies from a dam failure. The licensee, as chair, should ensure that this remains the primary focus of the exercise.

The licensee should establish its objectives prior to contacting the State and local agencies to coordinate an exercise. The licensee should clearly set forth for the agencies the aspects of the EAP that it wants to examine and the level of involvement of the State and local agencies. The local agencies may introduce other emergencies that could occur at the time of the dam failure to test their capabilities to respond to several incidents at one time.

The FERC will provide assistance, as necessary. The FERC will participate in the exercise as an observer and will participate in the follow-up evaluation of the exercise.

6-4.4 FERC Goals and Objectives

The Commission's main objective of the EAP exercise program is to ensure that EAPs are periodically reviewed and that each EAP is workable in an actual emergency. A licensee's exercise program should build on the competencies developed from simpler exercises to achieve greater success with more complex exercises. Before a comprehensive exercise can be conducted, it is necessary to lay the groundwork for that exercise. This requires orientation seminars, drills, and a tabletop exercise be performed before the comprehensive exercise is conducted. The FERC focuses primarily on high hazard dams in identifying those projects that warrant a comprehensive exercise.

A comprehensive exercise consists of either a functional or full-scale exercise. A full-scale exercise of a simulated emergency is the ideal approach to evaluate every participant's knowledge, understanding, and reaction to a dam failure event. However, there are practical considerations that will indicate that full-scale exercises may not be appropriate in all cases. Due to the complexity and expense in terms of personnel and equipment committal, the full-scale exercise will normally be executed at the option of the licensee unless peculiar circumstances of a particular project or lack of confidence in previously performed lower level exercises warrants the Regional Engineer to require a full-scale exercise.

Therefore, the Commission's goal is to have licensees conduct a functional exercise of an EAP as their comprehensive exercise.

Each EAP is unique and each exercise must be tailored to the EAP being tested. For example, several unique applications to a dam failure event include the verification of failure, the moving or expanding nature of the area in danger, the impacts on timing, the disruption of transportation, areas that will become isolated due to flooding, alarms and sensors to detect a dam failure emergency, and the concern for transients and recreationists (i.e., hikers, boaters, fisherman, campers). Other complications could include the extent of flooding depending on the conditions at the time of failure, power and communication outages, and failure during times of darkness and on weekends or holidays. In addition, there are site specific concerns and complications that should be considered.

There are five standard functions or capabilities of the emergency preparedness agencies that should be included in an exercise. When coordinating with State and local agencies during the development of a functional exercise, the licensee should advise the agencies that it would like the exercise to focus on at least the following five functions:

A. Alert, Notification, and Warning

This tests the communication system, the primary and/or alternate back-up systems, the messages to determine if they are appropriate and clearly understood. It verifies the names and phone numbers on the notification list and their order of priority. Remote sensing equipment should be tested at unattended dams prior to or at the start of a functional exercise.

B. Direction and Control Function

This tests and evaluates the emergency operations capability and timely response in a stressful environment. It includes the response to health problems, fire, downed power lines and loss of life, including drownings.

C. Evacuation

This is a key issue in the exercise as it tests the participants' understanding of the inundation maps. Experience indicates the inundation boundaries and the road names thereon may not always be clear and fully understood. Maps are often revised as a result of the exercise.

D. Shelters

This reveals those shelters that should not be used because they are in the flood plain or access to the shelters is affected by transportation through the inundation area.

E. Public Information

This tests the capability to issue accurate information for a dam failure event.

The licensee, in discussing these five areas with the State and local emergency preparedness agencies, should provide the agencies with opportunities to identify other areas they believe should be exercised to evaluate their effectiveness to respond to situations unique to a dam failure situation.

6-4.5 Results from an Exercise

The FERC has identified four major results that should be achieved through an EAP exercise:

A. Develop a Spirit of Cooperation

This is to include the licensee, the State and local emergency preparedness officials, and the FERC. Without a cooperative spirit, the EAP program will not be as successful.

B. Exchange of Knowledge

The licensee, the FERC, and the State and local officials will help each party to understand their individual responsibilities and capabilities. It will also provide the opportunity to ensure that all parties clearly understand the EAP, particularly critical matters such as the data presented on the inundation maps and the notification flowchart. The exercise process should also reveal deficiencies in resources and information available to the licensee and the State and local agencies.

