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Dam Rehabilitation and Improvement Project

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Dam Rehabilitation & Improvement Project

Dam Safety Concerns – Lessons from DRIP

DAM REHABILITATION AND IMPROVEMENT PROJECT (DRIP)
CENTRAL WATER COMMISSION

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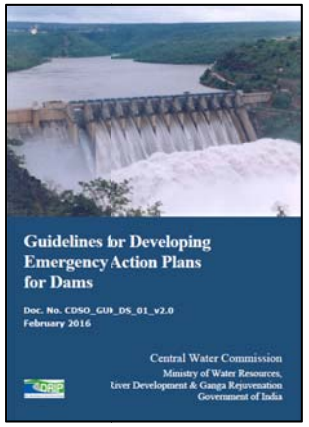
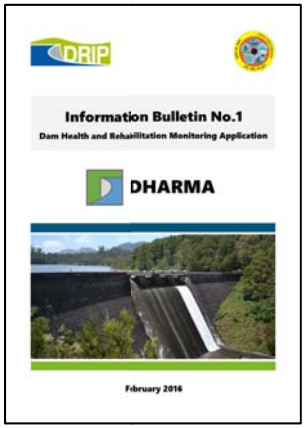
DRIP Highlights

DRIP is midway through its implementation and the major achievements are:

- Design flood reviews, dam health inspections and firming of rehabilitation proposals completed for 207 dams; rehabilitation works commenced on 83 dams.
- ISO 9001:2008 Certification for Quality Management System of Central Dam Safety Organization received in December 2015.
- Organized two *National Dam Safety Conferences* -- IIT Madras, 24-25 Mar 2015, and IISc Bangalore, 12-13 Jan 2016.
- Conducted 44 training classes benefiting more than 1500 participants on various aspects of DRIP implementation.
- Received award from CBIP in 2016 for promoting Health and Safety of Large Dams.
- Developed *DHARMA* (Dam Health and Rehabilitation Monitoring Application), a web-based application for managing dam physical assets effectively and efficiently.
- Prepared *Guidelines for Developing Emergency Action Plans for Dams* (Document No. CDSO_GUD_DS_01_v2.0)



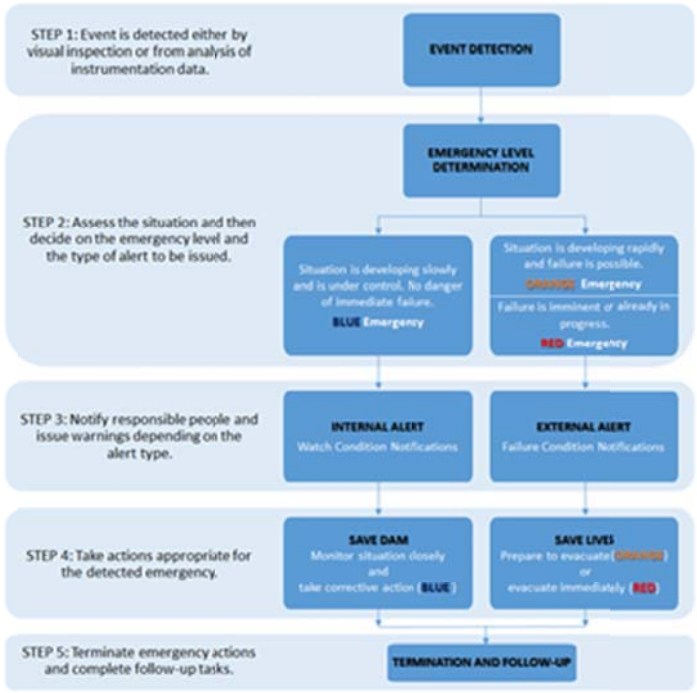


Emergency Action Plans

The primary purpose of an Emergency Action Plan (EAP) is to identify the scope of possible impact of a dam failure (structural or operational) and to lay out all the information necessary to implement evacuations and other actions effectively during an emergency.

