Federal Energy Regulatory Commission
Division of Dam Safety and Inspections
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Preparations for Handling Emergencies and Potential Emergencies at Projects

1. Information to Have Available for Each Project

● Have an electronic folder for each project that contains the following information in searchable PDF format:

Points of Contact names (dam safety and security) with telephone numbers
Driving directions to the project
Hotels (2) in the area with addresses and telephone numbers
Key data about the project (This could include the STI.)
- ▪ Site location map
- ▪ Plan view of the project
- ▪ Critical cross sections of the dam
- ▪ Foundation and embankment materials description (eg loose sand, compacted sand and gravel, etc.)
- ▪ Instrumentation plan and latest instrumentation report
- ▪ Information about upstream and downstream dams: points of contact names and telephone numbers; distance to the dams; storage volume; spillway capacity; etc.
- ▪ Dam break flood inundation map
- ▪ EAP call chart
- ▪ Contact information for State Dam Safety Office and appropriate Federal Dam Owners
- ▪ Hazard classification
- ▪ Security group classification
- ▪ PFMA, if available
- ▪ Upstream/downstream USGS gage numbers and information
- ▪ Local police/FBI telephone numbers (if security related incident)

In addition to the office electronic folder of the selected key data for each project, the RE, Deputy RE, and Lead Engineer should have a CD or paper copy of this information for each project available at their homes for ready reference when an emergency call comes in after work hours or on weekends.

2. Things to Do Upon Initial Notification of a Developing Problem or Emergency

● Record the name and telephone number of the person making the notification. Obtain the name, title, and telephone number of an available person who can make decisions regarding implementation of the EAP, if necessary. Obtain the project name, project number, and as much information about the situation as you can.

▪ Determine – is the project in imminent danger of failing, is a hazardous situation developing, has a hazardous situation developed, or is there a security problem?

If YES -- ▪ Activate the appropriate phase of the EAP if it hasn't already been activated.

▪ Discuss what can be done, if anything, to mitigate/control the situation.

▪ What security actions have been taken to limit access to the site by unauthorized personnel?

▪ Remind the licensee to keep the Emergency Management Personnel posted on developing conditions at the project. For emergency situations that result in the opening of an Emergency Management Operation Center (EMOC), the licensee and FERC should have representatives present in the EMOC for liaison.

Continue to identify and evaluate the problem as discussed in the If NO step and below.

If NO -- ▪ Identify the problem. Where is it located on the project? Is the problem due to flooding, embankment/foundation seepage, embankment instability, earthquake damage, sinkhole(s), gate failure, security breach, a combination of these reasons, or other issues?

▪ Evaluate the problem and determine what needs to be done to control the problem?

▪ Have the licensee identify a contractor who can provide materials, equipment, and labor to construct a temporary cofferdam, drainage blanket, stability berm – sand, sand bags, geotextile, gravel, dump trucks, front loaders, etc. if needed.

▪ The EAP should be reviewed and the potential impacts determined for the type of possible breach.

▪ Determine if there are upstream (U/S) projects that can affect this project and what measures are being taken at the U/S dams and reservoirs to reduce inflow into this reservoir.

▪ Determine if there are downstream (D/S) projects that could be affected by this project and what measures are being taken at the D/S dams and reservoirs to drawdown these reservoirs to make room for releases from the problem project.

▪ What actions are being taken to control or minimize the problem?

▪ Was the problem previously identified as a potential failure mode (PFM)?

If YES --- Are there any preplanned mitigation actions for this PFM? Have these actions been initiated?
If NO --- Could this problem result in a significant uncontrolled loss of the reservoir? If it could, then an EAP notification for developing problems should be initiated, if the problem is actively increasing.

▪ For projects that FERC will send personnel to, the Regional Office is to request that the licensee have available for review, when the project engineer arrives, the most recent Part 12D report, the most recent Operations Inspections report, EAP, STI, Instrumentation reports, and any other documents and drawings that may help in understanding the problem.

