

## **Minutes of the eleventh National Committee on Dam Safety meeting held on 21.10.1993 at Central Water Commission, New Delhi.**

The eleventh meeting of the National Committee on Dam Safety (NCDS) was held on 21 October 1993 at Sewa Bhavan, R.K.Puram, New Delhi under the Chairmanship of Shri M.S.Reddy, Chairman, CWC, and Chairman of NCDS.

The list of officers who attended the meeting is given in Annex I.

Shri D.S.Ramamurthy, Chief Engineer (DSO) and Member Secretary, NCDS welcomed the Hon'ble Chairman, Vice Chairman and members of NCDS and other officers from the States. He informed the Committee that NHPC who were participating in NCDS meeting as invitee till the last meeting, has now been nominated as one of its member.

At the outset, the Chairman, NCDS mentioned that after going through items of agenda he feels that the Committee is doing an infructuous exercise in meeting twice a year, as most of the information / data which is being asked from the States is not forthcoming in spite of these being taken as item in NCDS meetings time and again. He, therefore, requested the members that a solution must be found to this impasse and follow-up action must be taken on items to make the meetings more meaningful.

After the above opening remark, the items of agenda of the meeting were taken up for discussions.

### **11.1.0 Confirmation of the minutes of the tenth meeting.**

- 11.1.1 The minutes of tenth meeting were circulated to all the members of NCDS, special invitees and State Dam Safety Cells vide Letter No.3/19/NCDS/93-DS/454-484 dated 15.4.93. No comments were received from the member States / Organisations. The minutes as recorded were confirmed.

### **11.2.0 Status of implementation of "Dam Safety Assurance and Rehabilitation Project" for information**

- 11.2.1 As a matter of providing information to the members of NCDS, Chief Engineer (DSO), CWC narrated the activities that took place in the process of implementation of key issues of institutional strengthening, meetings of State Dam Safety Committees (SDSC), Dam Safety Review Panels (DSRPs), hydrological reviews, evolving suitable remedial measures for rehabilitation of identified dams, provision of basic facilities to selected dams, undertaking Phase I inspection of large dams, implementation of remedial works and

conducting workshops on dam safety aspects to train State engineers in the four participating States, namely, Madhya Pradesh, Orissa, Rajasthan & Tamil Nadu.

- 11.2.2 The Institutional Strengthening in the four participating States and CWC for the first phase have been completed. The progress of procurement of vehicle and equipments is, however, rather slow.
- 11.2.3 CWC has finalized the hydrology review of 8 dams of Orissa. For Hirakund dam, data is awaited from the Orissa Government. For Gandhi Sagar dam (MP), studies are likely to be finalized by the end of November 1993; and for Rana Pratap Sagar and Kota (Rajasthan) Barrage, studies will be taken up after review of hydrology of Gandhi Sagar is completed. Hydrological review of three dams of Tamil Nadu is under progress. The results of review of Sathanur Dam will be transmitted to Tamil Nadu Government by the end of November 1993.
- 11.2.4 The progress of implementation of remedial works in all the four States was reported to be slow except Periyar dam in Tamil Nadu. However, the State representatives assured that the State Government would be able to utilize the World Bank fund within the project period.

(Action : Madhya Pradesh, Orissa, Rajasthan & Tamil Nadu)

### **11.3.0 Review of National Scenario.**

- 11.3.1 The States are requested to intimate NCDS, fresh cases of distress in dams, structural and operational deficiencies noted during the monsoon and failure cases, if any, since the last meeting.
- 11.3.2 As no fresh cases of distress in dams were reported by the States, some of the reports appearing in the newspapers regarding the dam safety activities in the States, viz. occurrence of cracks in Mandaha dam in Uttar Pradesh (Jansatha dated 14.9.93) and dam safety works in Madhya Pradesh (Rashtriya Sahara dated 13.7.93) were brought to the notice of the members. The representatives from Madhya Pradesh and Uttar Pradesh States assured to look into the reports and would send a report to NCDS. Representatives from Andhra Pradesh informed that a report on dislocation of one crest gate at Kalyani dam during November 1991 was sent to the State Government and the report is held up with the Government. However, the gate had since been repaired and the report would be sent to DSO, CWC as soon as cleared by their Government.

