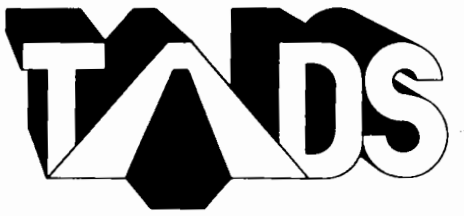
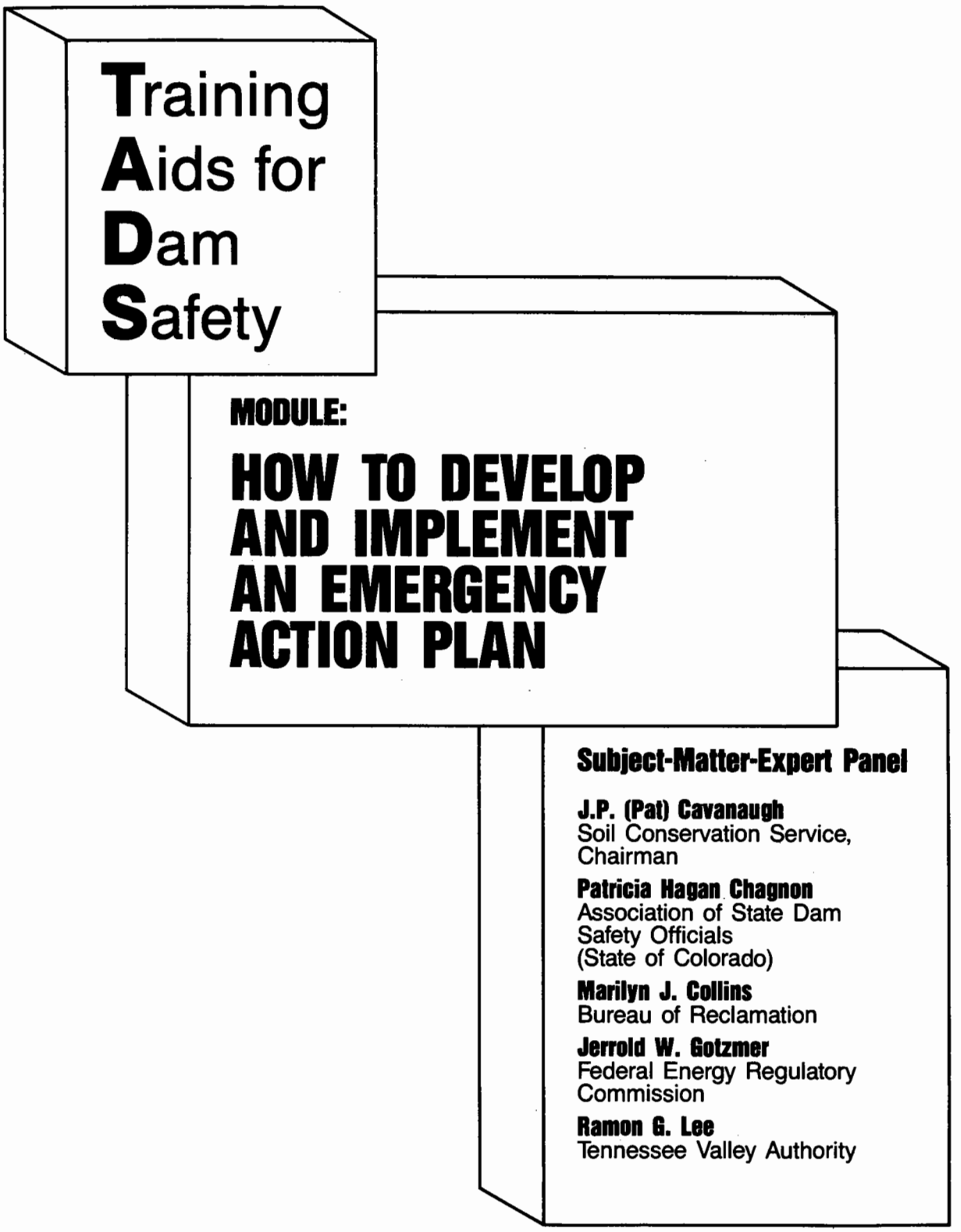
Training Aids for Dam Safety

MODULE:

HOW TO DEVELOP AND IMPLEMENT AN EMERGENCY ACTION PLAN



A video presentation accompanies this workbook.


Training
Aids for
Dam
Safety
MODULE:
HOW TO DEVELOP AND IMPLEMENT AN EMERGENCY ACTION PLAN
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PREFACE

There are presently more than 80,000 dams in use across the United States. Like any engineering works, these dams require continual care and maintenance, first to ensure that they remain operational and capable of performing all intended purposes, and then to preclude endangering people and property downstream.

The safety of all dams in the United States is of considerable national, state, and local concern. Given that, the principal purpose of the TADS (Training Aids for Dam Safety) program is to enhance dam safety on a national scale. Federal agencies have responsibility for the safe operation, maintenance, and regulation of dams under their ownership or jurisdiction. The states, other public jurisdictions, and private owners have responsibility for the safety of non-Federal dams. The safety and proper custodial care of dams can be achieved only through an awareness and acceptance of owner and operator responsibility, and through the availability of competent, well-trained engineers, geologists, technicians, and operators. Such awareness and expertise are best attained and maintained through effective training in dam safety technology.

Accordingly, an ad hoc Interagency Steering Committee was established to address ways to overcome the paucity of good dam safety training materials. The committee proposed a program of self-instructional study embodying video and printed materials and having the advantages of wide availability/marketability, low per-student cost, limited or no professional trainer involvement, and a common approach to dam safety practices.

The 14 Federal agencies represented on the National Interagency Committee on Dam Safety fully endorsed the proposed TADS program and have underwritten the cost of development. They have also made available technical specialists in a variety of disciplines to help in preparing the instructional materials. The states, through the Association of State Dam Safety Officials, also resolved to support TADS development by providing technical expertise.

The dam safety instruction provided by TADS is applicable to dams of all sizes and types, and is useful to all agencies and dam owners. The guidance in dam safety practice provided by TADS is generally applicable to all situations. However, it is recognized that the degree to which the methods and principles are adopted will rest with the individual agency, dam owner, or user. The sponsoring agencies of TADS assume no responsibility for the manner in which these instructional materials are used or interpreted, or the results derived therefrom.

ACKNOWLEDGMENTS

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TADS SUPPORTING ORGANIZATIONS

Association of State Dam Safety Officials
U.S. Committee on Large Dams

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MODULE INTRODUCTION

MODULE INTRODUCTION

OVERVIEW OF THIS MODULE

This module describes the recommended procedures for creating an Emergency Action Plan (EAP) for a dam. Specifically, the module defines the components of an EAP, explains the steps involved in developing and implementing a plan, and provides guidelines for subsequent updating and review.

HOW TO USE THIS MODULE

This module is designed to be used in conjunction with other Training Aids for Dam Safety (TADS) modules. The TADS Learner's Guide lists all of the TADS modules and presents a recommended sequence for completing the modules. You may want to review the Learner's Guide before completing this module.

CONTENTS OF THIS MODULE

This module is divided into three units, followed by two appendixes:

- **Unit I. Emergency Action Plans:** Explains why the development of an EAP is so important, and defines the components of an EAP.
- **Unit II. Developing An EAP:** Describes the steps involved in developing an EAP, and provides guidelines to help you develop a workable and comprehensive plan.
- **Unit III. Maintaining An EAP:** Explains procedures for performing periodic maintenance, such as testing and review, to ensure that your plan is accurate and effective.
- **Appendix A. Glossary:** Defines a number of technical terms used in the module.
- **Appendix B. References:** Lists recommended references that can be used to supplement this module.

DESIGN OF THIS MODULE

There are two basic components of this module: the text instruction, which you are now reading, and a video presentation. The text will tell you when to watch the video. After viewing the video, return to the text.