3. Staff to be Dispatched to Emergencies and their Responsibilities:

For all emergencies at a project that need an FERC staff person on site, RO Management should immediately establish a Regional Emergency Project Team that would be available throughout the emergency. The Regional Emergency Project Team would consist of the RO Manager, project engineer, and whatever additional engineers and points of contact are needed to address the emergency. A project engineer will be dispatched to the site. Actions he/she needs to do are found throughout this document.

If the emergency is severe enough that an EMOC will be activated, then the Regional Office will need to send both a FERC supervisor and a staff engineer to the project site. Both of these individuals should have photo cell telephones with them. The staff engineer should have a lap top computer and a CD containing the critical project data.

In remote areas where cell phone coverage is lacking, the FERC supervisor will coordinate with the EMOC manager and coordinate use of radio equipment or satellite phone as appropriate and possible so that communication can be made between the FERC supervisor, the staff engineer at the dam, or with staff in the Regional Office and/or Washington, DC.

FERC supervisor responsibilities:

1. Locates in the EMOC
2. Coordinates between Licensee management, EMOC manager, state DSO, and FERC Regional Engineer.
3. Provides assistance to the project engineer in recommending engineering actions to the Licensee to minimize the impact of the emergency situation.

4. Point of contact for the project engineer and second staff engineer for any questions or problems on which they need guidance or assistance.

FERC Project Engineer responsibilities:

1. Locates at the project site.
2. Assists the FERC supervisor and RO as assigned.
3. Supplements information being provided by licensee liaison.
4. Provides technical information.
5. Provides information details from EAP.
6. Assists in mitigation efforts.
7. Other assistance as needed.

4. Things for the Project Engineer to do:

Whether the project engineer is in the office or in the field at another project when notification of a problem at a project is received, the following items are things that need to be done and steps that may be needed to prevent failure of the dam or to minimize the damage and stabilize the condition.

▪ If the project engineer leaves from the office to go to the site, he/she should take a photo cell telephone, a lap top computer, a paper copy and CD of the key information from the electronic folder discussed above, a copy of the most recent Operations Report, and a copy of the last Part 12D review memorandum.

▪ If a project engineers travels directly to the project from home or from another project, the project engineer should be advised from the Regional Office who the licensee contact is at the site and to contact this person upon arriving at the site. If possible, the engineer should download the digital file/folder of key project information.

FLOODING:

▪ If flooding or potential flooding is the problem, determine if there are ways to minimize the effects of flooding, the potential for dam failure and the effects should failure occur.

If there is a dam upstream of the problem project with the capability to reduce inflow into the problem project reservoir, the licensee, FERC Regional Office, or project engineer should coordinate with the upstream owner of that project to reduce its flows. This applies to the upstream dam whether it is a FERC regulated dam or not. If outflows from the upstream project can be reduced or shutdown for a period of time, this could allow the operators of the problem project time to draw the reservoir down or reduce the rate of rise and possibly prevent failure of the project. The Regional Engineer (or RO representative) should also be contacted and asked to follow up with the upstream dam owner (federal or non-federal) on these requests. The Regional Engineer (or RO

representative) should coordinate this request with the State Dam Safety office if the dam is state regulated.

If there are downstream dams that could be impacted by the failure of the problem project, these owners need to be notified that it may be necessary to begin drawing down their reservoirs to reduce possible overtopping of their dams. Advise these dam owners or operators of this situation as soon as possible.

SEEPAGE:

▪ If seepage is a problem, a determination must be made quickly whether the seepage is carrying fine grain materials. This is commonly called piping. If seepage is significant in quantity and is increasing this could lead to failure of the dam or project structures.

If the area of seepage is localized, the seepage is clear (i.e. no fine grained soils are being carried), the seepage is small in volume, and the area around the seepage exit location is stable, the situation can be monitored and investigated further to better understand what action needs to be taken. As long as the situation remains stable and unchanged, time should be available to investigate and plan for the corrective action. If large quantities of seepage are evident, consideration should be given to reducing the seepage quantity along with controlling the seepage with a drain in a weighted filter berm.