C. Evaluation of EAP Exercises

The purpose of the exercise is to identify areas for improvement of the EAP. One of the follow-up requirements to drills, tabletop, functional, and full-scale exercises is an evaluation session to find out what each person has learned and if anything should be revised. The evaluation session should ask for comments in a discussion format as well as in written form. The participants should be encouraged to suggest changes to the EAP that would improve the plan and help them perform their responsibilities during emergencies. Following the exercise, a written evaluation report should be prepared by the licensee and submitted to the Regional Engineer. See Section 6-2.2.3 for reporting requirements and Appendix 6-C for a suggested report format.

The evaluation report does not need to be elaborate; it should be clear and concise in the presentation of the information required. The report should include:

- documentation and an evaluation of the various aspects of the exercise, including the timeliness of responses and areas of concern.
- observations and recommendations that result from the exercise,
- a summary of the evaluation comments and lessons learned by the participants,
- comments made during the oral evaluation session from the licensee and the participating agencies regarding their respective participation in the exercise.
- the participants' written evaluations,
- any subsequent clarification or discussions, and
- a plan and schedule to make changes to the EAP or other follow-up actions.

D. Revision to EAPs

An exercise may reveal areas of the EAP that require revisions. This should reveal the strengths and weaknesses of the EAP, including specified internal actions, external notification procedures, and adequacy of other information, such as inundation maps.

6-4.6 Availability of Training

The Commission offers the "Emergency Action Plan Exercise Design Course" at various locations throughout the United States at least once a year. This course is tailored for licensees and other dam owners. The course includes an invited speaker from a FERC-licensed project to provide the "licensee perspective" related to the design of an EAP exercise. The Commission endeavors to also invite other appropriate agencies, such as the National Weather Service, State dam safety officials, and local emergency management agency personnel to contribute to the course instruction. We recommend licensees encourage their local emergency management agency personnel to participate in the course. The FERC Regional Offices should be contacted for availability of this course.

The "EAP Exercise Design Course for Dam Owners" developed by FEMA is sufficiently generic in nature so that the knowledge learned about tabletop, functional, and full-scale exercises can be useful for developing an EAP exercise for a simulated dam failure. The course is given on an as-needed basis and is conducted by FEMA in partnership with State emergency management offices. Licensees, as well as Regional Office personnel, are encouraged to attend the course. The State's emergency management office should be contacted for dates and other information on the course.

Another source of "hands-on" training is to attend one, or more, tabletop, functional, or full-scale exercises. Licensees can contact Regional Offices for a list of upcoming exercises and contact information. As licensees develop and conduct their exercises, they are encouraged to invite other licensees as observers. As a licensee observes an actual exercise, it may identify deficiencies in its own plans and will be able to make improvements before it holds its own exercise.

6-5 ENSURING AN EFFECTIVE EMERGENCY ACTION PLAN

One goal of the Federal Energy Regulatory Commission is to ensure there are workable and effective EAPs for dams under its jurisdiction. For an EAP to be effective, the following items must occur before people would be impacted from a dam failure:

1. The licensee verifies there is an emergency and notifies the emergency management agencies.
2. People at risk are warned of the emergency and evacuate the inundation zone.

There are unique challenges associated with projects immediately upstream of individual residences, recreation areas, campgrounds, and population centers. In these instances, there is minimal time between a dam failure and when people would be inundated. Warning time could be further limited if the observer of the emergency is not from the licensee's organization or familiar with the EAP.

The following procedures should be performed when there are high risk areas downstream of a project:

1. The licensee should discuss any high risk areas with the local emergency management agencies.
2. Both parties should determine if current procedures allow enough time for:
(a) the licensee to determine there is an emergency and notify the emergency management agencies, and (b) the agencies to warn and evacuate people within the inundation zone. The timing can be determined through a functional exercise or a tabletop exercise where particular attention is paid to listing the detailed actions of each participant and the realistic time it would take to do each action. The process should consider worst case scenarios of a sudden, unexpected failure happening when there is minimal supervision at the project.
3. If current procedures do not allow enough time for the EAP to be effective, then the licensee and emergency management agencies should determine ways to decrease response times. Some examples are:
 - Installing additional instrumentation and cameras to quickly verify problems at unmanned projects.
 - Having the licensee's personnel or nearby third parties warn people in high risk areas. This would need to be agreed to by the emergency management agency.
 - Installing early warning systems such as sirens or reverse 911 systems.
4. The licensee can help emergency management agencies determine safe evacuation routes and areas where people would be outside of the inundation zone.
5. The licensee can help emergency management agencies educate the public in the high risk areas about what they should do during an emergency. For security reasons, the people that could be impacted from a dam failure should be targeted instead of the entire public. The following are examples

of how to provide public education:

- Provide information through free handouts. Calendars containing emergency information can be distributed to homeowners and businesses. Campgrounds and recreation areas can post information on bulletin boards or distribute information as people enter.
 - If there is interest, hold a public meeting describing the project and emergency procedures.
 - Periodically visit nearby residents to ensure they know procedures.
 - Provide signs showing evacuation routes and areas.
6. Emergency management agencies and licensees can discuss the following items with downstream residents during public education sessions or in literature:
- Explain there is a dam upstream of the area.
 - Inform residents they are located within the inundation zone in the unlikely event of a dam failure.
 - Show people where they are located within the inundation zone.
 - Explain where people should go if there was a dam failure. Show evacuation routes.
 - Describe where shelters are likely to be.
 - Explain emergency equipment and procedures, (e.g., how would they know if there was a problem at the dam, what it means if sirens go off, what to do if they receive a reverse 911 call).
 - Explain where residents can get information during an emergency (e.g., list radio stations, call centers).

6-6 EAP EXEMPTION REQUIREMENTS

6-6.1 Exemption Justification

In order to receive an exemption from filing an EAP, a licensee must demonstrate that no reasonably foreseeable project emergency (i.e., failure of a dam or water retaining structure) would endanger life, health or property. To satisfactorily demonstrate the consequences of a failure, the licensee should submit a report that documents all reconnaissance and other studies performed to determine that failure of the dam will not present a hazard to human life or cause significant property damage under all flood flow conditions up to the Inflow Design Flood. Regional Office staff will periodically review the circumstances pertaining to those projects that have already been exempted from EAP requirements to determine if

additional documentation is necessary to verify the validity and continuation of previously granted EAP exemptions.

Chapter II of the Engineering Guidelines discusses in detail the procedure for performing a hazard evaluation and estimating the consequences of a dam failure. If the results of a field reconnaissance study of the areas downstream of the dam are inconclusive in determining the hazard potential of the dam, a dambreak analysis should be performed and results of the analysis furnished in the report. The dambreak analysis should consider failure under normal operating conditions (i.e., fair weather) and flood flows up to the point where no significant increase in hazard to downstream life and property occurs as a result of failure, i.e. the inflow design flood. For each flood event analyzed, it should be assumed that the failure is initiated when the peak flow or reservoir elevation is reached. Dam failures should be assumed to occur at the peak and not on the rising limb of the inflow flood hydrograph. A sensitivity analysis should also be performed to establish the effect of breach width and time to failure on downstream flood levels at various flood flow conditions.

An inundation map and, if necessary, water surface profiles, should be developed and furnished for the flow condition which results in the greatest potential for loss of life and significant property damage. The method and assumptions utilized in the dambreak analysis should be fully documented. The inundation map and water surface profiles should delineate the affected areas and water surface elevations prior to failure with the dam in place and after the assumed failure. The map and river profiles should also show the travel time for the arrival of the initial or leading edge of the flood wave and the peak elevation of the flood wave at critical locations downstream of the dam. It is important that the inundation map be developed at a scale sufficient to be used for identifying the location of downstream inhabitants within the area subject to possible danger.

6-6.2 Annual Verification of Downstream Development

The licensee should annually perform a field reconnaissance to verify if there were any changes to upstream and downstream conditions affecting the determination that no reasonably foreseeable project emergency would endanger life, health or property. By December 31 of each year, the licensee should send a letter to the Regional Engineer documenting their findings and, if appropriate, request a continuation of the exemption from filing an EAP (see Section 6-2.2.7). If there are any changes to these conditions, it will be necessary to evaluate whether the exemption remains valid.

6-6.3 Contact List

Sudden releases of flows from projects exempt from having an EAP may still affect river conditions and be of concern to upstream and downstream interests. Licensees of projects exempt from EAP requirements should develop and post a contact list of people and organizations (e.g., local emergency management agencies, upstream and downstream dam owners) that will be called if a dam is in danger of failing or has failed. The licensees should annually verify the contact information on the list is accurate and inform the Regional Engineer this was done by December 31 each year (see Section 6-2.2.7).