UNIT I

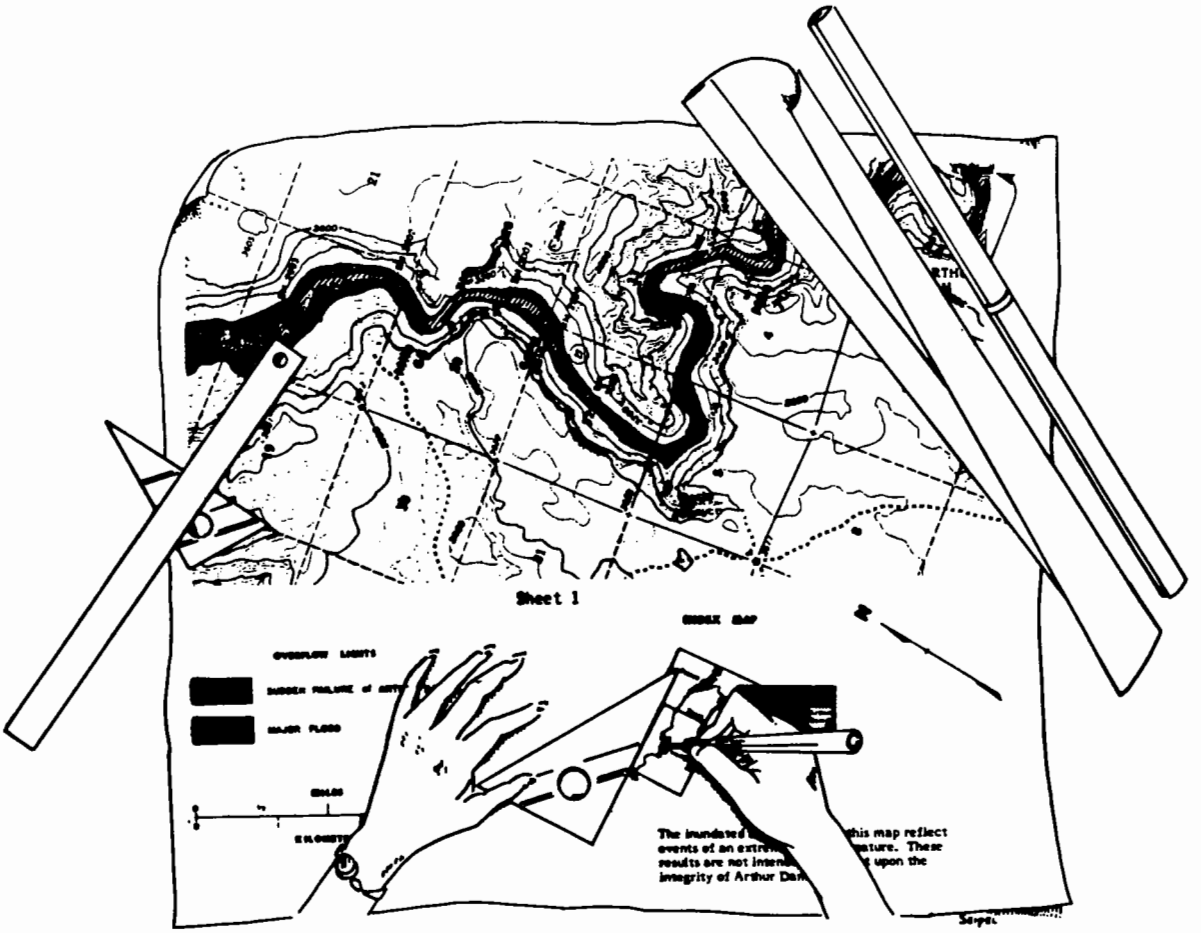
EMERGENCY ACTION PLANS

I. EMERGENCY ACTION PLANS: OVERVIEW

INTRODUCTION

The first unit of this module presents the following information . . .

- **Definition:** Provides a definition of the term "Emergency Action Plan (EAP)."
- **Importance:** Explains why the development and maintenance of an EAP is an essential part of a dam safety program.
- **Components:** Briefly describes the basic components of an EAP.



I. EMERGENCY ACTION PLANS: DEFINITION AND IMPORTANCE OF THE EAP

WHAT IS AN EAP?

An Emergency Action Plan, or EAP, is a formal plan that identifies potential emergency conditions at a dam and prescribes the procedures to be followed to minimize property damage and loss of life.

An emergency in terms of dam operation is defined as a condition which develops unexpectedly, endangers the structural integrity of the dam and/or downstream property and human life, and requires immediate action.

NOTE: Every EAP must be tailored to site-specific conditions and to the requirements of the agency/organization that owns or regulates the use of the dam.

WHY IS IT IMPORTANT TO HAVE AN EAP?

An EAP is needed for two main reasons:

- To preplan the coordination of necessary actions by the dam owner and the responsible local, State, and/or Federal officials to provide for **timely** notification, warning, and evacuation in the event of an emergency.

- To reduce the risk of loss of life and property damage, particularly in downstream areas, resulting from an emergency situation.

The design, construction, operation and maintenance, and inspection of dams are all intended to minimize the risk of future dam failures. Despite the adequacy of these programs and their implementation, unique situations do sometimes develop that may result in dam failure. Therefore, it is prudent for dam owners to identify conditions which could lead to failure, in order to initiate emergency measures that could prevent or minimize the consequences to life and property.

I. EMERGENCY ACTION PLANS: COMPONENTS

INTRODUCTION

This section will briefly examine the basic elements of an EAP. These components will be discussed in greater detail in Unit II of this module, and include the following:

- Notification Flowchart
- Responsibilities
- Emergency Identification, Evaluation, and Classification
- Notification Procedures
- Preventive Action
- Inundation Map
- Appendix(es)

NOTIFICATION FLOWCHART

A Notification Flowchart is a schematic representation of the hierarchy for notification in an emergency situation, including who is to be notified, by whom, and in what priority. The flowchart should be prominently displayed in the EAP document; often it is the first page of the EAP.

RESPONSIBILITIES

A determination of responsibility for EAP-related tasks must be made during the development of the plan. Generally speaking, owners are responsible for the development and maintenance of the EAP, and for activating the notification procedures of the plan. Local, State, and Federal officials having statutory obligation are responsible for warning and evacuation within affected areas. The EAP must specify the person(s) responsible for declaring an emergency under various circumstances, and for initiating emergency actions. In doing so, the plan must be site-specific, since conditions at all dams are different.

EMERGENCY IDENTIFICATION, EVALUATION, AND CLASSIFICATION

Determine and identify the situation(s) or triggering event(s) that initiate or require an emergency action. The establishment of procedures for reliable and **timely** recognition of emergency situations is imperative. If time permits, an emergency situation should be evaluated and confirmed by an experienced and qualified engineer. Finally, to determine the appropriate course of action, the emergency situation or triggering event should be classified according to its urgency.

NOTIFICATION PROCEDURES

Notification procedures should be developed to ensure the timely notification of persons responsible for taking emergency actions. The procedures should be brief, simple, and easy to implement.

I. EMERGENCY ACTION PLANS: COMPONENTS

PREVENTIVE ACTION

Preventive action is a general term used to refer to both preplanned and emergency actions that are aimed at preventing failure of a dam and minimizing loss of life and property damage. A few of the preventive actions that a dam owner might take are to ensure access to the dam site under adverse conditions, provide emergency flood operating instructions, and arrange for equipment, labor, and materials for use in emergency situations.

INUNDATION MAP

An inundation map delineates the areas that would be flooded as a result of a dam failure or unusually large spillway releases. An inundation map is sometimes supplemented by a narrative description of the areas that would be flooded.

APPENDIX(ES)

One or more appendixes, containing supporting materials used in the development and maintenance of the plan, are usually included in the EAP document.

VIDEO PRESENTATION

At this point you should watch the video presentation that accompanies this module. To watch the video presentation . . .

- Turn on your video player.
- Load the videocassette.
- Watch the video presentation.

After watching the video presentation, return to the next unit in this text.