However, if seepage flows carry fine grain soils at any time, settlement is observed above the seepage area, the seepage area is large, the area unstable or soft, or some combination of these factors, then more immediate preventative measures are required. Initiation of reservoir drawdown should be considered. Appropriate equipment and adequate quantities of sand or geotextile fabric, pea gravel, and larger gravel (2" minus) need to be brought on site, as soon as possible, for construction of a weighted filter to prevent the migration of fines, control the seepage, and to provide stability to the area. Filter criteria must be considered in the selection of the filter and gravel drain materials, but getting an exact match of criteria should not delay needed emergency measures. Cutting of brush and some vegetation may be needed in order to clear an area for the weighted filter. However, excavation into the embankment or foundation <u>should not</u> be permitted during this unstable time, since an uncontrollable piping condition could develop rapidly. For small isolated seepage areas that are transporting fines, the construction of a ring dike around the seep using sand bags may provide sufficient back pressure on the seep to control the movement of fines. Once the emergency condition is under control, procedures for reducing the inflow seepages to acceptable quantities need to be developed and implemented.

EMBANKMENT STABILITY:

▪ If stability of the embankment is in question, the emergency conditions that need to be taken could be a combination of the defensive actions discussed above. Depending upon the severity and size of the unstable area the priority of actions taken or considered are as follows: (1) increase discharges from this project downstream to decrease the reservoir level, notify any downstream dam owners that would be affected by these releases; (2) if an upstream dam exists

nearby, contact the operator or owner and request a reduction of their discharges to decrease inflows into the problem project reservoir; (3) temporary stabilization of the unstable embankment; and (4) notify Emergency Management Personnel of the situation. These actions may all need to be initiated quickly and essentially simultaneously. Stabilization of a slide area of the embankment should first be treated at the toe of the slide with a weighted filter as described for seepage conditions even if a seepage outbreak is not evident. Any work at the top of the slide should be limited initially to repairs that are needed to prevent overtopping of a lower crest section. Adding weight to the top of a slide could cause additional movement of the slide and possible overtopping of the embankment.

OTHER EMERGENCY CONDITIONS:

▪ Emergency conditions, such as a failed spillway gate, breach of an outlet structure, or other limited structure failures that are causing uncontrolled partial releases of the reservoir need to be evaluated to determine if the condition is limited to this structure or if an unchecked continuation of this condition could cause a breach of a larger section of the dam. EMA's and downstream dam owners should be notified that a potentially hazardous situation is developing. If the emergency condition is isolated and would not result in a breach of the dam, then efforts can be focused on stopping the localized uncontrolled release of water. Depending upon the potential hazard to dam safety, notification of downstream dam owners of the situation would be appropriate. A request to limit inflows from an upstream dam may also be appropriate to allow the project reservoir to be drawn down.

If the emergency condition could lead to a larger breach and create a dam safety problem, then a request to limit outflows from the upstream dam and notification of downstream dam owners of the situation as soon as possible are appropriate. Initiation of the appropriate EAP hazard notification should also be made.

EARTHQUAKE DAMAGE:

▪ Embankment instability due to an earthquake is not a frequent occurring event. However, instability can be caused by liquefaction or embankment deformations can occur without liquefaction. If an earthquake incident is reported, you should follow the above procedures under "**2. Things to Do Upon Initial Notification of a Developing Problem or Emergency".** If liquefaction of the dam embankment or foundation has occurred, the dam may have already failed or may be on the verge of failure when FERC receives the incident notification. If the dam has not failed, conditions affecting the safety of the dam as discussed above and actions associated with those conditions should be followed. See Attachment A, STEPS TO BE FOLLOWED IN THE EVENT OF AN EARTHQUAKE for more specific instructions to follow up on a report of seismic activity at a project site. The licensee should immediately inspect the project for signs of damage or problems caused by the earthquake. If the reservoir is low at the time of a significant seismic event and the reservoir is retained, the dam should be inspected for seepage and stability in the future as the reservoir is brought back to normal or above normal levels.