6-7 RADIOLOGICAL EMERGENCY RESPONSE PLANS

Each owner of a hydroelectric project under the jurisdiction of the Federal Energy Regulatory Commission located within a 10-mile radius of a nuclear plant licensed to operate shall prepare a radiological emergency response plan to be implemented in the event of a severe accident or incident resulting in the release of radioactive materials. A plan is required if the 10-mile radius includes any project structures such as the dam or powerhouse that are used in changing water flows, or project facilities that would be affected by radioactive materials in such a manner that would interfere with project operations. The plan will be a supplement to the Emergency Action Plan and made a part thereof. It should contain, but not be limited to, the following items:

- A. Detailed procedures for:
 - 1. The evacuation of power plant personnel when advised or directed to do so by the appropriate State or local government official.
 - 2. Setting of gate openings.
 - 3. Continuation, curtailment or cessation of generation.
 - 4. Coordination with, and notification of, customers, power pools, and other interconnected power suppliers.
 - 5. Advance coordination with operators of upstream and downstream reservoirs.
 - 6. Other actions as considered appropriate.

- B. A list of State and/or local government officials who are responsible for notification of hydroelectric project personnel that nuclear accident or incident is developing (or has occurred). This part of the plan should:

1. Specifically identify the State or local government officials responsible for notifying individual(s) in the hydroelectric power plant owner's organization.
 2. Include provisions for keeping the owner's key personnel currently informed on the developing situation to allow timely action or response at the affected hydroelectric project.
 3. Identify, if other than the officials noted above, the State or local government agency representatives authorized to direct or advise implementation of action, such as evacuation of the area, or other appropriate action.
- C. Notification plans should be developed for alerting the concerned individuals of the proposed plan implementation as described below. Reference can be made to the notification procedures contained in the main body of the emergency action plan if appropriate.
1. Local, State, and Federal government officials, including the FERC Regional Engineer or alternate.
 2. Operators of water-related facilities.
 3. Residents and owners of properties that could be endangered by the change in project operation.
 4. Supervisors and other company officials.

The Radiological emergency response supplement to the emergency action plan shall be posted with the main body of the emergency action plan in a prominent location accessible to operating and supervisory personnel. Such personnel shall be familiar with their responsibilities under the plan. Training of these personnel shall be conducted to assure adequate and timely performance of their duties in the event of an emergency.

As with the other parts of the emergency action plan, all aspects of the plan are subject to continuous review and updating. At least once a year, a comprehensive review shall be made of the plan. Any revisions shall be made after consultation with Federal, State, and local agencies, and electric power producers and users, as appropriate. The need for an update shall be reported to the Regional Engineer no later than December 31, of each year.

The affected owner will be requested to file a plan no later than 3 months after the date of issuance of a license to operate a nuclear plant.

If the Regional Engineer determines that an emergency action plan is not required for the hydroelectric project, the radiological supplement shall, nevertheless, be filed. Evidence of coordination with the appropriate State official responsible for

emergency preparedness, should be obtained and forwarded with the plan. Three copies should be submitted to the Regional Office.

6-8 EMERGENCY ACTION PLANS AT GOVERNMENT DAMS

When a project is located at a Federal dam, the licensee is to cooperate with the appropriate Federal agency in any emergency action planning which would provide procedures to be followed the case of an accident to or failure of water retaining structures or other structures under Commission jurisdiction that may affect the integrity and/or operation of the Federal project. Therefore, a documented procedure should be prepared for notifying the appropriate representatives of the Federal agency of an emergency. The licensee must ensure that the operating personnel are familiar with these procedures.

The document does not need to conform to the format discussed in Section 6-3.2. The EAP is to include the requirement that the Commission's Regional Engineer is notified of the occurrence of an emergency situation. Also, the procedure should discuss the licensee's responsibilities and plans to act under any EAP formulated by the Federal agency for that government facility.

The licensee must submit to the Commission's Regional Engineer three copies of: (1) the procedure for notifying the Federal agency, (2) a written statement, verified in accordance with Section 12.13 of the Commission's regulations, indicating that the licensee will cooperate in the implementation of that Federal agency's EAP; and (3) a written statement that the licensee has instructed its operating personnel on how to respond to an emergency under the Federal agency's plan.

The notification procedure is subject to the requirements for training, exercising, updating and posting described on in Section 6-3.2.2 VIII B.