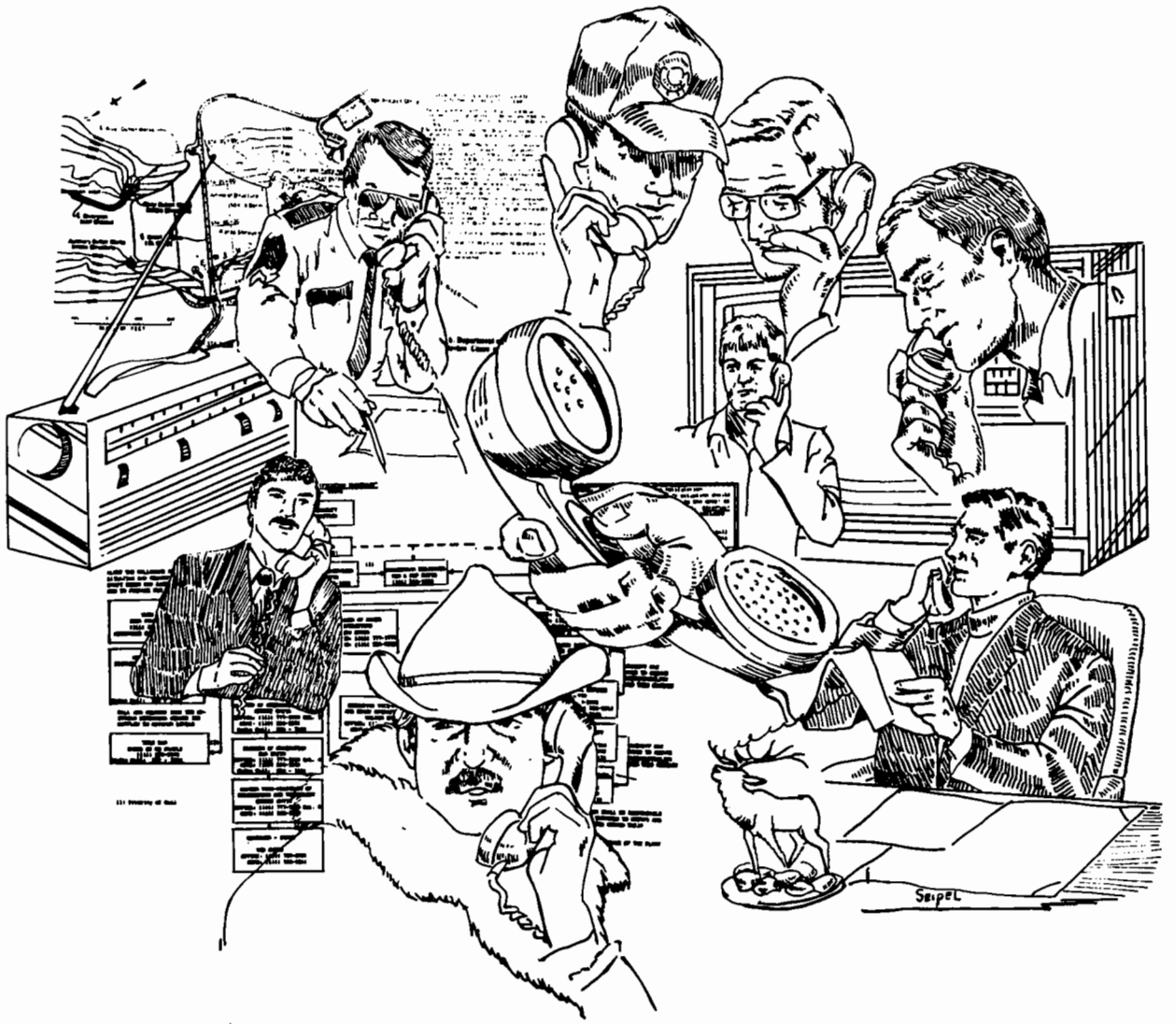
UNIT II

DEVELOPING AN EAP

II. DEVELOPING AN EAP: OVERVIEW

INTRODUCTION

This unit describes the development of an Emergency Action Plan for a dam. It begins with a discussion of the overall process of developing an EAP, presenting a series of nine steps in that process. Then some guidelines are provided for formatting an EAP. While the format described is only suggested, and not mandatory, using this format or a similar organization will help ensure that the EAP is comprehensive. The discussion of the six-part format identifies the contents that should be included in an EAP. Unit II closes with a checklist that can be used in evaluating an EAP to ensure that sufficient information is presented in the document.



II. DEVELOPING AN EAP: OVERALL EAP DEVELOPMENT PROCESS

OVERALL PROCESS FOR DEVELOPING AN EAP

Careful research and coordinated planning with all involved parties will lay the foundation for a responsible and thorough emergency action program. The process of developing an EAP generally follows the nine steps listed below.

Step 1: Determine the potentially inundated area, by defining dam break flood profiles downstream from the dam. Conditions to be considered may include:

- Fair-weather dam failure at normal full pool levels.
- Design flood with and without failure.
- As appropriate, other flood flow conditions, with and without failure, to determine the worst-case scenarios.

Step 2: Prepare inundation maps which clearly depict the flooded areas.

Step 3: Determine and identify those situations or triggering events that would initiate an emergency action, and specify the actions to be taken and by whom.

Step 4: Identify all jurisdictions, agencies, and individuals who will be involved in the EAP. Coordinate the development of the EAP with these other parties. This interaction should include discussion of the need for and operation of an emergency operations center and reception center, as well as a discussion of evacuation (destinations, priorities, and procedures), post-flood actions (recovery and cleanup), and other measures in the event of an emergency.

Step 5: Identify primary and auxiliary communications systems, both internal (between persons at the dam) and external (between dam personnel and outside entities).

Step 6: List and prioritize all persons and entities involved in the notification process, and draft the Notification Flowchart.

Step 7: Develop a draft of the EAP. **Note:** A suggested format for an EAP is described on the following pages, along with suggestions for what content might be important to include in the EAP.

Step 8: Hold coordination meeting(s) with all parties included in the notification list for review and comment on the draft EAP. The public may be invited.

Step 9: Make any revisions, obtain the necessary signatures of plan approval, and disseminate the EAP to those who have responsibilities under the plan.

II. DEVELOPING AN EAP: OVERALL EAP DEVELOPMENT PROCESS

COORDINATING THE DEVELOPMENT OF THE EAP WITH ALL PARTICIPANTS

Development of the EAP must be coordinated with all entities, jurisdictions, and agencies that would be affected by a dam failure, or that have statutory responsibilities for warning, evacuation, and post-flood actions. The finished product will therefore realistically take into account each organization's capabilities, and each participant will be fully aware of individual responsibilities. Appropriate levels of management must be involved in developing the EAP to ensure that each entity will agree to execute its responsibilities under the plan.

II. DEVELOPING AN EAP: SUGGESTED EAP FORMAT

SUGGESTED GUIDELINES FOR EAP FORMAT

These guidelines are provided 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 helpful to place the EAP 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.

An EAP can be organized in whatever format seems most useful for those involved in the plan. One format will be described in this unit. While an EAP need not be **organized** in the described manner, it should include the **contents** described on the following pages. The contents and a suggested format for an EAP are listed briefly below, and described in detail on the subsequent pages:

- Part I -- Introductory Section
- Part II -- Responsibilities
- Part III -- Emergency Procedures
- Part IV -- Preventive Actions
- Part V -- Inundation Maps
- Part VI -- Appendixes

A discussion of each of these parts follows.

II. DEVELOPING AN EAP: PART I—INTRODUCTORY SECTION

OVERVIEW OF PART I—INTRODUCTORY SECTION

The introductory section of an EAP should include the following items:

- Title Page/Cover Sheet
- Notification Flowchart
- Statement Of Purpose

A discussion of each item follows.

TITLE PAGE/COVER SHEET

An EAP document's cover identifies it as an Emergency Action Plan and specifies the dam for which it was developed. For some dams, different EAP's may be developed for different emergency situations or conditions, each with its own specific procedures to be followed. In such instances, title pages or cover sheets are essential, so personnel can be sure that they are using the right plan for the circumstances.

NOTIFICATION FLOWCHART

The EAP should begin with a Notification Flowchart clearly summarizing the following information for each of the emergency conditions considered:

- Who is responsible for notifying each owner representative(s) and/or public official(s).
- Who is to be notified.
- Prioritized order in which individuals are to notified.

Include individual names and position titles, office and home telephone numbers, and alternative contacts and means of communication (e.g., radio call numbers).

Some of the emergency conditions to be considered are:

- Failure is imminent or has occurred.
- Potential emergency situation has developed or is developing.
- Flooding is occurring or is expected.

The flowchart should be easy to follow under emergency conditions and should normally be limited to one page. Color coding (i.e., using different colored lines to trace the proper sequence of notification under various emergency conditions) will prove helpful. Narrative information supplementing the flowchart should be provided in the section discussing notification procedures.

Continued . . .