The Five-Step EAP Process

An EAP is most effective if the decision to warn and evacuate is carefully thought out and planned in advance of an emergency. Most EAPs will typically have several different alert levels to allow emergency responders to take an appropriate stance depending on conditions at the dam. The flowchart below illustrates the five-step response process usually followed by an EAP for a dam.



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Some Dam Failures

Tighra Dam (1917)

Tighra Dam is a masonry gravity structure built in 1916 for agricultural irrigation and municipal water supply. The dam failed on the afternoon of Aug 4, 1917 because of sliding during a large flood. Reportedly, about 1000 people lost their lives.

Machhu II (Morbi) Dam (1979)

The masonry and earthfill Machhu II (Morbi) Dam failed on Aug 11, 1979, because of overtopping during a flood. About 1800 metres of earth-fill embankment were washed away. Reportedly, about 2000 people died.

Gararda Dam (2010)

Gararda Dam in Bundi District of Rajasthan breached during the very first filling on Aug 15, 2010. At least a dozen villages downstream of the dam were flooded, and traffic in Jaipur-Kota Highway near Talera was also disrupted.

Some Dam Problems

Concrete Gravity Dams

Onsite inspection of concrete gravity dams helps to identify deterioration of the structures and plan corrective actions. Remedial measures may be needed to prevent existing cracks from propagating into previously uncracked zones.

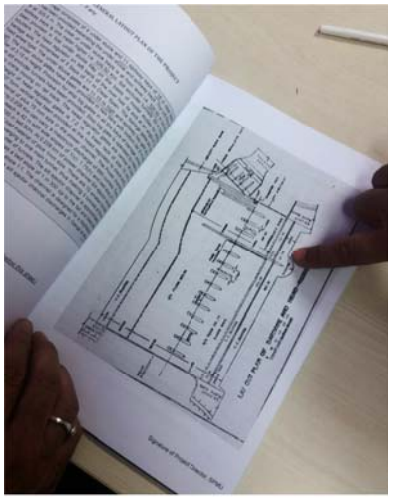
Masonry Gravity Dams

Masonry gravity dams are subject to leakage caused by failed mortar and construction joints, and by the growth of plant roots that create paths along which water can flow easily. Large seepage flows can remove internal material, resulting in catastrophic failure.

Embankment Dams

Seepage can erode a channel through earthen embankment dams that will increase in diameter until the roof collapses and a breach forms, allowing an uncontrolled release of water. Many dam failures have occurred upon first filling because of internal erosion.

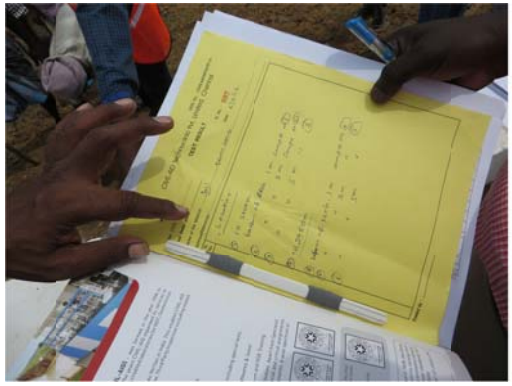
Remedial Action Proposals



Proposals prepared by Implementing Agencies for remedial measures to be undertaken by DRIP are reviewed to ensure that the designs of engineering works are technically sound. Concerted efforts are made to bring in new technologies for seepage control, block joint treatment, instrumentation, spillway gates, etc.

Construction Supervision

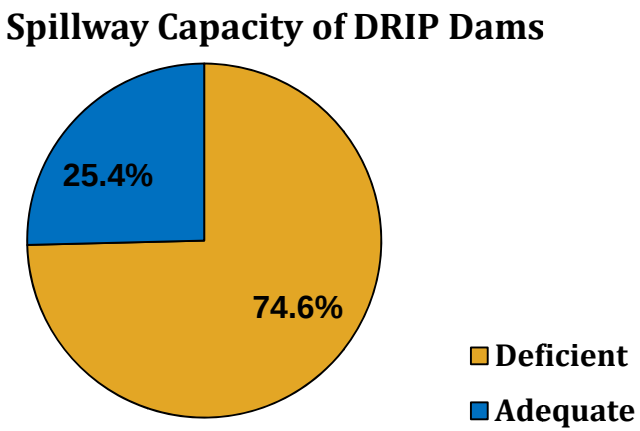
Efforts are being made for achieving highest quality of rehabilitation works. The DRIP Central Project Management Unit (CPMU) also carries out independent third-party supervision of the construction activities.



Rehabilitation of Dams

Design Flood Review

Assessing the ability of dams to pass safely current inflow design floods was an initial task of DRIP. Nearly 3 out of every 4 dams in the program were found to lack adequate spillway capacity for handling the revised estimates of design flood. Options being considered under DRIP to accommodate increased design floods include both structural and non-structural measures based on assessment of the dam site conditions.



Evaluation of Dam Health

The first step to improving structural stability and sustainability of dams and their appurtenant structures is a thorough on-site inspection that identifies need for remedial measures. Evaluation of data collected automatically by various monitoring devices also helps detect potential problems.

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Spillway Capacity

Spillways are provided to safely pass the large volume of flood waters so as to avoid possibilities of over toping of dam and consequent dam failure. Spillways of adequate capacity and structural integrity are essential requirements of a safe dam.

Gates

Dam gates are hydro-mechanical equipment used to maintain reservoir elevations. Deterioration from weathering, repeated operation, or infrequent operation can prevent gates from functioning properly when they are needed most. In very old dams, obsolescence of gate machinery is also a cause of concern.

Siltation

Water flowing into reservoirs can contain heavy sediment loads during floods. Sediment is deposited as water velocities decrease within a reservoir, gradually reducing available water storage volume over time. Measures for controlling reservoir sedimentation need to be implemented at some dams.

Dam Rehabilitation and Improvement Project

Purpose

There are nearly 4900 large dams in India and about 300 more are under construction. These dams are vital for ensuring the water security of the country; and they also constitute a major responsibility in terms of asset management and safety. In April 2012, the Central Water Commission (CWC), with financial assistance from the World Bank, embarked upon the six-year Dam Rehabilitation and Improvement Project (DRIP) to facilitate rehabilitation of about 250 large dams in seven States, and to assist in development of Emergency Action Plans (EAPs) for these dams. The Central Dam Safety Organisation (CDSO) of CWC is coordinating and supervising the program.

Primary Objectives

The following two objectives are the primary focus of DRIP:

- Improve the safety and operational performance of 253 large dams and appurtenant structures in a sustainable manner; within participating States, and,
- Strengthen the dam safety institutional capacity in participating States as well as at the Central level to manage dam safety administration, operation, and maintenance

In addition to ensuring safety by proper upkeep of some of India's largest dams, it is also necessary to prepare to face any emergency caused by a dam failure. For this reason, basic-level Emergency Action Plans (EAPs) will be developed for all DRIP dams. Additionally, guidelines for developing EAPS for dams have been prepared to help dam owners to improve dam safety throughout India.

Implementing Agencies

The following dam-owning agencies are DRIP partners who provide day-to-day management of the program:

- Madhya Pradesh Water Resource Department (MPWRD)
- Orissa Water Resource Department (OWRD)
- Tamil Nadu Water Resource Department (TNWRD)
- Tamil Nadu Generation and Distribution Corporation (TANGEDCO)
- Kerala Water Resource Department (KWRD)
- Kerala Electricity Board (KSEB)
- Central Water Commission
- Karnataka Water Resources Department (KaWRD)
- Uttarakhand Jal Vidyut Nigam Ltd (UJVNL)
- Damodar Valley Corporation (DVC)

DRIP Implementing Agencies gather quarterly at Technical Committee Meetings