6-9 TEMPORARY CONSTRUCTION EMERGENCY ACTION PLANS

A Temporary Construction Emergency Action Plan (TCEAP) is required where construction workers or the public would be endangered from failure of a temporary or permanent cofferdam or large sediment control structure. The TCEAP should be submitted at least 60 days before starting construction to the Regional Engineer for review and evaluation.

The TCEAP should include the following:

1. A notification list of emergency response agencies.
2. A plan drawing showing the proposed arrangement of the structure.
3. The location of safety devices and escape routes.
4. A brief description of testing procedures for the plan.

The TCEAP should be posted at a strategic location at the construction site visible to all workers and discussed during weekly safety meetings. Periodic testing of the plan should be performed at least quarterly and be documented by the contractor and Quality Control staff.

6-10 APPENDICES

Appendix 6-A – FEMA Courses and Documents Pertinent to EAPs

Appendix 6-B – Sample Title Page, Verification Form and Table of Contents

Appendix 6-C – Sample Evaluation Report Format for EAP Exercises

Appendix 6-D – FERC Requirements for Submitting GIS Inundation Zones

Appendix 6-E – Sample Coordination Checklist for EAP Status Report

APPENDIX 6-A

FEMA Courses and Documents Pertinent to EAPs

FEMA Independent Study Courses – FEMA offers free independent study courses about exercises and other emergency management topics over the internet (www.FEMA.gov). The following courses and documents are excellent source materials:

1. Exercise Design, IS-139, March 2003
2. Introduction to Incident Command System, IS-100, June 2005
3. Basic Incident Command System, IS-195, January 2002
4. Principles of Emergency Management, IS-230, April 2006
5. Emergency Planning, IS-235, March 2003
6. National Incident Management System (NIMS), An Introduction, IS-700, May 2004

APPENDIX 6-B

Sample Title Page, Verification Form, and Table of Contents

[Title Page]

EMERGENCY ACTION PLAN

[Name of Development]

Project No. [FERC No.]

National Inventory of Dams No.

Name of the licensee/exemptee/applicant for license:

Address:

Submitted [date]

Verification:¹

State of [],

County of [], ss:

The undersigned, being first duly sworn, states that [he, she] has read the following document and knows the contents of it, and that all of the statements contained in that document are true and correct, to the best of [his, her] knowledge and belief.

(Name of Person Signing)

(Title)

Sworn to and subscribed before me this [day] of [month], [year].

state

(Signature of Notary Public or other
or local official authorized by law to
notarize documents).

SEAL

¹The verification form is to be completed only by the licensee, exemptee, or applicant for license that prepared the plan, not by agencies that received copies of the plan.

Contents of the Plan

Page No.

- I. Notification Flowchart
- II. Statement of Purpose
- III. Project Description
- IV. Emergency Detection, Evaluation, and Classification
- V. General Responsibilities Under the EAP
 - A. Licensee Responsibilities
 - B. Responsibility for Notification
 - C. Responsibility for Evacuation
 - D. Responsibility for Termination and Follow-Up
 - E. EAP Coordinator Responsibility
- VI. Preparedness
 - A. Surveillance
 - B. Response during Periods of Darkness
 - C. Access to Site
 - D. Response during Weekends and Holidays
 - E. Response during Periods of Adverse Weather
 - F. Alternative Systems of Communication
 - G. Emergency Supplies and Information
- VII. Inundation Maps
- VIII. Appendices
 - A. Investigation and Analyses of Dambreak Floods
 - B. Plans for Training, Exercising, Updating, and Posting the EAP
 - C. Site-Specific Concerns
 - D. Documentation

APPENDIX 6-C

Sample Evaluation Report Format for EAP Exercises

Report on (Tabletop, Functional, Full-Scale) EAP Exercise
Name of Project
Project Owner
FERC Project Number
National Inventory of Dams Number

I. Purpose of Exercise

II. Date and Location

III. Design of the Exercise

- A. Brief description of the physical set-up of the exercise and level of "play"
- B. Selection process of participants
- C. Exercise objectives

IV. Exercise Evaluation

- A. Timeliness of responses during exercise
- B. Licensee's capability to notify agencies and agencies capabilities to execute timely evacuation (this should include the coordination of information between the licensee and the agencies)
- C. Summary and evaluation of oral comments from the debriefing
- D. Summary and evaluation of written comments (this should reference copies of participants' comments - refer to Appendix C)

V. Results of Exercise

- A. Lessons learned
- B. Recommendations
 - 1. Improvements to EAP
 - 2. Ways to improve future exercises

VI. Plan and Schedule for Follow-Up Actions

VII. Summary Table of Key Evaluation Comments, Frequency of Key Comments, Lessons Learned, and Recommendations.

Appendices

- A. List of participants
- B. Copy of narrative and messages
- C. Copies of written evaluations
- D. Copies of any pertinent handouts

APPENDIX 6-D

FERC Requirements for Submitting GIS Inundation Zones

FERC Requirements for Submitting GIS Inundation Zones

General Specifications of GIS data

The following five (5) types of data files will be required for each EAP.

1. Point File

The point file will be used both for locating project structures, such as dams and powerhouses, as well as for reference points for georeferencing raster format inundation maps. Points can be acquired by, survey, GPS, or by identification of electronic coordinates of features (such as road intersections) from a USGS DRG or DOQQ. Three points are required for each map panel on the inundation map sheets. Most inundation map sheets will have a single map panel, but if inset maps are used to illustrate different resolutions, these insets must have three reference points as well.

2. Rasters

A raster map is simply a digital copy of the paper inundation map used in the EAP. The digital copy can either be a scanned copy of an existing paper map, or a digitally created map from a program such as GIS or CAD. This copy will be georeferenced by FERC staff using the required point file, and used to verify the accuracy of the GIS failure inundation polygon files.

The raster (and paper) maps must have a minimum of three reference points for each map panel. If a sheet has insets or a split drawing with match lines, then each inset or split must have its own 3 reference points.

The inundation area delineated on the map must overlay the failure inundation polygon (see 3 below) EXACTLY when georeferenced using the reference points provided by the licensee. The map must overlay the USGS QUADs or the DOQQs with a positional error no greater than 40 ft.

3. Failure Inundation Polygon

The failure inundation zone should be a single shapefile feature for each flood scenario (i.e. fair weather, PMF, etc), and should be a closed polygon. This polygon can be used by emergency response personnel to delineate the affected area, which can then be cross-referenced with other GIS layers such as water and sewer lines, electrical lines, roads

and bridges, jurisdictional areas, and geocoded addresses, which can be used to automatically generate a call list.

4. Cross Section File

The cross section file is used for determining the timing and depth of flooding at a given location. This information can be used by emergency responders to identify houses or subdivisions that are high priority due to early flooding or excessive flooding depths. Submit only information from the cross sections shown on the inundation maps.

5. Metadata Text File

A metadata file is literally “data about data.” Metadata is a text file that describes the details of the data set such as the source, the year the data was produced, the coordinate system used to create the data (Albers Equal Area – see Technical specs below), the datum (NAD 83 should be used – NAD 27 should not be used unless there is no other alternative), and the units of measurement (meters should be used). One metadata file should be included with each of the above four files.

Technical Specifications

All data submitted should meet the following requirements.

1. Spatial Projection

All data files shall be filed in Albers’ Equal Area Conic Projection, a readily available national scale spatial projection, which has the following specifications:

Parameters:

False Easting: 0.000000
False Northing: 0.000000
Central Meridian: -96.000000
Standard Parallel 1: 29.500000
Standard Parallel 2: 45.500000
Latitude of Origin: 37.500000

Units: meters

Datum: North American Datum 1983

2. Accuracy

All georeferenced electronic data files must be positionally accurate to ±40 feet in order to comply with National Map Accuracy Standards for maps at a 1:24,000 scale.

We recognize available base data is not as accurate in Alaska. These projects should attempt to meet our standards to the best extent possible. If the accuracy standards above cannot be met, include a written description of the base data used to georeference the inundation area.

The following data requirements are unique to each data type:

Point File

Three reference points will be required for map panel. The points should be triangular in orientation to facilitate georeferencing of the raster files. Typically, each inundation map will have one map panel per sheet. If a sheet has more than one map panel, such as an inset at a different scale or a split drawing with match lines, each of the map panels should have three reference points. Include points at the main section of the dam and other major project features, such as the powerhouse or saddle dike. The location of the coordinate for the dams should be the spillway or the approximate center of the impounding structure, if possible. The location of the powerhouse should be the approximate center of the building.