II. DEVELOPING AN EAP: PART I—INTRODUCTORY SECTION

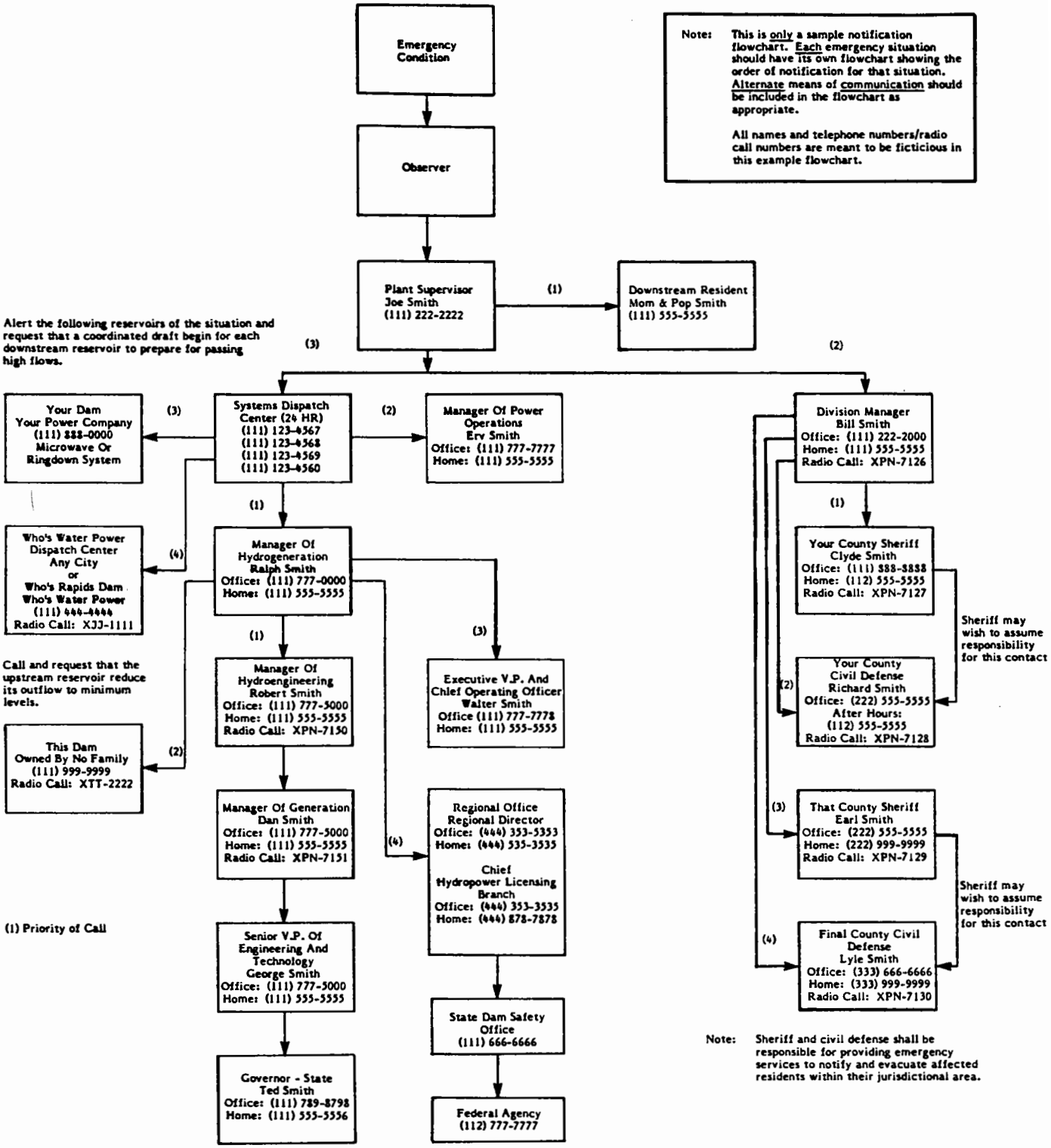
NOTIFICATION FLOWCHART (Continued)

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

A typical Notification Flowchart is shown in Figure II-1 on the next page. **(NOTE:** This is only a sample flowchart. A flowchart must be tailored to the specific needs and notification priorities of the dam to which it applies.)

II. DEVELOPING AN EAP: PART I—INTRODUCTORY SECTION

FIGURE II-1. SAMPLE NOTIFICATION FLOWCHART



II. DEVELOPING AN EAP: PART I—INTRODUCTORY SECTION

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 North Fork Dam in time to take remedial action and to notify the appropriate public officials of possible, impending, or actual failure of the dam. The plan also provides for 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 Alfred County living along Bear Creek, in the event of failure of the Rockfish Dam or flooding caused by large runoff."

II. DEVELOPING AN EAP: PART II—RESPONSIBILITIES

OVERVIEW OF PART II—RESPONSIBILITIES

The responsibilities section of an EAP should include the following items:

- General Responsibilities Under The Plan
  - Owner Responsibility
  - Responsibility For Notification
  - Responsibility For Evacuation
  - EAP Coordinator Responsibility
- Approval Of The Plan

A discussion of each item follows.

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.

Owner Responsibility

The duties of the owner or the owner's designated representatives in implementing the EAP should be clearly described. Some suggestions for information to include in this section are listed below.

- Determine and identify the condition(s) or triggering event(s) that initiate or require emergency actions, and specify the actions to be taken and by whom.
- Provide guidance on how to communicate the emergency situation to those who need to be contacted.
- Include sample warning messages tailored to specific situations.
- Describe who is responsible for taking specific actions at the dam **after** the notification procedures have been implemented. For example, spell out procedures for opening spillway gates, especially if a certain sequence is required, and opening/closing water intakes, as appropriate. (This information should be available in the established procedures for reservoir operation.)
- Provide instructions for the operation of the project during the anticipated emergency. Specific actions should be discussed under the section "Preventive Action."
- Encourage local officials to develop a plan to safeguard life and property from flooding should the dam fail or pass unusually large flows through its spillway system. This plan should include as a minimum procedures for an emergency operations center, evacuation, and post-flood actions.

II. DEVELOPING AN EAP: PART II—RESPONSIBILITIES

Responsibility For Notification

The person(s) authorized to notify local officials should be determined and **clearly identified** in the EAP. If time allows in 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.

The National Weather Service (NWS) and/or other agencies have the general responsibility for issuing flood warnings. It will therefore be beneficial to notify the NWS or other appropriate agency of any pending or actual dam break flooding, so that its facilities can enhance warnings being issued.

Responsibility For Evacuation

Warning and evacuation planning are the responsibilities of the entities having statutory obligation. Under most plans, the dam owner is responsible for notifying the appropriate officials when flooding is anticipated, or a failure is imminent or has occurred.

Dam owners should not assume the responsibility of governmental 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 below the dam. In this case, the dam owner should arrange to notify that person directly. This procedure should be coordinated with the appropriate public officials.

EAP Coordinator Responsibility

If appropriate, designate an EAP coordinator who will be responsible for EAP-related activities, including (but not limited to) preparing revisions to the EAP, establishing training seminars, coordinating EAP drills, etc. This person should be the EAP contact should any involved parties have questions about the plan.

APPROVAL OF THE PLAN

The EAP should include a section that is signed by all parties involved in the plan, where they indicate their approval of the plan and agree to their responsibilities in its execution. Including the approval signatures is essential, for they assure that all parties involved are aware of and understand the EAP and agree to do their assigned roles, should an emergency take place.

II. DEVELOPING AN EAP: PART III--EMERGENCY PROCEDURES

OVERVIEW OF PART III--EMERGENCY PROCEDURES

The section of the EAP that covers emergency procedures should include the following:

- Emergency Identification, Evaluation, And Classification
- Notification Procedures

A discussion of these two procedures follows.

EMERGENCY IDENTIFICATION, EVALUATION, AND CLASSIFICATION

The EAP document should include a discussion of procedures for timely and reliable identification, evaluation, and classification of existing or potential emergency conditions. Major elements of these procedures are:

- A listing of the conditions or events which could lead to or indicate an existing or potential emergency. Situations involving flood emergencies due to a breach or other structural failure as well as a major flood without a breach should be included. Breach conditions could occur as a result of such occurrences as piping, floods, earthquake, or sabotage.

- A brief description of the means by which potential emergencies will be identified, including the data and information collection system, monitoring arrangements, surveillance, inspection procedures, and other provisions for early detection of conditions indicating an existing or potential emergency. A more detailed discussion of instrumentation can be found in the section of this unit entitled "Part IV--Preventive Action."

- Procedures, aids, instructions, and provisions for interpreting information and data to assess the severity and magnitude of any existing or potential emergency. One example of this type of document that might be included in the EAP is an Emergency Action Table. Three pages from a sample table are shown in Figure II-2 on the following pages.

Continued . . .

FIGURE II-2. SAMPLE PAGES FROM AN EMERGENCY ACTION TABLE

NORTH JACKSON PROJECT
EMERGENCY ACTION TABLE

Problem	How To Evaluate	Emergency Action	Required Equipment, Materials, And Labor	Notification	Data To Record
Flooding	Flood Prediction				
	a. Large spillway releases.	During and after any unusual spillway use a special inspection shall be made. If any problems are found, see appropriate items for evaluation, emergency action, and notification procedures.		Reservoir Operations Branch initiates notification process as shown on Flood Notification Chart; see page 6-4.	Discharge, headwater and tailwater elevations, and duration of spill. Complete special inspection checklist.
	b. Headwater is predicted to exceed elevation 1737.0.	Make a special inspection of the dam; see above.		Reservoir Operations Branch is to notify Hydro Engineering Projects as shown on Flood Notification Chart; see page 6-4.	Discharge, headwater and tailwater elevations, and duration of spill. Complete special inspection checklist.
	c. Flood to approach or exceed top of dam.	Make a special inspection of the dam; see above.		Reservoir Operations Branch initiates notification process as shown on Flood Notification Chart; see page 6-4.	Discharge, rate of rise, time when dam is overtopped, and time of failure. Complete special inspection checklist.

FIGURE II-2. SAMPLE PAGES FROM AN EMERGENCY ACTION TABLE
(Continued)

NORTH JACKSON PROJECT
EMERGENCY ACTION TABLE

Problem	How To Evaluate	Emergency Action	Required Equipment, Materials, And Labor	Notification	Data To Record
Seepage					
a. Water - Uncontrolled leakage.	Not Serious - Uncontrolled leak without the removal of fines. Rate of flow not increasing.	None required.		Notify the Technical Service Branch which will notify the Hydro Engineering Projects. See Nonemergency Notification list.	Size and location of area, approximate flow.
	Serious - Rate of flow is increasing. Tailwater flows and elevation are increasing without the removal of fines and no increase in powerhouse or spillway discharge.	Lower the reservoir. Coordinate with Reservoir Operations Branch for spilling instructions. Place a ring of sandbags with a weir at the top towards natural drainage to monitor flow. If boil becomes too large to build a dike around it; place a blanket filter over the area.	Materials: Sand and bags; see materials list.	See Slowly Developing Condition notification procedure.	Size and location of area, approximate flow and how rapidly flow is increasing.

FIGURE II-2. SAMPLE PAGES FROM AN EMERGENCY ACTION TABLE
(Continued)

NORTH JACKSON PROJECT
EMERGENCY ACTION TABLE

Problem	How To Evaluate	Emergency Action	Required Equipment, Materials, And Labor	Notification	Data To Record
Seepage	Serious (Continued)	Blanket of material to be coarse sand at bottom to large gravel 2-4" at top. Blanket to be 3-5' thick. Safety precaution: In no case shall the personnel making the repairs be placed in danger.			
	Failure Imminent-Emerging water is muddy; rate of flow is increasing and an upstream whirlpool develops in reservoir. Tailwater flows and elevation increasing with no increase in powerhouse or spillway discharge.	Lower reservoir by opening spillway gates and generating to capacity. Notify the Reservoir Operations Branch. Control loss of material by using sandbags to sufficient height to provide back pressure to prevent loss of materials. Safety precaution: In no case shall the personnel making the repairs be placed in danger.	Equipment: Shovels, trucks, dozer, and crane; see equipment list. Materials: Sand, bags, gravel, bales of straw or hay, and riprap; see materials list. Labor: Equipment operators, 2 or 3 laborers; see labor list.	For failure in less than 1 day, see Actual or Imminent Failure notification procedure.	Size, location, rate of flow, and how fast flow is increasing for boil. Also, size and location of the whirlpool.

II. DEVELOPING AN EAP: PART III--EMERGENCY PROCEDURES

EMERGENCY IDENTIFICATION, EVALUATION, AND CLASSIFICATION (Continued)

- Designation of the person responsible for identifying and evaluating the emergency. This would normally be the owner or the owner's representative; however, if the owner does not have the proper technical expertise, responsibility may need to be assigned to another individual. Make sure that continuous coverage is provided by designating appropriate alternatives.

NOTE: At unattended dams (i.e., dams not continuously manned), special consideration should be given to the need for surveillance. Since any Emergency Action Plan has little value unless it can be implemented in a timely manner, surveillance at the dam should be evaluated to ensure that sufficient time will be available for notifying responsible officials and warning the public. The section of this unit entitled "Preventive Action" contains more detailed information on surveillance.

Once an emergency condition has been identified and evaluated, it should be classified as to its urgency so that the appropriate action can be taken.

NOTIFICATION PROCEDURES

The notification portion of the EAP should contain a listing of all persons to be notified in the event that an emergency condition develops. This list should include individual names and position titles, locations, office and home telephone numbers, and radio communication frequencies and call signals (if available) for owner personnel, public officials, and other personnel, including alternates. For each type of emergency situation, the EAP should clearly indicate who is to make a call, to whom it is to be made, and in what priority.

The number of persons to be notified by each responsible individual in the notification plan should be kept to a minimum. The number of calls will in some cases be governed by what other responsibilities the caller has been assigned.

For each emergency condition that is anticipated, the plan should describe actions to be taken and contacts to be made. Priority of notification will depend upon the actual emergency situation.

The following individuals or agencies, where applicable, should be considered for inclusion in the notification procedures:

- Residents and property owners located immediately downstream of the dam within the area of potential inundation, where available warning time is very limited.
- Owner personnel.
- Law enforcement officials.

Continued . . .

II. DEVELOPING AN EAP: PART III—EMERGENCY PROCEDURES

NOTIFICATION PROCEDURES (Continued)

- Operators of upstream and downstream dams or water-retention facilities.
- Appropriate Federal, State, and local agencies.
- Managers and operators of recreation facilities.
- Others, as appropriate.

The plan should designate a spokesperson to disseminate information. 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 dam owner and/or public officials. Notification of the news media may be done by the dam owner or by public 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. (**NOTE:** News releases ordinarily should **not** be relied upon as the primary means of warning the public.)

To ensure that the contact that implements the plan is real, and not a prank, a code or keyword might be arranged by the parties involved in the early stages of notification.

II. DEVELOPING AN EAP: PART IV--PREVENTIVE ACTIONS

OVERVIEW OF PART IV--PREVENTIVE ACTIONS

The EAP should describe preventive actions taken both prior to and following the development of emergency conditions, to prepare for any emergency. Preventive 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 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 detection of an emergency situation and should clearly indicate that it 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 is a crucial element in its effectiveness.

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

- Surveillance
- Response during periods of darkness
- Access to the site
- Response during periods of adverse weather
- Alternative means of communication
- Emergency supplies and resources

This section will discuss each of these actions.

II. DEVELOPING AN EAP: PART IV—PREVENTIVE ACTIONS

SURVEILLANCE

When a dam is not continuously manned and failure 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 public safety officials responsible for evacuating 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 dam owner or owner's representative must receive a timely warning that an emergency has developed or is developing. The information received must be clear and concise, so that the responsible official(s) may react with confidence and activate the EAP, if necessary, without requiring personnel to visit the site to verify conditions.

At unattended dams, the dam owner should consider installing a remote surveillance system that includes instrumentation and telemetering facilities at the dam site, to provide a continuous reading of headwater and tailwater levels at an operations control center that is manned 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 also should be activated if the headwater or tailwater elevations exceed prescribed maximum or minimum levels. Design must be site-specific. The limits programmed in a system must account for changes in headwater and tailwater levels that would occur during dam operation, floods, maintenance, etc.

Monitoring of the tailwater generally is more sensitive to changes resulting from a breach of the structures than monitoring of the headwater. Changes in tailwater will alert operators more quickly to site conditions and help determine whether public safety 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, consideration should also be given to having an alarm in the dam tender's house.) When power to or communication with the site instrumentation is interrupted, the dam should be manned until conditions are returned to normal. Operation of the alarms should be checked periodically. Proper functioning of alarms should be confirmed by testing. For instance, annual testing of the plan might be initiated by causing one of the alarms to go off.

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

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

Continued . . .

II. DEVELOPING AN EAP: PART IV--PREVENTIVE ACTIONS

SURVEILLANCE (Continued)

Also describe procedures for providing round-the-clock 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. In addition, it is recommended that an observer be at the dam when flood conditions or signs of serious structural distress have been identified.

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

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.

RESPONSE DURING PERIODS OF DARKNESS

Discussion in the EAP of the response to potential or actual emergency conditions during periods of darkness should:

- Describe actions to be taken to illuminate the spillway operating deck, and other actions that will facilitate the operation of gates or other emergency equipment.
- Explain how the emergency operations center, spillway gates, etc. are to be operated during a power failure.
- Describe any special procedures for contacting or notifying the proper personnel, local officials, or others during a power failure.
- Discuss in detail the expected response time for verifying an emergency and implementing the EAP.
- Include any other special instructions for the dam operators or local officials.

RESPONSE DURING PERIODS OF ADVERSE WEATHER

Discussion of emergency response under adverse weather conditions should:

- Describe in detail the actions to be taken. Action should be based on whether the dam is manned or unmanned.
- Describe methods of access to the site (e.g., foot, boat, snowmobile).
- Discuss in detail the expected response time.
- Include any other special instructions for the dam operators or local officials.

II. DEVELOPING AN EAP: PART IV--PREVENTIVE ACTIONS

ALTERNATIVE SYSTEMS OF COMMUNICATION

The description of the availability and use of alternative communications systems at the site should:

- List alternative channels of communication to be used in case of failure of the primary system or failure of other systems immediately available.
- Explain proper procedures for activating the alternative channels of communication.
- Include any other special instructions.

EMERGENCY SUPPLIES AND RESOURCES

There are certain planning and organizational measures that can help dam personnel and local officials manage emergency situations more safely and effectively. These measures include:

- Stockpiling materials and equipment for emergency use.
- Coordinating information on flows.
- Providing alternative sources of power for spillway gate operation and other emergency uses.

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 resources follow.

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., laborers, engineers), and how they are to be contacted.

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

Also include any other special instructions. If stockpiling of materials and equipment is not applicable to your dam, that fact should be stated in your EAP.

II. DEVELOPING AN EAP: PART IV—PREVENTIVE ACTIONS

Coordinating Information On Flows

Where applicable, describe:

- The need for coordination of information on flows based on weather and runoff forecasts, and failure and other emergency conditions. Describe how the coordination is achieved and the chain of communication, 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.

Also describe any other appropriate actions to be taken. If coordination of information on flows is not applicable, that fact should be stated in the EAP.

Providing Alternative Sources Of Power

Where applicable, describe the alternative sources of power for spillway gate operation and other emergency uses. 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 the operator or other responsible person. If this action is not applicable, that fact should be stated in the EAP.

Finally, describe any other site-specific actions devised to mitigate the extent of possible emergencies.

II. DEVELOPING AN EAP: PART V—INUNDATION MAPS

OVERVIEW OF PART V—INUNDATION MAPS

An EAP should include one or more inundation maps. An inundation map shows areas that would be subject to flooding due to storm conditions or failure of a dam or other water retaining structure. The flood routing shown on inundation maps should typically be carried to a point beyond which flooding would no longer constitute a hazard to downstream life and property. The following discussion describes how these maps are developed, and how they are used in evacuation planning.

INUNDATION MAPS

Whenever communities or significant numbers of dwellings are located in the floodplain downstream of a dam, inundation maps are usually needed to develop an adequate evacuation plan. These maps should show an outline of the area covered by the dam break flood in enough detail to identify dwellings and other significant features that are likely to be directly affected. Mapping is generally accomplished by superimposing the flood outline on an existing map. Estimated flood travel time and depth at selected locations should be included on the map. The maps should be of sufficient scale and detail to identify clearly the areas that would be flooded if large flows occurred from dam failure, misoperation, or extreme storms. Clarity and simplicity are important. Therefore, the map scale should be such that all important features can be identified.

Since local officials are likely to use the inundation maps for evacuation purposes, a note should be included on the maps to advise that, because of the method, procedures, and assumptions used to determine 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. Areas inundated in an actual event will depend on actual failure conditions and may differ from areas shown on the maps.

Generally, an inundation map depicting both breach and large flood conditions should be included in the plan. Although additional conditions could be covered, caution should be used to keep the plan simple enough to be clear and understandable. Generalized breach inundation maps may be used in the plan if sufficient for clearly depicting the inundated areas. Generalized maps may need to be supplemented with larger scale and more detailed maps in some areas. The mapping and the number of different flooded areas should be coordinated with local officials who are developing evacuation plans. It may be appropriate to supplement the inundation maps with water surface profiles in critical areas.

For detailed maps, it is recommended that the best available maps for evacuation planning be used. Topographic or orthographic mapping or street maps may prove best. The lines delineating the inundated area should be drawn in such thickness or form (e.g., solid line, dashed line, dotted line) as to identify the inundation limits as the main features of the map, but not bold enough to obliterate features which would be inundated by the flood waters.

When plotting inundation limits between cross sections used for the analysis, the lines should reasonably reflect the change in water levels caused by topographic patterns and manmade features. Color-coded maps are recommended.

Continued . . .

II. DEVELOPING AN EAP: PART V--INUNDATION MAPS

INUNDATION MAPS (Continued)

When inundation lines enter the area of an existing reservoir, they should represent an increase in the water level of the reservoir. If this increased water level would overtop the dam impounding the reservoir, the appropriate inundation lines should extend downstream of the dam.

For dams not in series but which affect a common downstream area, it is usually adequate to consider the breach condition for each dam individually, unless special conditions warrant multiple failure considerations. Breach inundation lines of such dams should then consist of a line enveloping the lines for the individual breaches when common areas would be inundated.

If inundation maps are to be shown on several pages, a map index should be included to orient the individual pages.

NOTE: Development in the floodplain below some dams is sparse, and the expense of preparing inundation maps may not be warranted. Flooding information can be readily provided by detailed vicinity maps showing pertinent data at the key locations. Individuals living between key locations can estimate their vulnerability by interpolating data from locations upstream and downstream of their site.

II. DEVELOPING AN EAP: PART VI--APPENDIXES

OVERVIEW OF PART VI--APPENDIXES

Following the main body of the plan, you should include an appendix (or several appendixes, for a more clear division of information) that contains basic information about the dam, data used in the development of the EAP, and instructions for the maintenance of the plan.

Listed below are some of the specific topics to be covered in the appendix(es) accompanying your EAP:

- Description And Location Of The Dam
- Investigation And Analysis Of Dam Break Floods
- Benchmarks And Flood Profiles
- Training
- Testing
- Updating
- Posting Of The Notification Flowchart
- Recording Of Emergency Conditions
- Glossary

This section describes each of these possible appendix topics.

DESCRIPTION AND LOCATION OF THE DAM

The appendix would be an appropriate place to summarize the principal features of the dam and provide an illustration (drawing and/or photograph) of the dam and appurtenances. Such an appendix could also describe the upstream and downstream areas and topography and establish the location of the dam, using maps and narrative description.

INVESTIGATION AND ANALYSIS OF DAM BREAK FLOODS

The EAP appendix can identify and briefly describe the method and assumptions selected to identify the inundated areas.

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 if a realistic breach is to be assumed. 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 choice of size, shape, and time of dam breach. There are also several available procedures for routing dam failure hydrographs to determine information on areas inundated by the flood as it travels downstream. To avoid unnecessary study and costs, the routing should cease at a point where real-time flood warning information can be provided on a pre-planned basis.

Continued . . .

II. DEVELOPING AN EAP: PART VI—APPENDIXES

INVESTIGATION AND ANALYSIS OF DAM BREAK FLOODS (Continued)

Many methods for developing the dam failure hydrograph and routing dam break flows downstream are available. Regardless of the method used, all EAP's for communities and other affected areas in a watershed should be developed using, to the extent practicable, the same computational procedures to ensure coordination, compatibility, and acceptance. Many Federal agencies have developed procedures that are available upon request. They may be obtained from the National Weather Service (NWS), Bureau of Reclamation, Soil Conservation Service, Corps of Engineers, Tennessee Valley Authority, U.S. Geological Survey, and Federal Emergency Management Agency (FEMA). Procedures developed by the NWS are the most widely used.

Sensitivity analyses are recommended in order to fully investigate the effects of a failure on downstream areas.

BENCHMARKS AND FLOOD PROFILES

The appendix would be an appropriate place to provide a listing of the benchmarks used in the preparation of inundation maps, to provide elevation data for reference and subsequent evaluations. The flood profiles used in the development of inundation maps should also be included.

TRAINING

Training of people involved in the EAP should be conducted to ensure that they are thoroughly familiar with all elements of the plan, 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 appendix to your EAP. Exercises simulating dam failures are excellent training 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 be kept of training completed and refresher training conducted.

II. DEVELOPING AN EAP: PART VI—APPENDIXES

TESTING

Prepare scenarios for the various emergency conditions, and test the state of training and readiness of key personnel responsible for actions during an emergency, to make sure that they know and understand the procedures to be followed and actions required. Any special procedures required for nighttime, weekends, and holidays should also be included. The tests should involve a drill simulating emergency conditions, preferably up to but not including actual evacuation. Testing of remote sensing equipment at unmanned dams should be included.

Coordination and consultation with local government, law enforcement officials, and other organizations involved is desirable in order to enhance the realism of the drill. Their involvement will perfect the close coordination with agencies necessary for a successful execution of the plan in an actual emergency. The drills should be critiqued in writing and the plan should be revised to correct any deficiencies noted.

UPDATING

The EAP should be updated promptly after each change in involved personnel or their telephone numbers. Together with local governmental officials, conduct a comprehensive review of the adequacy of the EAP at intervals not to exceed one year. During the review, an evaluation of any amendments to guidelines or changes in downstream human habitation or in the reservoir should be made, to determine whether any revisions to the current plan (including inundation maps) are necessary and would improve the workability of the plan. These revisions must be made in consultation with the appropriate public agencies. Reviews should be conducted on or about the same date each year. If no revision is necessary, a statement that the review was made and no revision to the plan was necessary should be provided to each recipient of the original plan.

Copies of any revisions that do result from updating the plan or from periodic testing of the plan should be furnished to all individuals to whom the original plan was distributed. A procedure should be established to ensure that all copies of the plan are revised.

POSTING OF THE NOTIFICATION FLOWCHART

An up-to-date copy of the Notification Flowchart and/or list should be posted in prominent locations at the dam site or local emergency operations center (essential for unmanned dams). The flowchart should be posted at each phone and radio transmitter at the dam, powerhouse (if applicable), emergency operations center, and at all other desirable locations. The locations of the posted flowcharts should be indicated in the EAP.

A copy of the complete, up-to-date EAP should also be available to the dam operators, emergency operations center personnel, and local officials. The location of each copy should be stated in this section of the EAP.

II. DEVELOPING AN EAP: PART VI—APPENDIXES

RECORDING OF EMERGENCY CONDITIONS

A record of all telephone or radio reports of emergency conditions and facility failures, and actions initiated, should be kept at all steps of the communications network. Each call should be recorded in chronological order to maintain continuous records during an incident. A log could be developed, and kept as an appendix to the EAP, for documenting emergency conditions, facility failures, and actions initiated and carried out.

GLOSSARY

The EAP may include a glossary that defines any technical terms used in the EAP.

II. DEVELOPING AN EAP: CHECKLIST FOR EVALUATING THE EAP

CHECKLIST FOR EVALUATING THE PLAN

Upon completion of a first draft of the Emergency Action Plan, it should be reviewed to evaluate its workability and comprehensiveness, and to make sure that nothing has been overlooked. Ask each entity and/or person involved to review the plan and comment on its adequacy. A checklist such as the one shown in Figure II-3 may help carry out this task.

FIGURE II-3. EAP DEVELOPMENT CHECKLIST

I. Development Of The Plan

Overview

✓ Are reporting procedures clear enough in showing what data must be collected and what information should be reported?

✓ Are terms in the plan defined so that users will have no questions about the nature of the situation?

- Failure vs. impending failure
- Emergency situation vs. potential problem
- Amount of time before a crisis occurs

Problem Identification

✓ Are the following indicators of potential failure covered in the plan?

- Slumping/sloughing
- Erosion
- Riprap displacement
- Slides on dam or abutments
- Increased amount of seepage
- Cloudy seepage
- Boils
- Piping
- Whirlpools (vortices)
- Settlement
- Cracks
- Bogs
- Sinkholes
- Abnormal instrumentation
- Failure of operating equipment
- Water in the intake tower
- Other

Continued . . .

CHECKLIST FOR EVALUATING THE PLAN (Continued)

FIGURE II-3. EAP DEVELOPMENT CHECKLIST (Continued)

Problem Identification (Continued)

✓ Are all events that could cause either a dam failure or flooding covered in the plan?

- Earthquake
- Storms
- Structural problem
- Massive landslide
- Volcanic eruption
- Fire
- Sabotage
- Sudden water releases
- Other potential disasters

✓ Does the problem identification show all the possible locations of the problem?

✓ Are the above indicators and events sufficiently defined so that the user can understand them?

✓ Does the plan identify the cause of the problem?

✓ Can the user ascertain the seriousness of the problem (i.e., determine when the problem becomes an emergency)?

✓ Can the user determine what action is needed?

✓ Can the user ascertain exactly when to notify local officials and which local officials to notify, depending on the nature of the problem?

✓ Can the user determine what equipment or supplies are needed for each type of problem?

✓ Does the format of the plan easily link problem identification with the action to take, notification to make, and equipment and supplies to use?

✓ Does the plan include a list of historical problems or a list of the most common problems for that type of dam?

Continued . . .

CHECKLIST FOR EVALUATING THE PLAN (Continued)

FIGURE II-3. EAP DEVELOPMENT CHECKLIST
(Continued)

Notification

✓ Does the plan contain a list of key dam personnel and local officials in charge of evacuation which shows the following information?

- Which officials to call first,
- Their day/night telephone numbers,
- Technical experts and their fields of expertise,
- At what point technical and/or evacuation experts should be called (triggering mechanisms),
- The names of their alternates, and
- Their responsibilities?

✓ Does the plan's format allow the user to find the name of the primary contacts quickly? Has the order of notification been **prioritized**?

✓ Does the plan show the user's (dam owner/personnel and local officials) responsibility/authority in the event of a total loss of communications?

✓ Does the plan describe the communications system?

- Normal conditions
- Backup
- Radio call numbers and frequencies
  - For onsite radios
  - For those to be notified

✓ Does the plan provide for remote sensing equipment if the dam is unmanned?

✓ Does the plan include procedures for downstream warning?

- Availability of equipment
- Levels of responsibility for warning
- Downstream operators
- Other dams
- Industries
- Other agencies
- Recreational users

Continued . . .

CHECKLIST FOR EVALUATING THE PLAN (Continued)

FIGURE II-3. EAP DEVELOPMENT CHECKLIST (Continued)

Local Coordination

✓ Was the development of the plan coordinated with local officials during the planning phase?

- Owner/staff and/or agency input into plan
- Local officials' and/or agencies' input into the procedures for emergency operations center, evacuation, and post-flood operations
- Utilization of existing local plan

✓ Do the inundation maps provide sufficient information and explanation?

- Language understandable?
- Terms explained?
- Map usage explained?
- Criteria explained?
- Travel time shown?
- Maximum elevations for each depicted event shown?
- Floodplain information available?
- Areas impacted within flood boundaries clearly shown?

Resources

✓ Are resources adequately identified?

- Equipment and sources specifically described, including the contact name and telephone number?
- Supplies and suppliers specifically described, including the contact name and telephone number?
- Repair material and erosion protection material described?
- Arrangements to share with government entities described?

Review

✓ Is a comprehensive review of the plan conducted at the time it is developed?

- Is it technically accurate?
- Is it workable?
- Does it comply with criteria?
- Is it comprehensive as a whole?
- Is it presented effectively?

Continued . . .

CHECKLIST FOR EVALUATING THE PLAN (Continued)

FIGURE II-3. EAP DEVELOPMENT CHECKLIST
(Continued)

II. Implementation Of The Plan

Local Coordination

✓ Was the plan (complete with notification list and inundation map) sent to all appropriate officials? Is a list of these officials maintained?

✓ Have local officials had a briefing or other explanation of the plan? Is a record of such explanation maintained?

- Notification procedures clarified
- Communications network explained
- Points of contact exchanged
- Maps explained
- Basic project data explained

✓ Have effective lines of communication for emergency conditions been set up?

✓ Has agreement between the dam owner and local officials been reached with respect to roles and responsibilities during a dam emergency? Is the agreement in writing?

✓ Has the dam owner reviewed local evacuation plans and provided feedback to local officials?

Testing

✓ Has a plan for testing the EAP been developed?

✓ Have drills been conducted? Is a schedule of drills maintained?

✓ Have the following elements of the plan been tested?

- Problem identification
- Emergency scenarios
- Notification of dam owner and operating staff
- Notification of local officials and others
- Communications system
- Equipment (including remote sensing equipment)

Continued . . .

CHECKLIST FOR EVALUATING THE PLAN (Continued)

FIGURE II-3. EAP DEVELOPMENT CHECKLIST
(Continued)

Testing (Continued)

✓ Were all appropriate personnel involved in the drills?

- Owner's personnel
- Dam safety personnel
- Maintenance personnel
- Support staff
- Federal, State and local officials
- Contractors and suppliers

Personnel And Resource Readiness

✓ Are all appropriate employees familiar with the EAP?

✓ Do all appropriate employees have access to the plan?

✓ Have all appropriate personnel received training in the following areas?

- How to use the plan, including the notification flowchart and inundation map
- Identifying a problem
- Identifying the severity of a problem
- Using the communications equipment
- Using the notification subplan
- Using the evacuation subplan
- Overall dam safety

✓ Is dam attendance appropriate?

✓ Are key personnel available 24 hours a day?

✓ Is the division of personnel into emergency response teams appropriate?

✓ Do employees and local officials understand their roles during emergencies?

✓ Do key employees and local officials have access to the dam during emergencies?

Continued . . .

CHECKLIST FOR EVALUATING THE PLAN (Continued)

FIGURE II-3. EAP DEVELOPMENT CHECKLIST
(Continued)

Personnel And Resource Readiness (Continued)

✓ Are resources ready?

- Equipment available and up-to-date?
- List of contractors up-to-date?
- Supplies on hand or readily available?

Reviewing And Updating

✓ Is the plan reviewed at least annually? Periodically?

✓ Are notification procedures regularly updated?

- Names and telephone numbers of key staff
- Names and telephone numbers of local officials
- Names and telephone numbers of contractors

✓ Are the following conditions confirmed during the review?

- Drills conducted
- Personnel trained
- Communications equipment operational
- Other equipment operational
- Access to dam clear
- Downstream warning system in place and operational
- Inundation maps still current
- Evacuation routes and priorities still current
- New problems accounted for in the plan

II. DEVELOPING AN EAP: SUMMARY

SUMMARY

This unit outlined the general steps to follow when developing an EAP for a dam:

- Step 1: Determine the areas that could be inundated.
- Step 2: Prepare inundation map(s).
- Step 3: Identify the triggering events that initiate an emergency action, and specify the actions to be taken and by whom.
- Step 4: Coordinate the development of the EAP with all involved parties.
- Step 5: Identify all communications systems.
- Step 6: Draft the Notification Flowchart.
- Step 7: Draft the EAP.
- Step 8: Hold meetings for review and comment on the draft EAP.
- Step 9: Revise the EAP as appropriate, obtain the necessary approvals, and disseminate the EAP.

Unit II also presented a sample six-part format for an EAP, and described the contents applicable to each section of the EAP. The EAP format described is as follows:

- Part I--Introductory
- Part II--Responsibilities
- Part III--Emergency Procedures
- Part IV--Preventive Actions
- Part V--Inundation Maps
- Part VI--Appendixes

Finally, this unit presented a checklist that can be used in developing an EAP, to ensure that all necessary information is included.

