EMERGENCY ACTION PLAN

IMPLEMENTATION FOR DRIP DAMS

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1. 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 loss of life and property damage. An emergency in terms of dam operation is defined as a condition which develops unexpectedly, endangers the structural integrity of the dam and/or safety of lives and properties, at the dam site as well as in the areas downstream of the dam, and requires immediate responsive action.

The EAP is the document that has to be used in case of an emergencies generated by either a dam break or to a significantly high release of water from gated or ungated spillways. It identifies the roles and responsibility of the Dam’s Owner and of the Authorities in charge to manage emergency situations and evacuate people from low-lying areas downstream. Furthermore, it specifies the actions to be implemented in different types of emergency conditions.
2. Risk Limitation Measures

How to reduce the risk?

Structural measures

a. Safe design approach
b. Safe construction procedure
c. rehabilitation of spillways
d. rehabilitation of drainage system
e. reduction of leakage/seepage
f. others

The implementation of structural measures can create a false sense of security due to their physical presence and frequently they lead to an inappropriate use of the areas affected by dam’s flood.
St. Francis dam before Failure
St. Francis dam after Failure

Sweetwater dam -1916
Spillway swiped away
2. Risk Limitation Measures

Non structural measures play always an important role to reduce the residual risk and the negative impacts on the environment

**Non Structural Measure**

The non structural measure should be actively considered as complementary measures.

Among the non structural action we can consider:

- Flood forecasting and warning system
- Land use regulation
- Population education in dealing with risks and emergencies
- Management of the operation in the reservoir

**THE EMERGENCY ACTION PLAN IS A NON STRUCTURAL MEASURE TO BE IMPLEMENTED IN ADDITION TO STRUCTURAL MEASURE**
3. Risk of dam Failure and Implementation of EAPs

At the moment there are potential high risk situations regarding safety of dams in India. Due to the high number of existing large dams, (4900) and new dams (350) under construction. Many of these dams are a key source for irrigation and the production of hydropower and many of them provide industrial and civil water supply.

The two main elements of risk are:
- The location of a dam is an element of risk itself, when it is located nearby urbanized areas.
- The spillway’s inadequacy is another important concern.

Some other problems are related to seepage (through earth dams), leakage (through concrete and masonry dams), inadequacy of drainage system and hydro mechanical equipment malfunctioning.

All elements of risk should also be evaluated and scored in order to be able to categorize the dams according to a “Risk analysis method”, that is also under preparation within our project.

Therefore, the preparation of EAPs to manage the potential emergency is a priority of our project.
4. Structure of the EAP

The EAP should contain the minimum information listed below:

- identification of dam,
- location,
- hazard class
- basic info (hydrology, hydraulic, draws)

The EAP should contain the specification of the roles and responsibilities with a Notification Flowchart clearly summarizing the following information:

- Who is to be notified?
- Who is responsible for notifying Owner’s staff and Public Officials?
- Prioritized order in which individuals are to be notified.
Summarizing we can identify two main roles in the management of emergencies:

1. **Dam Owner**: Has to take care of all the procedures regarding the dam

2. **Public Authorities**: They have to take care of evacuation and to save lives. (the Collector/District Magistrate and the Civil Protection Service).

Following the basic information regarding the dam and the definition of roles and responsibilities it is identified a simple and straightforward procedure, articulated in 5 steps, to really manage the emergency phase, that is:

4. **Structure of the EAP**
Structure of the EAP

EAP Core Process (5 steps procedure)

1. Emergency detection
2. Emergency Level determination
3. Notification and communication
4. Expected Action
5. Termination

The General structure of the EAP can be summarized in the following flow chart.
EMERGENCY ACTION PLAN OVERVIEW

STEP 1: Emergency Condition Detection

STEP 2: Emergency Level Determination

Emergency Level-1
Non-emergency incident; Unusual event; Slowly developing situation

Emergency Level-2
Potential dam failure situation; Rapidly developing

Emergency Level-3
Urgent; Dam failure is imminent or in progress

STEP 3: Notification and Communication

Level-1 Notification List
Inspect Dam
Increased Monitoring

Level-2 Notification List
Save Dam
Expected Actions

Level-3 Notification List
Save Lives
Evacuation

STEP 4: Expected Actions

STEP 5: Termination and Follow-up

Termination and follow-up
**Structure of the EAP**

**EMERGENCY CLASSIFICATION**

The assessment of degree of seriousness of unusual situation can be classified as:

1. **Blue-Yellow** (Emergency Level 1)
2. **Orange** (Emergency Level 2)
3. **Red** (Emergency Level 3)

**STEP 1: Emergency detection**

During this phase whatever event that is unusual and detected by technical personnel or either by a visitor should be investigated by the dam owner. These events may also include unusual dam monitoring results (typically from instrumentation readings), earthquakes and or severe weather conditions.
Structure of the EAP

STEP 2 – Emergency evaluation

As the emergency is detected it is necessary to carefully assess the situation and determine the Emergency level in accordance

Emergency level 1 - Non emergency situation – unusual event under control – situation developing slowly. The situation has not yet become a serious threaten for the structural integrity of the dam but it may give problems if it continues to develop.

Emergency level 2 - Potential dam failure situation rapidly developing. The event may lead to eventual dam failure and consequent release of water downstream, anyway, the dam-break is not imminent.

Emergency level 3 - Dam failure is imminent or in progress. This is an extremely dangerous situation and the dam failure cannot be avoided. A destructive flood is to be considered imminent and certain. Evacuation should start initiated immediately for all at risk dwellings, roads and infrastructures.
**Structure of the EAP**

**STEP 3 - Notification procedures**

After the emergency level has been evaluated responsible people, identified in the flowchart (roles and responsibilities), will be notified and messages should be sent accordingly, indicating the emergency level.
For each emergency condition that is identified, the plan should describe actions to be taken and contacts to be made.

**Emergency Level 1 – BLUE\YELLOW - Non-emergency incident; unusual event; slowly developing situation:**

- The Dam Owner should inspect the dam and the reservoir area. If increased seepage, erosion, cracking, or settlement is observed, immediately report the observed conditions to the State Dam Safety Engineer (EE).

- The Dam Owner should contact the State Dam Safety Engineer and Dam Owner’s Engineer and request technical staff to investigate the situation and recommend corrective actions.
EAP Core Process (5 steps procedure)

Emergency Level 2 – ORANGE - Potential dam failure situation; rapidly developing

- The Dam Owner should contact the District Magistrate to inform him/her that the EAP has been activated and, if current conditions get worst, the emergency level may increase and the emergency situation may require evacuation.
- Preparations should be made for road closures and evacuations.
- The Dam Owner should report the situation to the State Dam Safety Engineer and the Dam Owner’s Engineer and request investigation of the situation and recommend corrective actions.
- If time permits, the Dam Owner should inspect the dam and the reservoir. If increased seepage, erosion, cracking, or settlement is observed, immediately report the observed conditions to the District Magistrate and State Dam Safety Engineer.
Emergency Level 3 – RED – Urgent - dam failure is imminent or in progress

- The Dam Owner shall immediately contact the District Magistrate, and others shown on the notification flow chart, to inform him/her that the EAP has been activated on emergency level 3.
- The District Magistrate will carry out warnings, close roads, and evacuate people at risk downstream from the dam.
- The Dam Owner will take care of the people in the dam’s area and surroundings.
- The Dam Owner shall maintain continuous communication and provide the District Magistrate with updates of the situation to assist him in making timely decisions concerning warnings and evacuation.

STEP 5 – Termination

Whenever the EAP has been activated, an emergency level has been declared, all EAP actions have been completed, and the emergency is over, the EAP operations must eventually be terminated and follow-up procedures completed.
5. CAPACITY BUILDING AND INSTITUTIONAL STRENGTHENING

Within the DRIP project we are working on Capacity Building and Institutional Strengthening aiming to provide to SPMU the necessary tools to prepare or manage the preparation of the EAPs.

In the framework of **Capacity Building** the main tasks identified are:
- Updating of existing guidelines for the preparation of the EAP originally prepared by the CWC.
- Preparation of a practical case study that can be used as a reference by the SPMU.
- Guidelines on Dam Break Analysis and spontaneous Release of water from outlets.
- Preparation of a practical case study on DBA that can be used as a reference by the SPMU.

Regarding the **Institutional Strengthening** the main activities are related to the training of States Officials in the preparation of Emergency Action Plans and on Dam Break (DB) Analysis. Within this framework three training sessions on EAP and DB and a practical training on HEC-RAS have been given.

All the trainings are aimed to give the necessary information and tools regarding the EAP preparation and to detail the theory and practice of dam break and flood routing.

The expected result of this Institutional Strengthening (IS) activity is to furnish to the SPMUs staff the necessary basic knowledge to manage the preparation of the EAP themselves or using any external qualified entity as Academic Institution or private Consultant.
6. Future Development and Expectation

Considering the high level of potential risk the current program is aimed at the preparation of EAPs for each dam in the DRIP program. Therefore, after the training sessions and the issuing of Guidelines, the different States in DRIP will be assisted in the preparation of EAPs, according to a specific program that has been prepared and is under implementation at the moment.

All activities will be coordinated centrally from CPMU by qualified engineers, in every State the SPMU will appoint a dedicated team for local coordination. Dam’s Owners (DO) will have the responsibility to prepare EAP with their workforce or outsourcing it to external Consultants.

A General Coordinator will guide and assist all the local teams and DOs during the first pilot phase (consisting in the implementation of EAP for two pilot dams for each CPMU) and during the follow on standardization phase.

Our main expectation is to accomplish the preparation of simple and effective EAPs for all the dams under study within the schedule of the DRIP project.
THANK YOU FOR ATTENTION