- 11.3.3 Chief Engineer & Joint Secretary, Maharashtra gave a brief account of the occurrence of earthquake in Latur and Osmanabad Districts on the early morning of 30 September 1993 and informed that a report on special inspection of large dams around Killari, the epicenter, has been given to DSO, CWC. During the inspection, 20 large dams as per ICOLD definition were covered, out of which three viz. Manjra, Lower Terna (Makani) and Majalgaon are major projects. It was informed that in Lower Terna (Makani) project, which was reported in news, longitudinal cracks had developed at few locations on the top of earthen dam. However, these cracks were found to be superficial and did not travel up to hearting (core); separation between the spillway structure and earthen dam wrap round portion were also noticed. The dam is structurally safe and there is no cause of any anxiety. Three radial gates out of fourteen of the spillway showed slight out of alignment immediately after earthquake but these came to their original position after one day.

The Chairman requested all the members to intimate NCDS such unusual incidents on their occurrence.

(Action : all States / Organisations)

#### **11.4.0 Progress of implementation of recommendations of the "Report on Dam Safety Procedures."**

- 11.4.1 The States were requested to implement the recommendations contained in the "Report on Dam Safety Procedures" circulated during 1987 and send a consolidated report indicating their achievements on the issues and to highlight those recommendations, if any, which were difficult to implement for the States.
- 11.4.2 The States of Karnataka, Maharashtra, Orissa, Rajasthan and BBMB submitted their consolidated reports during this meeting. But Andhra Pradesh, Gujarat and Tamil Nadu did not submit the latest information. The remaining States, Bihar, Kerala, Uttar Pradesh, West Bengal and NHPC were requested to expedite their reports.
- 11.4.3 Regarding stepping up progress on key issues, namely, preparation of "Data Books" on large dams, Dam Safety Legislation, review of hydrology on existing dams, preparation of completion reports and Operation & Maintenance Manual of large dams, the Chairman, NCDS suggested that it would be better if the services of retired officers of the departments are engaged to carry out these jobs as they would be conversant with the various works carried out during

their service period. Chairman suggested that at least this work can be easily completed in the four States, namely, Madhya Pradesh, Orissa, Rajasthan & Tamil Nadu with the fund available under DSAR World Bank assisted Project.

(Action : all States / Organisations)

#### **11.5.0 Dam Safety Legislation**

- 11.5.1 All the member States and Organizations were requested to give their concurrence / comments on the draft Bill 'Dam Safety Legislation.' States of Andhra Pradesh, Gujarat, Kerala, Orissa and Tamil Nadu have sent their concurrence on the draft. However, Madhya Pradesh and Uttar Pradesh did not consider the Legislation essential. The State of Rajasthan has asked two amendments under Clause "General" and sub-clause 5(2) and 6(3) in the draft Bill of the Dam Safety Legislation. The remaining States did not express their views in favour or otherwise on the draft Bill. The Chairman suggested that the Dam Safety Legislation is essential as the dams are being controlled by the States / different agencies and the States are free to give their views or suggestions to make necessary changes in the draft Bill, if they so desire.

(Action : all States)

#### **11.6.0 Preparation of Emergency Action Plans and inundation maps for d/s area.**

- 11.6.1 A decision for preparation of Emergency Action Plan for downstream areas of dams of National Importance by all the States was taken during the 7<sup>th</sup> meeting of NCDS. During the 8<sup>th</sup> meeting all the four participating States – Madhya Pradesh, Orissa, Rajasthan & Tamil Nadu – under the World Bank assisted Dam Safety Assurance and Rehabilitation Project (DSARP) were requested to take up Emergency Action Plan for the 33 dams posed for rehabilitation.
- 11.6.2 Maharashtra has completed the studies for Koyna, Paithon and Ujjaini dams; and the Dam Break Studies for Totladoh are under progress. Gujarat has completed studies for Machhu-II and Ukai Projects. The Dam Break Studies for Linganamukhi dam has been completed by the Karnataka State. West Bengal has also initiated the analysis in respect of Kangsabati and Mayurakshi dams. Bhakra Beas Management Board (BBMB) requested the Chairman to take up this matter with the Punjab Government as the downstream areas are under the control of Punjab State.

- 11.6.3 Chairman suggested that these studies could be taken up under different stages, viz. maximum observed flood, 100 years frequency flood, inflow design flood and dam break flood.

Maharashtra expressed the views that these studies should be done for unforeseen condition like malfunctioning of spillway gates which might also lead to catastrophe. In Maharashtra, it was informed that a system of red line, blue line, etc., for demarking various stages of floods have been evolved.

