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CHAPTER

Chapter 9: Guidelines for Operations

9.0 General

An operation plan details each of the safety-program components outlined in Chapter 4 and detailed in Chapters 5 through 8. The extent of an operation plan depends on the complexity of the dam itself—factors such as dam size, the number and type of appurtenances, and operating mechanisms.

The operation of a dam may involve adjusting the reservoir level, controlling debris by opening and closing valves, keeping records, and, in general, ensuring public safety. Proper operation procedures are extremely important for maintaining a safe structure. Many small dams do not need a full-time operator, but should be checked regularly. Special operational procedures to be followed during an emergency should be posted, particularly if the owner/operator is not always available.

9.1 Plan Guidelines

Establishing an operations procedure or plan calls for detailed documentation of the following:

- data on the physical characteristics of dam and reservoir
- descriptions of dam components (Chapter 2)
- operations instructions for operable mechanisms (Chapter 9)
- inspection guidelines (Chapter 5)
- instrumentation and monitoring guidelines (Chapter 6)
- maintenance guidelines (Chapter 7)

- guidelines for emergency operations (Chapter 8)
- bibliographical information (Bibliography)
 - As recommended in Chapter 4, collection and review of existing information on the dam's design, construction, and structural characteristics comprise the first step in developing a dam-safety program. Guidelines for inspections, monitoring, maintenance, and emergency-action planning appear in the other chapters as indicated.

The operation plan should have several separate sections:

A. Background Data

1. Vital dam statistics
2. Description of appurtenances

B. Operating Instructions and Records

1. Operating instructions for operable mechanisms
2. Inspection instructions and forms
3. Monitoring instructions and forms
4. Maintenance instructions and forms
5. Bibliography
6. Telephone list

C. Emergency Action Plan

Sections A and B are described briefly below and a schedule of routine tasks is included. Instructions are included for frequent inspections, monitoring, and follow-up maintenance. The emergency action plan is discussed in Chapter 8.

9.1.1 Background Data

1. Vital dam statistics include:
 - a. General

- type of dam
 - height of dam
 - length and width of crest
 - location of instrumentation
 - angles of upstream and downstream slopes
 - available freeboard (area between the design flood and the top of dam)
 - capacity tables for reservoir and inflow and outflow works
 - elevation of top of dam
 - county location and distance to the nearest city
 - stream name
 - year completed
 - hazard classification
 - location of toe drain outlets
- b. Spillway
- type of spillway
 - length of spillway
 - spillway channel elevation
 - normal pool elevation
 - available freeboard
 - maximum observed flow and date of observation
 - discharge tables for spillway
 - location of spillway drains
- c. Outlet
- size, configuration, and type of outlet
 - size and type of outlet control device
 - discharge tables for outlet
 - elevation of inlet invert
 - elevation of outlet invert (the bottom surface of a conduit or a channel)

9.1.2 Operating Instructions and Records

Instructions for operable mechanisms.

The plan should provide complete, clear, step-by-step instructions for operating all mechanisms associated with a dam, including the outlet control valve and spillway gates, if any. It should emphasize proper sequences and include sketches, drawings, and photographs to identify handles, cranks, buttons, etc. It should also list the correct method of opening and closing guard gates, gate usage during low and high flow, openings at which excessive vibrations are experienced, and operating problems peculiar to a specific gate. For hydraulic and electric gates, the plan should supply a schematic diagram showing each component (including backup equipment) and its place in the operating sequence.

The plan should give instruction on the general operation of the reservoir, including the regulation of inflow and outlet ditches, stating the maximum pool levels allowable at different times of the year, maximum and minimum carryover storage, and maximum and minimum permissible outlet releases. The instructions should also describe operation of the outlet to limit or prevent excessive spillway flow, and the method for periodic drainage of the reservoir to permit thorough inspection of the outlets or upstream slope.

Inspection and instrumentation. The plan should also supply a set of clear, step-by-step instructions for a comprehensive inspection of the dam and its surroundings. Record data on forms like those in the Appendixes, keeping copies of all completed inspection records and photographs.

Monitoring instructions. Prepare clear instructions on how to use monitoring instruments and how to take measurements at monitoring points; include a map identifying each instrument and monitoring point and forms for recording the data.