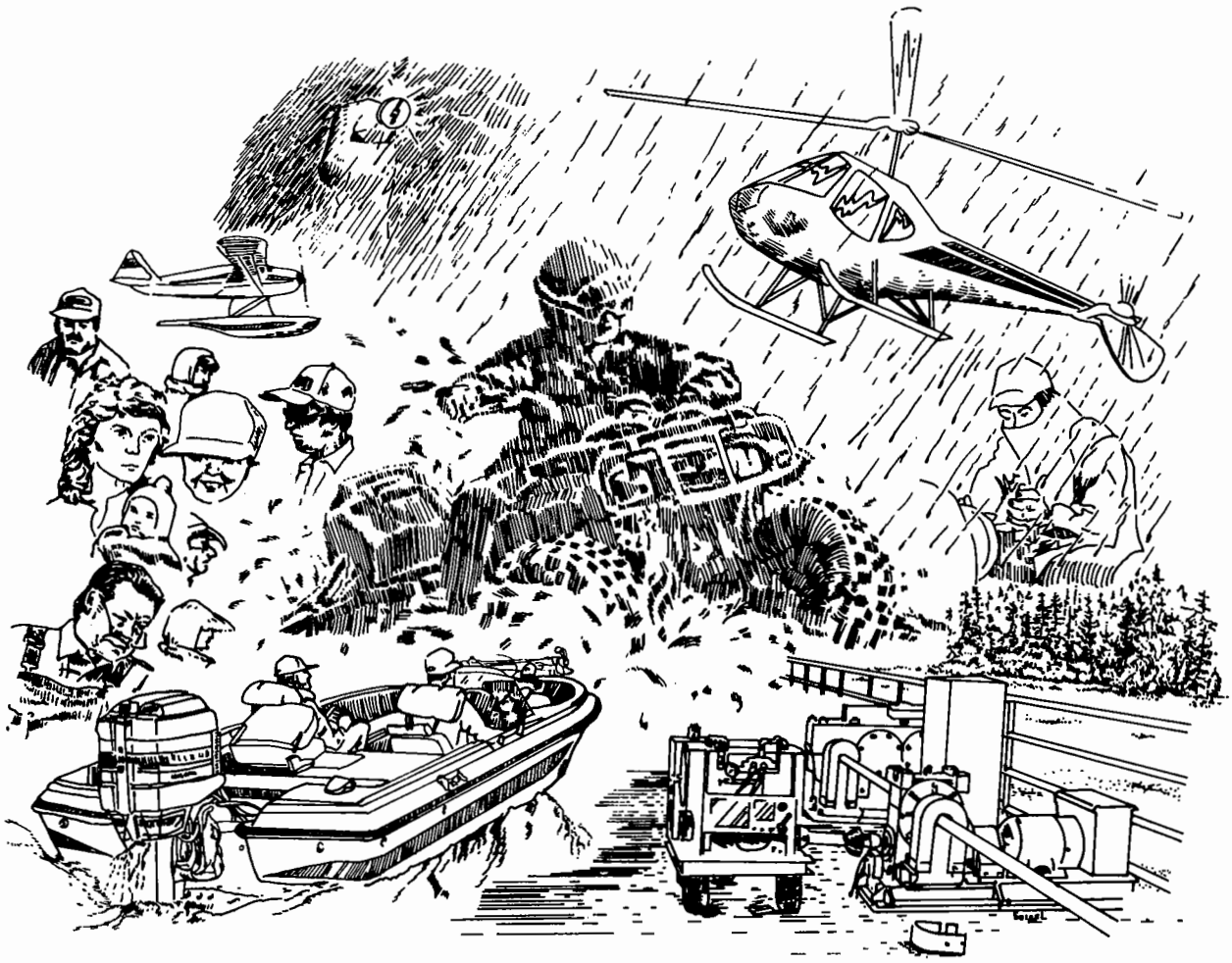
UNIT III

MAINTAINING AN EAP

III. MAINTAINING AN EAP: OVERVIEW

INTRODUCTION

Even after the Emergency Action Plan (EAP) has been developed, approved, and distributed, the job is not done. Without periodic maintenance, the EAP will become outdated, lose its effectiveness, and no longer be workable. If the plan is not tested, those involved in its implementation may become unfamiliar with their roles. If the plan is not updated, the information contained in it may become outdated and useless. This unit will explain proper procedures for maintaining an EAP, including methods for testing and critiquing the plan, and also for reviewing and updating it.



III. MAINTAINING AN EAP: TESTING THE EAP

TESTING THE PLAN

It is essential that an EAP be tested periodically by conducting an emergency drill. Testing is necessary to train participants, as well as to identify weaknesses in the plan. Annual testing is recommended.

Begin by developing a realistic scenario under which the EAP would be implemented. The scenario should be different every year. In addition, different **levels** of the notification hierarchy should be tested each time an emergency drill is conducted.

The merits of a surprise drill versus a planned one should be considered. While a planned drill will allow participants to rehearse their roles in the EAP, a surprise drill can be more educational, since it will be more realistic, and may reveal areas in which the plan can be modified to make it more workable.

At least once every five years, conduct a drill that is coordinated with all Federal, State, and county officials having responsibilities under the plan. The involvement of State emergency services in county affairs can be encouraging to county officials, and can foster enthusiasm for the maintenance and timely implementation of the EAP.

CRITIQUING THE TEST RESULTS

Immediately following a test or actual emergency, a critique should be conducted with all involved parties. Check the responses to the scenario at **all** levels. The critique should discuss and evaluate the events prior to, during, and following the test or actual emergency; actions taken by each participant; the **time** required to become aware of an emergency and implement the EAP; and what improvements would be practicable for future emergencies. The purpose of the critique is to identify deficiencies in the plan, such as wrong telephone numbers on the notification chart, inundation maps with inaccurate information, and problems with funding, procedures, priorities, responsibilities assigned, materials, equipment, and manpower.

After the critique has been completed, the plan should be revised, if necessary, and the revisions disseminated to all involved parties.

III. MAINTAINING AN EAP: UPDATING THE EAP

UPDATING THE PLAN

In addition to regular testing, also conduct a periodic (at least annual) review of the overall plan, to assess its workability and efficiency (i.e., timeliness), and to plan for the improvement of weak areas.

Some updating of the plan, such as discovering incorrect or outdated phone numbers, will be accomplished during emergency drills. But there are other aspects of the EAP that need to be examined on a regular basis. For example, make a periodic review of the downstream area, to identify changes (new developments, etc.) that might affect the priority of notification and evacuation, and the information shown on inundation maps.

Again, once the plan has been revised, the updated version--or simply the affected pages--should be distributed to all involved parties. It is recommended that the entire EAP be reprinted and distributed to all parties at least every five years.

NOTE: The distribution of copies of the EAP and the Notification Flowchart (if issued separately) must be controlled and documented, to ensure simultaneous updating of **all** copies.

APPENDIX A

GLOSSARY

GLOSSARY

BENCH MARK - A permanent or temporary monument of known elevation above sea level, used as a vertical reference during construction and for topographical surveys.

BREACH - An opening through a dam resulting from partial or total failure of the dam.

DAM - A barrier constructed across a watercourse for the purpose of storage, control, or diversion of water.

EMERGENCY - A condition which develops unexpectedly, endangers the structural integrity of a dam and/or downstream property and human life, and requires immediate action.

EMERGENCY ACTION PLAN (EAP) - A formal plan of procedures designed to minimize consequences to life and property in the event of an emergency at a dam.

FAILURE - The catastrophic breakdown of a dam, characterized by the sudden, rapid, and uncontrolled release of impounded water.

FLOODPLAIN - The downstream area that would be inundated or otherwise affected by the failure of a dam or by large flows.

FLOOD PROFILE - A graph (elevation view) showing the relationship of the water surface elevation and natural ground elevations for a discharge at a given location along longitudinal segments of a watercourse for a flood event. The flood event may either be a dam failure or a natural flow condition. Also see **WATER SURFACE PROFILE.**

FLOOD ROUTING - The process of determining progressively over time the amplitude of a flood wave as it moves past a dam or downstream to successive points along a river or stream.

HEADWATER - The water immediately upstream from a dam. The water surface elevation varies due to fluctuations in inflow and the amount of water passed through the dam.

HYDROGRAPH - A graph showing the discharge, stage, velocity, or other hydraulic property with respect to time at a particular point on a watercourse.

INFLOW DESIGN FLOOD - The flood hydrograph used in the design of a dam and its appurtenant structures, particularly the spillway and outlet works, and for determining maximum temporary storage and height of dam requirements.

INSTRUMENTATION - The use of special devices to obtain critical scientific measurements of engineered structures.

INUNDATION MAP - A map showing areas that would be affected by flood conditions and/or by an uncontrolled release of reservoir water due to the failure of a dam.

GLOSSARY

SENSITIVITY ANALYSIS - An analysis in which the relative importance of one or more variables thought to have an influence on results of the study being conducted is determined.

SPILLWAY - A structure over or through which flood flows are discharged. If the flow is controlled by mechanical means, such as gates, it is considered a controlled spillway. If the elevation of the spillway crest is the only control, it is considered an uncontrolled spillway.

TAILWATER - The water in the natural stream immediately downstream from a dam. The water surface elevation varies with discharge from the reservoir.

WATER SURFACE PROFILE - A graph (elevation view) showing the relationship of the water surface elevation and natural ground elevations at a given location along longitudinal segments of a watercourse for a specific discharge. Also see **FLOOD PROFILE.**

APPENDIX B

REFERENCES

REFERENCES

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