(Action : all States)

#### **11.7.0 Compilation of "Data Books."**

- 11.7.1 As per the decision taken in the fourth meeting of NCDS, "Data Books" for dams of National Importance are to be prepared by the States and sent to DSO, CWC for record.
- 11.7.2 The States of Andhra Pradesh, Bihar, Gujarat, Karnataka & Tamil Nadu and also BBMB have submitted "Data Books" for dams of National Importance. It was informed that "Data Books" for 4 dams of Maharashtra and for 5 dams of Madhya Pradesh are under preparation. The officers from Rajasthan were requested to send legible copies of "Data Books."
- 11.7.3 So far, no information has so far been received from the States of Kerala, Orissa, Uttar Pradesh and West Bengal and also from NHPC. These States / Organisations were requested to submit the same as early as possible.

(Action : Kerala, Orissa, Uttar Pradesh, West Bengal & NHPC)

#### **11.8.0 Preparation of completion report of large dams**

- 11.8.1 During the ninth meeting of NCDS, it was agreed that completion reports of all large dams are to be prepared by the respective States giving priority to dams of National Importance. It was decided in the 10<sup>th</sup> meeting that original geological report should also form part of the completion report.
- 11.8.2 The States of Gujarat, Karnataka, Maharashtra, Orissa, Rajasthan & Tamil Nadu and BBMB intimated their progress. So far, most of the States are giving information of dams of National Importance only. It was clarified that completion reports are to be prepared of all the existing large dams.

All the States / Organisations were requested to speed up the work and submit the reports as early as possible.

(Action : all States / Organisations)

#### **11.9.0 Preparation of Operation & Maintenance Manual**

- 11.9.1 Although the States of Gujarat, Uttar Pradesh, West Bengal and BBMB have intimated during the 10<sup>th</sup> meeting that action for preparation of Operation & Maintenance Manual had been taken up, no further progress has been intimated so far. There is no progress in the States of Andhra Pradesh, Bihar, Karnataka, Kerala, Madhya Pradesh, Orissa, Rajasthan and Tamil Nadu.
- 11.9.2 All the States are, therefore, requested to take up this work on priority and complete without further delay.

#### **11.10.0 Periodical inspection of dams and the report on dam safety activities in the States.**

- 11.10.1 The States are requested to perform periodical inspection of dams in their States and take up safety measures. A yearly consolidated report on this aspect under the title "Health Status of Dams and Dam Safety Activities in the States" is required to be sent to DSO, CWC.
- 11.10.2 The States of Gujarat, Karnataka, Madhya Pradesh and Maharashtra & BBMB have submitted the report upto the year 1992. Although the periodical inspection reports from the State of Rajasthan are being received in piecemeal from their field engineers, these reports do not cover any safety measures undertaken by them. The State of Bihar has submitted the status report in respect of seven dams in the proforma meant for safety status report for dams of National Importance. This needs to be sent in the correct proforma. M/s NHPC has submitted a status report for the Salal Hydroelectric Project upto the year 1992. The State of Kerala has submitted only draft status reports in respect of 5 dams. However, they are requested to send detailed reports.
- 11.10.3 The States of Andhra Pradesh, Bihar, Kerala, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal are also requested to carry out the periodical inspections of the dams and send the report regularly.

#### **11.11.0 Safety review of large dams once in ten years.**

- 11.11.1 As per recommendations contained in the "Report on Dam Safety Procedures", safety review of large dams which are more than 15 m in height or which store 60 million cubic metre or more of water, are to be carried out by an independent panel of experts once in ten years. The proposal was accepted by the Government of India in 1987 and as such a review of all large dams is to be completed by the year 1997.
- 11.11.2 The programme for inspection of dams drawn out by the States of Gujarat, Kerala, Orissa, Rajasthan and Tamil Nadu has already been intimated. Further progress achieved on this programme is awaited.
- 11.11.3 All the States are requested to chalk out an yearly programme for inspection by an independent panel of experts and report the progress as the review is to be completed by the year 1997.

#### **11.12.0 Safety status of dams of National Importance.**

- 11.12.1 There are 43 dams of National Importance. Information has been received only for 29 dams so far.
- 11.12.2 The States of Kerala, Madhya Pradesh, Orissa and Uttar Pradesh have not given any information.
- 11.12.3 As a publication on the "Health Status of Dams of National Importance" is to be brought out by DSO, CWC, all the States are requested to send the information expeditiously.