Keep the monitoring points themselves, plus any seepage or other areas needing special attention, clear of obscuring growth. The points should be permanently marked so they can be found during inspection. The help of a qualified engineer will be useful in developing this section.

Monitoring can only be beneficial if the observations are recorded in an orderly way and form a clear record of performance. Thus, plotting or charting some of the readings will be necessary. The plan should give instructions on how to make and record each measurement or observation. If your own engineer is not going to plot or chart the data, develop instructions and forms to allow yourself, an operator, or maintenance personnel to do this work. An experienced consulting engineer may be helpful in preparing the needed formats.

Maintenance instructions. The plan should give instructions for periodic maintenance in detail, so that new personnel can understand the task and experienced personnel can verify that they have completed the work properly. See Table 9.1 for a schedule of routine tasks. List all needed maintenance work. Include the tasks described in Chapter 7, such as:

1. removing brush and trees
2. removing debris
3. mowing and trimming
4. regrading the crest and access roads
5. removing harmful rodents
6. operating and lubricating gates
7. adding riprap when needed
8. sealing joints in concrete facings
9. cleaning drainpipes and outlets
10. maintaining monitoring points
11. maintaining the security of operating equipment

Bibliography. The plan should catalog all available reference material in a single list. Include the title, the author or agency responsible for publication, the date and place of publication, and the permanent location of the material (for example, *filings*

cabinet in basement) for each resource. Even materials without titles or authors, such as photographs and maintenance information, should be listed.

Telephone List. A comprehensive up-to-date listing of important telephone numbers should be maintained and include numbers for:

- the owner's and operator's home, office, mobile, pager, and any other phones
- employees actively involved with the dam
- the local emergency management agency
- the Texas Department of Public Safety
- local police and fire departments
- the Texas Dam Safety Program
- qualified local engineering consultants
- downstream residents
- a contractor with access to adequate equipment and material

9.2 Schedule of Routine Tasks

Establish a schedule that includes both day-to-day tasks and tasks performed less frequently during the year. Such a schedule serves to formalize inspection and maintenance procedures and makes it easy to determine when a task should be done. As suggested in Table 9.1, the frequency of a required task is often dependent upon the hazard classification of the dam (see Chapter 3).

9.3 Record Keeping

As already suggested, operating a dam should include keeping accurate records of:

1. **Observations**—Record all observations. Periodic observation of seepage is particularly important. Again, photographs are valuable for recording observations and documenting changes. Record the dates the photographs and observations were made.

Table 9.1
Operation Plan—Schedule of Routine Tasks
Hazard Classifications

Frequency (minimum)	CATEGORY 1 High Hazard (many lives lost excessive damage)	CATEGORY 2 Significant Hazard (few lives lost appreciable damage)	CATEGORY 3 Low Hazard (no lives lost minimal damage)
Daily	Surveillance.	—	—
Weekly	Monitor seepage.	Surveillance.	—
Monthly	Collect & examine observation well or other data.	Collect & examine observation well data.	Surveillance. Monitor seepage. Collect & examine observation well data.
Quarterly	Inspect visually.	Inspect visually.	—
Bi Annually	Test outlet & spillway components.	—	—
Annually	Inspection by engineer. Check alignments & movements.	Inspection by engineer. Test outlet & spillway components. Check alignments & movements.	Visual inspection. Test outlet.
As Required	Routine maintenance & additional inspections.	Routine maintenance & additional inspections.	Routine maintenance & additional inspections. Check alignments & movements.
Immediately After Floods & Earthquakes	Additional inspections.	Additional inspections.	Additional inspections.

2. **Maintenance**—Written records of maintenance and major repairs are important for evaluating the safety of a dam.
3. **Rainfall and Water Levels**—A record of the date, time, and maximum elevation of extremely high levels of the lake and associated rainfall or runoff is especially helpful in evaluating the performance of a dam and its spillway system. In particular, keep records for reservoirs that have widely fluctuating water levels.
4. **Drawdown**—Keep a record of the amount, rate, and reason for any drawdown of the reservoir level.
5. **Other Procedures**—Maintain a complete record of all operating procedures.