▪ Other emergency type situations not specifically identified here will generally be handled using some combination of the procedures discussed.

5. ▪ **NOTE**: As the FERC engineer on site assessing the emergency situation, you may be more knowledgeable about what actions need to be taken to control the problem than any one else on site. Use your experience and knowledge to help direct what actions need to be taken. Keep Regional Office management posted on the emergency and coordinate important decisions you are about to make, with them, so the best decisions can be made. Your actions may save the dam and save lives downstream. The RO should keep the WO Senior Staff advised of the state of the emergency and involve them in the decision processes as appropriate.

5. Other Coordination During the Emergencies

The licensee will establish a liaison at the EMOC to coordinate with the Emergency Managers and provide general and technical information as needed for the Emergency Manager to fulfill his/her responsibilities.

There should be established a Public Information Center separate from the EMOC to respond to public inquiries, medial inquiries, State inquiries, etc. The licensee will have a representative at this Center to provide information and any public messages as appropriate.

The FERC Supervisor will coordinate with the State Dam Safety Officer during any emergency to keep the Dam Safety Officer apprised of the situation so that this person can provide information to other State authorities as needed and as may be requested.

6. Procedures for Handling Media During Emergencies

▪ During the time of emergency when you are at a project site, media personnel may show up on site. They may want to talk with you about what is going on, what you are doing, or what your opinion or assessment of the situation is. You must be aware that this is likely to happen and be prepared to respond as briefly as possible.

The following are ready responses to keep in mind, in your notebook, or on a 3 by 5 card as a reminder of what to say and do if approached by the media while at a project during an emergency:

1. Refer all requests for interviews to the Office of External Affairs, (202) 502-8680.
2. If faced by media with a camera, do not try to escape or hide. Use the following statements as many times as necessary:
   ▪ When a project is issued a license, we remain involved with the safety of the project and will take whatever measures necessary to ensure the safety of the project.
   ▪ We are inspecting the site, collecting information, and assessing the project for safe operations.
   ▪ Our evaluation of the situation will be made public as soon as possible through our Office of External Affairs.

Attachment A.

STEPS TO BE FOLLOWED IN THE EVENT OF AN EARTHQUAKE

The following steps should be undertaken in the course of events, although many of these individual steps should occur simultaneously:

- The affected D2SI Regional Office and D2SI-WO are automatically notified that a significant earthquake has occurred within the region by the NATIONAL EARTHQUAKE INFORMATION CENTER (NEIC).

- Upon notification of an earthquake, the appropriate D2SI Regional Office determines if FERC projects are near the preliminary epicenter (see item number 1, below).

- The licensee/exemptee of any dam, as instructed in Part 12.10 of 18 CFR Chapter 1, must orally notify the Regional Engineer as soon as practicable of any condition affecting the safety of a project, or project works, including earthquakes [12.3(b)(4)(xii)].

- The licensee/exemptee should be encouraged to initiate their own inspection whenever earthquake damage is suspected. The licensee/exemptee is required to verbally notify the Regional Engineer of any unusual conditions discovered during their post-earthquake inspection. In addition, FERC staff should inspect dams following earthquakes if they meet certain earthquake criteria as described below.

- Following the oral report of the safety related incident, the licensee/exemptee is required to submit a written report to the Regional Engineer which documents the results of the inspection and further actions identified to be taken, as also defined in Part 12.10 of 18 CFR Chapter 1.

- Licensee/exemptee personnel conduct an inspection before FERC arrival. If necessary, upon arrival FERC personnel will perform an independent inspection, or coordinate with on-site personnel currently performing the inspection. If unusual conditions that could affect the ability of the structure to retain the reservoir are discovered, an on-site decision, with the appropriate coordination with FERC supervisory staff, is made as to whether to institute emergency procedures. Monitoring is continued until conditions stabilize or corrective measures are completed.