#### **11.13.0 Monitoring of safety report of inter-State dams by sub-committees.**

- 11.13.1 Three sub-committees were set up during March 1990 to monitor the safety aspects of inter-State dams in the Parambikulam Aliyar System (PAP), Mahanadi River System and Subarnarekha System.
- 11.13.2 To monitor the safety report of dams in PAP System, two meetings were held during October 1991 and in July 1992. The State of Tamil Nadu intimated that the follow-up action is being taken by their field officers on the recommendations made by the Committee.
- 11.13.3 To monitor the safety status of dams in Subarnarekha System, two meetings had taken place (September and December 1992).

However, no information is available on the follow-up action of the recommendations of this Committee.

11.13.4 The State of Orissa has convened the first meeting on 8.9.93 to monitor the safety aspects of dams of Mahanadi River System and have also issued minutes of the meeting in respect thereof.

11.13.5 All the concerned States are requested to convene the meeting of sub-Committees regularly to monitor the safety status of inter-State dams. In the 10<sup>th</sup> meeting, the Chairman desired that the lower riparian States are required to take initiative to convene meetings and to provide all facilities to member States to inspect the dams coming under the purview of sub-Committee.

#### **11.14.0 Setting up of hydrological unit in the States for review of hydrology of existing dams.**

11.14.1 Hydrology of existing dams needs to be reviewed by setting up or strengthening existing hydrology units in the States. Some States / Organisations have initiated actions for strengthening / setting up of hydrology units. Progress achieved in this respect is as under:

<u>State</u>	<u>No.of dams for which hydrologic Review has been completed</u>
1. Gujarat	152
2. Madhya Pradesh	22
3. Maharashtra	28
4. Orissa	18

Progress achieved in respect of above States since the 10<sup>th</sup> meeting is awaited. The remaining States / Organisations are, therefore, requested to take appropriate steps to complete this activity giving priority to dams of National Importance.

#### **11.15.0 Instrumentation for dams.**

11.15.1 During the 6<sup>th</sup> meeting, it was decided to take stock of the status of instrumentation installed at the large dams in order to see their performance, mortality, periodicity for analysis of data, referring the analysis to the designers for their suggestions, studies of structural behaviour report and the adequacy or otherwise of the staff engaged on this job.



During the 10<sup>th</sup> meeting, the Chairman also suggested installation of micro earthquake instruments in the existing dams.

11.15.2 Information received so far from various States in respect of instrumentation of dams is as under:

Madhya Pradesh	11 dams
Maharashtra	46 dams
Tamil Nadu	6 dams
Gujarat	25 dams
Karnataka	1 dam
BBMB	3 dams

11.15.3 All the remaining States / Organisations are also requested to expedite information.

#### **11.16.0 Standardized meteorological and other observations.**

11.16.1 In order to collect information regarding meteorological observations being carried out by the States in the catchment areas and in the reservoirs for large dams, the States were requested to supply detailed information on the type of meteorological instruments installed and in the specified format.

11.16.2 Information has, so far, been received from the States of Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Orissa and BBMB. The remaining States / Organisations are also requested to furnish this information as early as possible.

#### **11.17.0 Data on gated storages.**

11.17.1 The States have been requested to furnish data on gated storages of large dams in a specified format. In this respect information has, so far, been received from Andhra Pradesh, BBMB, Gujarat, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Tamil Nadu, Uttar Pradesh and West Bengal.

11.17.2 The State of Orissa has furnished data for only 16 dams out of 48; and Rajasthan has given data only for 15 out of 20 dams. The State of Bihar has not furnished any data so far. As this data is to be included in a publication on "Dam Safety", the States are requested to supply complete information as early as possible.

### **11.18.0 Safety inspection of barrages.**

11.18.1 It has been decided to collect information in respect of all important barrages State-wise in a prescribed format and send to DSO, CWC. Information has, so far, been received from Andhra Pradesh, BBMB, Gujarat, Karnataka, Kerala, Madhya Pradesh, Orissa, Rajasthan, Tamil Nadu and West Bengal. The State of Uttar Pradesh has furnished information in respect of 6 out of total number of 20 barrages and the State of Bihar has not responded so far. The States of Bihar and Uttar Pradesh are, therefore, requested to furnish the information without any further delay.

### **11.19.0 National Register of Large Dams**

11.19.1 A publication titled "National Register of Large Dams" (NRLD) brought out by DSO, CWC was circulated to all the representatives from various States / Organisations for scrutiny and indicating corrections / modifications / additions, if any.

11.19.2 On the basis of information received from various States / Organisations, necessary corrections have already been carried out in the computerized data. Response from Orissa and Rajasthan is still awaited. These States are requested to expedite the information so that steps to bring out revised publication on NRLD are taken immediately.