The following data fields should be included in any point file submittal:

Field Name	Field Type	Units	Description
ID	ObjectID	None	Field reserved by GIS data – the ID of the point
Shape	Geometry	Point	Field reserved by GIS data – where the point geometry is stored
Project	Integer	None	FERC Project Number
Dam_Name	Text	None	Name of Dam
Sheet	Integer	None	Sheet number that reference points refer to
DESC	Text	None	A description of the point, i.e. center of dam crest, road intersection

Raster

Each sheet of the inundation maps must be contained in a separate electronic raster file, which meets the following format specification:

IMAGERY - black & white raster file
FILE TYPE – Tagged Image File Format, (TIFF) CCITT Group 4

RESOLUTION –300 dpi desired, (200 dpi min)
 FILE SIZE – less than 1 MB desired

This format minimizes file storage space on computer servers, and is universally read by most computer software. Each sheet must contain a minimum of three known reference points. The positional coordinates of each reference point must be shown.

Failure Inundation Polygon

The dam failure inundation polygon should match the inundation area on the EAP paper maps. Each inundation area must be a closed polygon. A collection of line segments, such as from a converted CAD file, will not be accepted.

The following data fields should be included in the failure inundation area attribute table:

Field Name	Field Type	Units	Description
ID	ObjectID	None	Field reserved by GIS data – the ID of the polygon
Shape	Geometry	Polygon	Field reserved by GIS data – where the polygon geometry is stored
Project	Integer	None	FERC Project Number
Dam_Name	Text	None	Name of dam
Scenario	Text	None	Fair weather or IDF

Cross Section

The cross section file should include a single polyline feature for each of the cross section locations shown on the inundation maps. The following data fields should be included in the cross section attribute table:

Field Name	Field Type	Units	Description
ID	ObjectID	None	Field reserved by GIS data – the ID of the cross section line
Shape	Geometry	Lines	Field reserved by GIS data – where the line geometry is stored
Project	Integer	None	FERC Project Number
Dam_Name	Text	None	Name of dam
DIST	Float	Miles	The distance of the cross section downstream of the dam
IDF_TOA	Float	Hours	Time of arrival of leading edge of IDF failure hydrograph
IDF_TTP	Float	Hours	Time to peak of IDF failure hydrograph
IDF_WSEL	Float	Feet	Peak water surface elevation of IDF failure hydrograph
IDF_RISE	Float	Feet	Incremental rise due to IDF dam failure
IDF_FLOW	Float	CFS	Peak flow of IDF failure hydrograph
FW_TOA	Float	Hours	Time of arrival of leading edge of fair weather failure hydrograph
FW_TTP	Float	Hours	Time to peak of fair weather failure hydrograph

FW_WSEL	Float	Feet	Peak water surface elevation of fair weather failure hydrograph
FW_RISE	Float	Feet	Incremental rise due to fair weather dam failure
FW_FLOW	Float	CFS	Peak flow of fair weather failure hydrograph

Metadata

One metadata file should be included with each of the other four file types. The metadata should be a simple text file and should contain background information about each of the data sources. Metadata should be submitted in Federal Geographic Data Committee format (<http://www.fgdc.gov/metadata>). Items that are required in the metadata are: the model used to calculate the inundation, the date of the dam break model run, the source and date of the elevation data for the model, and the PMF, IDF, and fair weather flows used in the model.

APPENDIX 6-E

Sample Coordination Checklist for EAP Status Reports

Sample Coordination Checklist for EAP Status Reports

Organization	Name	Title	Received Update ¹	Participated in Annual Orientation	Participated in Annual Drill & Call Down
Utility	Joe Smith	Operator	Yes	No	Yes
	Thomas Knapp	Manager, Hydro Engineering	Yes	Yes	Yes
	Jason Morgan	VP Energy Projects	Yes	No	Yes
	Judith Robertson	Public Relations	Yes	No	Yes
Alpha County	Varies	Dispatcher	Yes	No	Yes
	Deloris Shea	Sheriff	Yes	No	No
	Ralph Watts	EMA	Yes	Yes	Yes
Beta County	Joe Girardi	EMA	Yes	No	No
State	Al Sanders	EMA	Yes	No	No
	Phyllis Kline	Dam Safety	Yes	No	No
FERC	Walter Johnson	Regional Engineer	Yes	No	Yes
NWS	Josephine Hunt	Hydrologist	Yes	No	Yes
Downstream Camp	Pop Jones	Owner	N/A	No	Yes
Downstream Dam	Varies	Control Room	Yes	No	Yes
Upstream Dam	Varies	Control Room	N/A	No	Yes

¹ Confirmed by mailed returned receipt, telephone call, or in person.