WHEN POST-EARTHQUAKE INSPECTIONS ARE NECESSARY BY FERC STAFF

The following seven items, as a minimum, should be used to determine if a FERC Post-Earthquake Inspection is necessary:

1. In general, the estimated earthquake magnitude is 5.0 or greater and within an epicentral distance of 12 miles of the dam, or an earthquake of magnitude 4.0 or greater is reported with an epicenter within 5 miles of the dam.

2. The D2SI Regional Office along with consultation with the D2SI-WO determines if peak horizontal ground motions in excess of 0.1 g, or liquefaction, are possible at the dam by referencing to Figures 1 through 4, attached. Inspection is necessary if:

A) potential peak horizontal ground motions are equal to or greater than 0.1 g (Figures 1 through 3) and/or,

B) liquefaction is possible (Figure 4) and liquefiable materials at the dam are suspected to exist. In addition, the liquefaction potential for projects with high and significant downstream hazard potential have been evaluated for a maximum credible earthquake in the Part 12 or stability evaluation. The peak acceleration should be compared to the peak acceleration in the liquefaction analysis to determine whether liquefaction at the project is a probability.

Figures 1 through 3 (ground motion attenuation curves) are provided for three general areas within the United States. These curves represent the latest available attenuation relationships from published sources, and consist of superimposed curve data for lower-end and upper-end magnitude earthquakes. In general, Figure 1 is to be used by the San Francisco Regional Office, Figure 2 is to be used by the Atlanta, Chicago, and New York Regional Offices (and the far-eastern portions of the San Francisco and Portland Offices), and Figure 3 is to be used by the Portland Regional Office.

3. Ground shaking, damage, falling or displaced objects (such as books and pictures), are reported at a dam due to seismic energy. Note that such effects can be observed at a site resulting from non-damaging (micro) earthquakes. Figure 5, attached, lists the Modified Mercalli Intensity Scale and describes site effects commonly reported by individuals at a site. Generally, effects reported at a value below Intensity VII will not be considered for Inspection purposes.

4. Effects, such as 3 above, are reported within ten miles of a dam by the general public, reflecting Intensity VII or greater (Figure 5).

5. Horizontal ground motions are reported to be equal to or greater than 0.1 g at a dam.

6. Unusual conditions, such as site type, attenuation relationships, directivity effects, or other special conditions in the dam or foundation are present that could give a higher priority for immediate inspection.

7. This requirement applies to all significant hazard and high hazard potential dams; low hazard potential dams will generally not be inspected, unless unusual circumstances so warrant. However, the licensee/exemptee should be instructed to perform a site inspection following any earthquake felt at the dam site regardless of hazard classification.

In general, communications are initiated between D2SI Regional and D2SI Washington Offices whenever a magnitude 4.0, or greater, earthquake occurs near a Commission dam, regardless of the above criteria. Inspections may not be necessary, but options should be discussed to fully evaluate potential site conditions. In the event of a magnitude 5.0, or greater, earthquake occurring near a Commission dam, interoffice communications must be initiated regardless of the day, or time of the day. In the event of a magnitude 6.0, or greater, earthquake occurring near multiple Commission dams, FERC Inspection Teams are mobilized.

SEVERE EARTHQUAKE (6.0+ MAGNITUDE) INSPECTION TEAMS

Severe earthquakes not only release significantly more seismic energy than earthquakes of a lower magnitude, but are also capable of generating foreshocks and after shocks, which can lead to increased damage to critical structures. Severe earthquakes can affect a larger area, and thus may result in numerous dams being inspected in a short period of time. As a result, each region identified personnel who will constitute emergency inspection teams capable of reacting to severe earthquakes at a very short notice.