### **11.20.0 Seismic status of dams of National Importance.**

11.20.1 DSO, CWC has forwarded a document titled "Guidelines for Inspection of Dams following Earthquake" to all the members of NCDS with the request to make use of it and report in the prescribed proforma to NCDS immediately after occurrence of an earthquake.

11.20.2 After the occurrence of Uttarkashi earthquake of October 1991, all the northern States were expected to conduct a thorough inspection of their large dams and report to NCDS their findings. In this respect, information has, so far, been received only from BBMB in respect of 3 dams under their charge; NHPC for Salal dam; Uttar Pradesh for Ram Ganga dam. No damage has been reported to the structures of these dams.

11.20.3 After the occurrence of recent earthquake in the early morning of 30.9.93 in Latur and Osmanabad districts of Maharashtra, the States of Andhra Pradesh, Karnataka and Maharashtra have been requested to assess the condition of water resources structure in

their regions and conduct post-earthquake survey in accordance with the "Guidelines for inspection of dams following earthquake" brought out by the International Commission on Large Dams (ICOLD) and report the findings to the Committee. These States are requested to intimate the requisite information to the Committee.

- 11.20.4 Regarding monitoring micro-seismic activity in or around the reservoirs and the instrumentation system required for monitoring the structural response of the dams, efforts are being made to obtain suitable recommendations from the GSI on the basis of studies carried out by them.

In the meantime, the member States / Organisations are requested to utilize the document already available with them and carry out inspection of dams following occurrence of an earthquake.

#### **11.21.0 Problem bank on research & development.**

- 11.21.1 All the members of NCDS were requested to suggest areas requiring research for development of projects and gadgets in the field of dam safety and send their suggestions to DSO, CWC. The Chairman, during the 10<sup>th</sup> meeting, desired that the States should examine the list circulated as Annex II of the special areas suggested for "Conducting Research on Dam Safety" and take up research on a subject of their choice. They should also prepare a project report on the scheme for research and send the same to Member (D&R) for further processing.

No suggestion has, so far, been received from any of the States / Organisations. The list of special areas as mentioned above is again circulated for information of all the members in Annex II.

## **List of special areas suggested for conducting research on dam safety**

The list of specific areas for conducting research on dam safety, category-wise suggested are as under:

### **1. Dam Foundation**

- (a) Improvements in tracer techniques for the detection of seepage sources and seepage paths and also further development in the technology of borehole TV and geologgers.
- (b) Define and develop techniques for evaluating permeability and to improve the existing system for conducting water pressure tests.
- (c) Research for further development of new techniques for impermeabilization criteria such as the free oscillation, air permeability and radioactive methods.
- (d) Research for defining the rock-type specific groutability and to develop the relationship between the penetration radius, grouting pressure, thickness of joints and viscosity of mix.

### **2. Fill Dams**

- (a) Studies to be conducted for understanding the causes of cracking and defining appropriate measures to remove or reduce the causes.
- (b) Research for defining a core material which would be less prone to cracking and more resistant to corrosion.
- (c) Research for defining criteria for the design of filters which could prevent migration of core particles once erosion has started.

### **3. Concrete & Masonry Dams**

- (a) Analysis and design : Defining and reviewing parameters like factors of safety, allowable stresses for analysis, reviewing models for dynamic analysis, etc.

- (b) Construction practices : Improvement of existing practices and the development of new techniques for the economical heightening of concrete / masonry dams and assessment of the performance of dams constructed, using new techniques like RCC and new composites.
- (c) Inspection & monitoring : Improving underwater inspection techniques and to evolve a quantified rating system for preliminary inspections.
- (d) Repair & maintenance : More experience with evaluation of commercial polymer systems and the development of a rating system for their performance and the development of better abrasion resistant composite materials.

### **3. Earthquake Consideration**

Areas for further research have been identified as under:

- (a) The influence of construction joints**
- (b) The concrete rock contact**
- (c) Pressurized cracks**
- (d) Fracture mechanics for triaxial structures and loads**
- (e) Fracture mechanics for dynamic loads (speed, fatigue)**
- (f) Numerical analysis**

### **4. Instrumentation**

- (a) Development of procedures and equipment to embed instruments in the dam body and foundation of existing dams.**
- (b) Development of transducers & readouts to facilitate measurement of several critical parameters simultaneously by specific sets of instruments (eg. Inclination & settlement).**
- (c) Improvement in transducer technology for ease in conversion of the signal to the parameter being monitored.**