Each team member assembles an informational packet which includes all items needed for an inspection, such as inspection forms, camera(s), binoculars, cellular phones, notebooks, boots, hard hat, safety vest, flash light, area maps, emergency phone numbers of key personnel (FERC and all applicable licensees/exemptees), general seismic parameters for assigned projects, copies of basic plans and drawings of assigned projects, instrumentation layout, historical readings, weir tables, etc. Determine the exact procedures necessary to procure unusual transportation, such as boats, helicopters, charter aircraft, snowmobiles, off-road vehicles, etc.

POST-EARTHQUAKE INSPECTION FORM

PROJECT:_____ DATE:
INSPECTORS:
EARTHQUAKE MAG. & DATE:_____ EPICENTRAL DISTANCE:___miles__ (km)

1. Are strong motion recordings available? NO___ YES___. Is reported or estimated peak ≥0.1 g? NO ___ YES___, *if yes (or calculated potential g exceeds 0.1) go to ITEM A (back of form).*

2. Are piezometer/uplift readings indicating abnormal trends? NO___ YES___, *if yes go to ITEM B.* Summarize:_____.

3. Are inclinometer readings indicating abnormal trends? NO___ YES___, *if yes go to ITEM C.* Summarize:_____.

4. Are settlement/monument point readings indicating abnormal trends? NO___ YES___, *if yes go to ITEM C.* Summarize:_____.

5. Is there evidence of increased downstream seepage? NO___ YES___, *if yes go to ITEM D.* What is normal for this time of year?_____ What is recorded?_____.

6. Is there evidence of turbid or muddy seepage? NO___ YES___, *if yes go to ITEM E.* Summarize:_____.

7. Is there evidence of piping, boil, and/or sinkhole development? NO___ YES___, *if yes go to ITEM E.* Record number and severity of activity_____.

8. Is there evidence of cracks, bulging or settlements within earth embankments? NO YES__, *if yes go to ITEM E.* Summarize:_____.

9. Is there evidence of structural deformations within concrete structures? NO___ YES__, *if yes go to ITEM F.* Describe:_____.

10. Is there evidence of gate malfunctions, such as binding spillway gates? NO__ YES__, *if yes go to ITEM F.* Summarize:_____.

11. Is liquefaction of foundation or embankment materials possible or suspected? NO YES___, *if yes go to ITEM G.* Summarize:_____.

12. Is there evidence of riprap displacements or settlement? NO__ YES__, *if yes go to ITEM H.* Summarize:_____.

13. Is there evidence of landsliding or slumping near the dam and along the reservoir rim? NO__ YES__, *if yes go to ITEM I.* Summarize:_____.

14. Is there evidence of wave seiches? NO__ YES__, *if yes go to ITEM I.* Summarize:_____.

EARTHQUAKE INSPECTION ACTION ITEMS

ITEM A: **If recorded ground motion ≥0.1 g then the potential for damage is significantly increased. Heightened awareness is necessary during the inspection, and monitoring may be necessary for longer periods of time.**

ITEM B: **If piezometers are indicating abnormal trends, then piezometers should continue to be recorded at least daily until stabilized. If pore pressures continue to be elevated, there is a potential for liquefaction and/or piping of fine embankment or foundation materials, or increased uplift pressures on gravity structures. Evidence of instability must be re-examined on a periodic basis.**

ITEM C: **If inclinometers/settlement points are indicating abnormal trends, then instruments should continue to be recorded daily until stabilized. Emergency earth stabilization, or reservoir drawdown, measures may be necessary if trends continue. Refer to EAP and initiate emergency procedures, if necessary.**

ITEM D: **If downstream seepage increases then there is a potential for piping of fine materials. Be alert for muddy or cloudy discharges and increase the awareness of potential instabilities.**

ITEM E: **If muddy seepage/boils/settlement is present this may be an indication of movement of fine material from the dam and/or foundation. Depending upon the severity, further exploration may be necessary, or emergency earth stabilization measures may be warranted if settlement is observed within the embankment. Pour white paint down earthen cracks for determination of crack depth and severity.**

ITEM F: **Structural deformations, such as settlement or cracking, within the concrete may be indicative of potential failure; continue to monitor for deformations until stabilized. Inoperable spillway gates may result in the lost ability to draw down the reservoir in emergency situations. Refer to EAP and initiate emergency procedures.**

ITEM G: **Liquefaction of the foundation or embankment materials can create "quick" conditions which may cause materials to flow under high pore pressures, possibly resulting in significant horizontal and vertical displacements of the embankment. Be alert for the presence of boils, settlement of embankments, increased seepage, etc. If present, monitor the conditions carefully and prepare for potential emergency conditions. If continued movement is suspected, the reservoir may need to be drawn down; refer to EAP and initiate emergency procedures, if necessary.**

ITEM H: **Deformation along riprap is indicative of verified movement, and potential over-steepening. If exposed to severe wave action, this may initiate beaching of the upstream embankment shell. New riprap may need to be added. Exploration may be warranted to discern if additional portions of the upstream embankment and/or core experienced movement.**

ITEM I: **Landsliding or slumping, at the dam abutments may result in instability of the dam structure and subsequent failure. Landsliding or slumping along the reservoir rim may result in rapid mass movement which subsequently may generate a wave capable of overtopping the dam. Further monitoring of the unstable area is necessary, including a calculation of the potential mass of the instability and consequent wave generation. If continued movement is suspected, the reservoir may need to be drawn down; refer to EAP and initiate emergency procedures, if necessary.**

NOTE: It is important to recognize that if the reservoir is not at a high elevation at the time of the earthquake, it is possible that the dam and/or appurtenant structures could suffer some ill effects from the earthquake (associated with seepage performance) that will not show up until higher reservoir elevations are subsequently reached. Therefore heightened awareness, and possibly monitoring, would be appropriate following an earthquake whenever the reservoir is rising to elevations that have not been previously experienced since the occurrence of the earthquake. Also, delayed problems are possible due to the potential release of artesian pressures at depth in the foundation, and these may not be noticeable for several weeks. Specific changes to monitoring schedules would need to be established on a case-by-case basis in light of the magnitude of the earthquake, and apparent damage sustained by the dam and appurtenant structures as a result of the earthquake.

ABBREVIATED CHECKLIST

DAM

UPSTREAM FACE

Slope protection_____
Erosion-beaching_____
Settlement_____
Unusual conditions_____

DOWNSTREAM FACE

Signs of movement
Seepage or wet areas
Slope protection
Unusual conditions

CREST

Surface cracking_____
Settlement_____
Lateral movement_____
Parapet wall_____

ABUTMENTS

Seepage
Cracks, joints, bedding
Slides
Foundation at D/S toe

GALLERIES

Condition of concrete_____
Seepage_____
Drainage and drains
Offsets

FOUNDATION TUNNELS

General
Seepage

INSTRUMENTATION

Piezometers_____
Surface settlement points_____
Reservoir-level gage_____

Inclinometers
Strong motion recorder
Uplift/Other

SPILLWAY

APPROACH CHANNEL

Slides above channel_____
Side slope stability_____
Log boom_____
Slope protection_____

CONTROL STRUCTURES

Apron
Crest
Walls
Bridge

CHUTE OR TUNNEL

Walls_____
Floor_____
Drainage gallery_____
Other_____

STILLING BASIN

Walls
Floor
Weir
River channel below basin

OUTLET CHANNEL

Slope protection_____
Stability of side slopes_____

OUTLET WORKS

Inlet works/Intake
Gates
Outlet conduit
Valve or gate house

POWER FEATURES

Intake structure_____
Trashrack_____
Bulkhead gates_____
Intake gates_____
Intake gate hoist

Gantry crane
Penstock
Tailrace
Standby power unit

RESERVOIR

Log boom_____
Access road_____

Landslides
Res. level _____; max level

NOTES: