Minutes of the XVIII meeting of National Committee on Seismic Design Parameters (NCSDP) for River Valley Projects held on 05/07/2007 in CWC, New Delhi

The XVIII meeting of the National Committee on Seismic Design Parameters (NCSDP) for River Valley Projects was held on 05th July 2007 at 1100 hours in the Conference Hall, Central Water Commission, New Delhi. Shri A.B. Pal Member (D&R), CWC and Chairman, NCSDP Chaired the meeting. The list of members, project representatives and invitees who attended the meeting is given at Annexure I.

18.1 Welcome by Chairman, NCSDP

Shri A.B. Pal, Member (D&R), CWC welcomed all the participants and invitees of the XVIII meeting of NCSDP. This was followed by a brief self-introduction by the participants. Thereafter, the Member-Secretary was requested to take up the agenda items for discussion.

18.2 Confirmation of the minutes of the last meeting

The Minutes of the XVII meeting of NCSDP held on 06/03/07 at Conference Hall, Central Water Commission, New Delhi under the Chairmanship of Shri. B.S Ahuja, the then Member (D&R), CWC were sent to all members vide letter No. CWC/FE&SA/2/2/2007/429-440 dated 04/04/2007. The Member secretary apprised the committee that Dr.I.D.Gupta, Joint Director, CWPRS and Sh. Sujit Das Gupta, Director (P&M), GSI had raised some objections on the seismic studies of the following projects which were circulated to all the Committee Members. The observations are in accordance with the decisions taken by the Committee in its Sixteenth Meeting when the Committee Members were advised to submit their observations in respect of these projects.

a) Chutak HE Project (J&K)
b) Karcham Wangtoo HE Project (Himachal Pradesh)
c) Chuzachen HE Project, Sikkim
d) Tail Pond dam at Satrasal (Andhra Pradesh)
e) Dibang HE Project, (Arunachal Pradesh)
f) Pakal Dul (Drangdhuran) HE project (J&K)
g) Kotlibhel HE Project Stage 1A, 1B and Stage-II (Uttrakhand).

He stated that no comments have been received in respect of other projects viz; Indira Sagar H.E. Project, Tapovan Vishnugad H.E.project and Loharinagpala H.E. Project, Uttarakhand as they were approved after deliberations and no comments were solicited in respect of them. The Committee, thereafter, confirmed the minutes and took up the projects on which observations were received.

18.3.0 Follow - up actions on minutes of last meeting.

18.3.1 Chutak H.E. Project, J&K

The Chutak H.E. Project involves construction of a 47.5m long, 15m high barrage on river Suru. The project is located in Kargil district of Ladakh having latitude of 34°27'N and longitude as 76°05'E. The project site lies in seismic zone IV as per seismic zoning map of India given in IS 1893-(Part-1) 2002. The Presentation regarding salient features and geological aspects was given by project representatives during sixteenth meeting.

The site specific study (Report no.P-2005-05 (April- 2005)) related to the local and regional geological conditions, earthquake occurrence and seismo-tectonic set-up of the region was carried out by IIT, Roorkee and copies of the report were made available to all the members of the committee. The IIT, Roorkee has estimated the PGA value of 0.36g. The vertical spectral acceleration value has been recommended as 2/3 of the corresponding horizontal value. The normalized horizontal response spectra are given in Fig. 2 & 3 of site specific study report with multiplication factors 0.36g for MCE condition and 0.18g for DBE condition.

The Member-secretary informed that the project was discussed in XVI and subsequently in XVII meeting also, when Dr. I. D. Gupta, Jt. Director, CWPRS had sought certain clarifications on the recommended values of multiplying factors for MCE and DBE conditions. As per Dr. Gupta the site specific response spectral shape should depend on the site parameters such as geological tectonical features present, their potential earthquake magnitude and distance from dam site. Also this dependence should be brought out in the report. However, all this was missing in the study for Chutak H.E. Project.

He informed that it was then decided that Dr. I.D. Gupta may carry out an independent study and derive the values for Chutak HE project, and if there is any difference, it may be discussed in the next meeting. He informed that the response of the Dr. Gupta and also of IIT Roorkee had been received which had also been circulated to all Members. The Committee after deliberations on the replies, approved the seismic coefficients and response spectrum as per the report submitted. The Committee decided that in future all seismic study reports should explicitly state:

1. The attenuation formula used alongwith calculations for MCE PGA.

2. The rationale behind deciding the earthquake magnitude 'M' for any earthquake source and the distance of that source from the project site.
3. Calculations of spectral ordinates.
4. Utilisation of past records of seismic history.

18.3.2 Chuzachen H.E. Project

The Chuzachen H.E. Project lies in the eastern part of Sikkim State and consists of two gravity dams of height 48m & 41m respectively. The Rangpo Dam is located at latitude 27°12'14"N and longitude 88°39'59"E and Rangli dam is at latitude 27°14'30"N and longitude 88°42'46"E.

The project site lies in seismic zone IV as per seismic zoning map of India given in IS: 1893-(part-1) 2002.

The site specific study [Report no IITK, March 2006] related to the local and regional geological conditions, earthquake occurrence and seismo-tectonic set up of the region was carried out by IIT, Kanpur with estimated PGA value of 0.40g and vertical spectral acceleration value recommended as 2/3 of the corresponding horizontal value. The normalized horizontal response spectra are given in Fig. 9 of the site specific study report with multiplication factors 0.40g for MCE condition and 0.20g for DBE condition. The project was initially presented in the XVI meeting and discussed in the XVI and XVII meetings. The Committee deliberated upon the revised report submitted by the project authorities and approved the revised response spectra with the values of multiplication factors as 0.40g for MCE condition and 0.20g for DBE condition as recommended in the report.

Item No. 18.3.3 Karcham Wangtoo H.E. Project, Himachal Pradesh

The Karcham Wangtoo H.E. Project envisages construction of a 98m high concrete gravity dam across river Satluj. The Project is located in Kinnaur district of Himachal Pradesh at latitude 31°50'N and longitude 78°17'E.

The project site lies in seismic zone IV as per seismic zoning map of India given in IS: 1893-(part-1) 2002.

The site specific study [Report no.P-2004-05, (August 2005)] related to the local and regional geological conditions, earthquake occurrence and seismo-tectonic set up of the region was carried out by IIT, Roorkee. IIT, Roorkee based on their study have estimated the PGA value as 0.38g. The vertical spectral acceleration value has been recommended as 2/3 of the corresponding horizontal value. The normalized horizontal response spectra are given in Fig. 2 & 3 of the site specific study report with multiplication factors 0.38g for MCE condition and 0.19g for DBE condition.

The Member-secretary apprised the Committee that the project authorities presented the salient features and seismo-tectonic studies as per the above report during the XVII meeting and these were discussed among the members and the Committee accepted the recommended values of 0.38g for MCE condition and 0.19 g for DBE condition. But subsequently, Dr. I.D. Gupta, Jt. Director, CWPRS, Pune made some observations. The replies to these were deliberated during the meeting and the committee approved the response spectra and multiplication factors as given in the above referred report, with the remarks as outlined in Para 18.3.1.

Item No. 18.3.4 Tail Pond dam of Nagarjuna Sagar dam (Satrasala), Andhra Pradesh.

The Tail Pond dam of Nagarjuna Sagar envisages construction of a 29.5m high concrete dam across the river Krishna 21km d/s of Nagarjuna Sagar Dam at Satrasala of Andhra Pradesh. The project is located at latitude 16°37'96"N and longitude 79°29'79"E.

The site specific study [Report no.NGRI-2006-SEISM-540 (March 2006)] related to the local and regional geological conditions, earthquake occurrence and seismo-tectonic set up of the region was carried out by National Geophysical Research Institute (NGRI), Hyderabad. The NGRI, Hyderabad has estimated the PGA value of 0.311g.The vertical spectral acceleration value has been recommended as 2/3 of the corresponding horizontal value. The normalized horizontal response spectra are given in Fig. 5 of site specific study report with a multiplication factor 0.311g for MCE condition and no value has been mentioned for DBE condition.

The Member-secretary apprised the Committee that the project was discussed in the XVII meeting and committee suggested the project authorities to review their study as the Committee had opined that the recommended values are too high. The Committee had advised NGRI to revise their studies taking the earthquake magnitude as 6.5 on Gundlakamma fault and distance of 24 Km. and depth of 15Km. He informed that NGRI has now submitted their revised report No. NGRI-2006 - SEISM-540, June2007. The report gives the estimated peak ground acceleration of 0.185g for MCE and0.092g for DBE condition, the horizontal and vertical seismic coefficients for MCE are 0.055g &0.037g respectively. The report also contains synthetic accelerogram (horizontal component at Fig.3) and synthetic accelerogram (vertical component Fig.4).

In the meeting the revised study submitted by NGRI was deliberated and it was suggested that since the study involves lot of assumptions it need to be crosschecked with other methods. The Committee, however, accorded conditional approval to the coefficients and

response spectrum as per the new report subject to their cross verification with other methods.

Item No. 18.3.5 Dibang H.E. Project, Arunachal Pradesh

The Dibang H.E. Project involves construction of a 288m high concrete gravity dam across river Dibang near village Hunli. The project is located at latitude 28°20'07"N and longitude 95046'38"E respectively.

The proposed site lies in seismic zone V as per seismic zoning map of India given in IS 1893-(Part-1) 2002.

The site specific study [Report no.P-2004-07 (October 2005)] related to the local and regional geological conditions, earthquake occurrence and seismo-tectonic set up of the region was carried out by IIT, Roorkee. IIT, Roorkee has estimated the PGA value of 0.38g. The vertical spectral acceleration value has been recommended as 2/3 of the corresponding horizontal value. The normalized horizontal response spectra are given in Fig. 2 & 3 of site specific study report with multiplication factors 0.38g for MCE condition and 0.19g for DBE condition.

In the last meeting project authorities presented the salient features and site geology of the project. The Committee, after deliberating on the report, suggested that geophysical investigations are required to be done before arriving at any PGA value as the height of the dam is quite high at 288 m. Mr. Sujit Das Gupta Director, GSI had insisted upon geophysical investigations and the Committee requested the project authorities to review the report and resubmit to NCSDP. The project authorities (NHPC) submitted a reply stating that they explored the possibility of carrying out deep seismic sounding; M.T. survey etc. through their service geophysical group and it was felt that such a survey in rugged and inaccessible terrain would be extremely difficult and might not give the desired results. They have also stated that regional lineament mapping had already been carried out by NHPC using satellite imagery with limited ground checks and thus the thrusts and faults identified from the GSI seismo tectonic atlas have been further confirmed. The reply submitted was deliberated and Committee decided to send the same to Mr. Sujit Das Gupta and seek his comments as he was not present in the meeting at the time of deliberation.

Item No. 18.3.6 Pakal Dul (Drangdhuran) H.E. Project, Jammu & Kashmir

Pakal Dul H.E. Project envisages utilisation of 417m gross head by constructing a 305m long and 167m high concrete faced rockfill dam across the river Marsudar, a tributory of Chenab in Distt. Doda of J&K state. The project is located at latitude 33°27'30"N and longitude 75°48'50"E.

The proposed site lies in seismic zone IV as per the seismic zoning map of India given in IS 1893-(part-1) 2002.

The site specific study [Report no.EQD-2001/2005-06 (March 2006) related to the local and regional geological conditions, earthquake occurrence and seismo-tectonic set up of the region was carried out by IIT, Roorkee. The IIT, Roorkee has estimated the PGA value of 0.31g. The vertical spectral acceleration value has been recommended as 2/3 of the corresponding horizontal value. The normalized horizontal response spectra are given in Fig. 2 & 3 of site specific study report with multiplication factors 0.31g for MCE condition and 0.16g for DBE condition.

The project initially was presented and discussed in the XVI meeting. The committee after deliberation had suggested that the logic of arriving at the earthquake magnitude along with the relation of the fault plane distance from the Dam site on earthquake calculations has to be made clear and the report should be supported by a diagram explaining all this. The project was again discussed in the XVII meeting and after deliberation the Committee felt that almost a thumb rule is being applied to derive MCE, which is 7.5 for MBT and 8.0 for MCT for almost all Himalayan Sites with the dip of the plane as 15^0 and focal depth of scenario earthquake as 15 km and it is too much of a simplification to accept as the site specific input parameters.

The project authorities (NHPC) submitted the reply given by the department of Earth Quake Engg., IIT Roorkee. The Committee decided that as the height of the dam is relatively high, the seismic parameters need to be worked out based on the geological set up of the site. The report shall clearly spell out the methodology adopted supported with figures. The Committee decided that a revised report shall be prepared using this approach and submitted.

Item No. 18.3.7 Kotlibhel H.E. Project, Uttaranchal

18.3.7.1 (A) <u>Stage-1A</u>

The Kotlibhel H.E. Project Stage-1A envisages construction of a 82.5m high concrete gravity dam across river Bhagirathi. The Project is located near Muneth village at latitude $30^0$09'26"N to $31^0$29'57"N and longitude $78^0$09'10"E to $79^0$25'04"E.

The project site lies in seismic zone IV as per seismic zoning map of India given in IS: 1893-(part-1) 2002.

The site specific study [Report no.EQD-2013/2005-06 (December 2005)] related to the local and regional geological conditions, earthquake occurrence and seismo-tectonic set up of the region was carried

out by IIT, Roorkee. IIT, Roorkee has estimated the PGA value of 0.31g . The vertical spectral acceleration value has been recommended as 2/3 of the corresponding horizontal value. The normalized horizontal response spectra are given in Fig. 2 & 3 of site specific study report with multiplication factors 0.31g for MCE condition and 0.16g for DBE condition.

18.3.7.2 (B) Stage-1B

The Kotlibhel H.E. Project stage - IB involves construction of 70.5m high concrete gravity dam across river Alaknanda. The project is located at latitude 30°09'01"N and longitude 78°30'02"E.

The project site lies in seismic zone IV as per seismic zoning map of India given in IS: 1893-(part-1) 2002.

The site specific study [Report no.P-EQD-2014/2005-06 (December 2005)] related to the local and regional geological conditions, earthquake occurrence and seismo-tectonic set up of the region was carried out by IIT, Roorkee and copies of the report have already been made available to all the members of the committee. The IIT, Roorkee has estimated the PGA value of 0.31g. The vertical spectral acceleration value has been recommended as 2/3 of the corresponding horizontal value. The normalized horizontal response spectra are given in Fig. 2 & 3 of site specific study report with multiplication factors 0.31g for MCE condition and 0.16g for DBE condition.

18.3.7. 3 (C) Stage-II

The Kotlibhel H.E. Project Stage-II involves construction of 58.6m high concrete gravity dam across river Ganga. The Project is located near Kandiyala village at latitude 30°04'05"N and longitude 78°30'02"E.

The project site lies in seismic zone IV as per seismic zoning map of India given in IS: 1893-(part-1) 2002.

The site specific study (Report no.P-EQD-2015/2005-06 (February 2006)) related to the local and regional geological conditions earthquake occurrence and seismo-tectonic set up of the region was carried out by IIT, Roorkee and copies of the report have already been made available to all the Members of the committee. The IIT, Roorkee has estimated the PGA value of 0.31g. The vertical spectral acceleration value has been recommended as 2/3 of the corresponding horizontal value. The normalized horizontal response spectra are given in Fig. 2 & 3 of site specific study report with multiplication factors 0.31g for MCE condition and 0.16g for DBE condition.

The Kotlibhel H.E. Project (Stage I-A, I-B & Stage-II) were presented and deliberated in the previous seventeenth meeting. The replies to the observations received from project authorities were discussed and after deliberations, the Committee approved the coefficients and response spectra given in the reports.

18.3.8 Site Specific Seismic Study for River Valley Projects

Member-Secretary apprised the Committee that following projects were considered in last two meetings also, reminders were issued to project authorities for expediting the Site Specific Seismic Study Reports, since no response has been received from project authorities regarding resubmission of the revised studies, Committee may like to drop these from the agenda till they are resubmitted. Committee agreed to the proposal.

(a) Rampur H.E. Project, Himachal Pradesh
(b) Brutang Irrigation Project, Orissa
(c) Thotapalli Barrage Project, Andhra Pradesh
(d) Mankulam H.E. Project, Kerala

Item No. 18.4 New Projects.

Item No. 18.4.1 Vishnugad Pipalkoti HE Project, Uttaranchal

Vishnugad Pipalkoti HE Project, Uttaranchal, involves construction of a 45m high gravity dam. The project is located at about 1.4 km d/s of Hailang village situated on the left bank of Alaknanda river at latitude 30°31'00"N and longitude 79°29'37"E.

The project site lies in seismic zone IV as per seismic zoning map of India given in IS: 1893-(part-1) 2002.

The site specific study [Report no.P-2005-01(Sept. - 2005)] related to the local and regional geological conditions, earthquake occurrence and seismo-tectonic set up of the region was carried out by IIT, Roorkee. IIT, Roorkee has estimated the PGA value of 0.38g. The vertical spectral acceleration value has been recommended as 2/3 of the corresponding horizontal value. The time history of ground motion and the horizontal acceleration are given in Fig. 2 & 3 of site specific study report with multiplication factors of 0.38g for MCE condition and 0.19g for DBE condition.

Member-Secretary informed the Committee that due to paucity of time, the project could not be discussed in the last meeting and subsequently,, M/s Tehri Hydro Development Corporation Ltd. requested to approve the seismic parameters for Vishnugad Pipalkoti hydro electric project as per Tapovan Vishnugad hydro electric project as the site is

located immediately D/s of Tapovan Vishnugad HE Project. It was also informed that World Bank Authorities have been continuously pursuing THDC for the seismic parameters and the designs of the structures could not be finalized for want of approved seismic parameters which is causing delay in taking up the implementation of the project. Accordingly, as desired by Member (D&R), CWC & the Chairman of the NCSDP, the request was forwarded to all members by post and their opinion for giving the conditional approval of the seismic design parameter to the Vishnugad Pipalkoti HEP was sought. In response, comments of five members were received and out of these, three had agreed to give the conditional approval and two (Dr. I.D. Gupta, Jt. Director, CWPRS and Sh. R.S. Dattarayam, Director (Seismology), IMD, New Delhi) had certain observations. Considering the urgency of the project, **the Chairman, NCSDP has accorded conditional approval for the Project, with multiplying factors as 0.38 g for MCE condition and 0.19g for DBE condition and response spectra as given in fig. 3 of the report.**

The project authorities presented the geology and seismic studies carried out in the report and replies to the observations raised by the committee members. The committee after deliberations decided that the conditional approval as accorded may remain in effect till the issues raised by some of the Committee Members get resolved. It was decided that the project authorities will submit the clarification raised by Dr. I.D.Gupta to the Member Secretary of NCSDP who will obtain the views of Dr. Gupta on the clarification & process the case further.

Item No. 18.4.2 Dhankari Dam (Andaman and Nicobar)

The existing Dhankari Water supply scheme comprises of a 32.25m high, 132m long concrete dam constructed across Dhankari Nallah. The present scheme envisages increase in the height of the existing dam by 5m in order to augment its live storage capacity by creating an additional storage of 3.2 M.cu.m. The project area lies in the Andaman Nicobar Island bounded by latitudes 11°32'30"N to 11°35'00"N and longitudes 92°40'00"E to 92°32'32" E.

The project site lies in seismic zone V as per the seismic zoning map of India given in IS 1893-(Part-1)2002.

The site specific study [Report No.NH/Con/208 of March 2003] related to the local and regional geological conditions, earthquake occurrence and seismo-tectonic set up of the region was carried out by IIT, Roorkee. IIT Roorkee has estimated the PGA value of 0.51g. The vertical spectral acceleration value has been recommended as 2/3 of the corresponding horizontal value. The horizontal response spectrum has been given in Fig. 2 & 3 of site specific study report with multiplication factors of 0.51g for MCE condition & 0.255g for DBE condition.

The project authorities presented the brief on seismic studies and geology of the project area along with salient features of the projected. The Committee considering the fact that the present study was undertaken in the year 2002 and after that there has been a major earthquake that had caused Tsunami, decided that the study may be reviewed after accounting for the mentioned earthquake.

18.5.0 Guidelines for Site Specific Seismic Studies for River Valley Projects.

After deliberations on different approaches being adopted for arriving at seismic parameters the Committee decided to organize a brain storming session by inviting experts from various institutions involved in seismic studies. The Committee suggested that detailed calculations listing all assumptions/basis considered in arriving at response spectra may be brought out based on a sample project for presentation and discussion. In this context the Committee requested Dr. I. D. Gupta of CWPRS and Dr.Paul, Professor, I.I.T. Roorkee to present their findings based on such sample project in the next meeting/workshop for discussion/deliberations so as to finalise the guidelines. The Committee also requested them and other Members to suggest names of some other experts for participation in the workshop/brainstorming session. The Committee desired that these guidelines be taken up on priority so that approach for arriving at the seismic parameters is finalized. Chairman desired that an effort be made to arrange the workshop at an early date, so that uniformity may be introduced in the studies and presentation of study results.

18.6.1 Malana Stage II H.E. Project, Himachal Pradesh

The Malana H.E. Project involves construction of a 51m high concrete gravity dam across river Malana near village Malana. The project is located at latitude 32°-05' N and longitude 770-16'E respectively.

The proposed site lies in seismic zone IV as per seismic zoning map of India given in IS 1893-(Part-1) 2002.

The site specific study [Report no.EQD-3005/2007-2008 (May 2007)] related to the local and regional geological conditions, earthquake occurrence and seismo-tectonic set up of the region was carried out by IIT, Roorkee. The IIT, Roorkee has estimated the PGA value of 0.36g. The vertical spectral acceleration value has been recommended as 2/3 of the corresponding horizontal value. The normalized horizontal response spectra are given in Fig. 2 & 3 of site specific study report with multiplication factors 0.36g for MCE condition and 0.18g for DBE condition.

The project authorities presented the brief on seismic studies and geology of the project area along with salient features of the project. After

deliberations the Committee accepted the coeffients and response spectrum given in the above site specific seismic report.

18.6.2 Pala Maneri H.E. Project, Uttrakhand.

The Pala Maneri H.E. Project involves construction of a 74m high concrete gravity dam across river Bhagirathi near village Pala. The project is located at latitude 30°-5o-25.35"N and longitude 78°-37-44.21"E respectively.

The proposed site lies in seismic zone IV as per seismic zoning map of India given in IS 1893-(Part-1) 2002.

The site specific study [Report no.EQD-3012/2006-2007 (April 2007)] related to the local and regional geological conditions, earthquake occurrence and seismo-tectonic set up of the region was carried out by IIT, Roorkee. IIT, Roorkee has estimated the PGA value of 0.36g. The vertical spectral acceleration value has been recommended as 2/3 of the corresponding horizontal value. The normalized horizontal response spectra are given in Fig. 6 & Table-II of site specific study report with multiplication factors 0.36g for MCE condition and 0.18g for DBE condition.

The project authorities presented the brief on seismic studies and geology of the project area along with salient features of the project. After deliberations the Committee accepted the coeffients and response spectrum given in the above site specific seismic report.

18.6.3 Rangit H.E. Project Stage IV, Sikkim.

The Rangit H.E. Project Stage IV involves construction of a 44m high concrete gravity dam across river Rangit near village Rishi. The project is located at latitude 27°-13-10"N and longitude 88°-18'-10"E respectively.

The proposed site lies in seismic zone IV as per seismic zoning map of India given in IS1893-(Part-1) 2002.

The site specific study related to the local and regional geological conditions, earthquake occurrence and seismo-tectonic set up of the region was carried out by CWPRS, Pune. The CWPRS, Pune has estimated separately the PGA value for horizontal component of the motion is 0.457g and for vertical component as 0.283g. The normalized horizontal response spectra are given in Fig. 9 & 11 of site specific study report. For preliminary studies as for initial dimensioning of the structure, seismic coefficients for horizontal (α_h) and vertical (α_v) component of motion for the maximum section of the dam have been recommended as 0.25g & 0.166g respectively.

The project authorities presented the brief on seismic studies and geology of the project area along with salient features of the project. IIT, Roorkee sought certain clarifications on the consideration of sources in deterministic and probabilistic approach in the study submitted and also on the earthquake magnitude adopted for the MCT & MBT. Dr.I.D.Gupta , Joint Director; CWPRS briefed the concept of earthquake occurrences considered in Himalaya range.

It was decided that Dr. I.D. Gupta will submit his clarification in writing to the Member-Secretary of NCSDP who will obtain the clearance format from IIT Roorkee on the study submitted by CWPRS & process the case for approval.

Meanwhile the Committee accepted the study as was done in the case of Vishnuguad Pipal Koti Project and accorded conditional approval of the parameters recommended in the study.

The meeting ended with vote of thanks to the chair.

Annexure -1

XVIII Meeting of National Committee on Seismic Design Parameters (NCSDP) on River Valley Projects

Date : 05.07.2007
Attendance

Sl.No.	Name & Address	Designation	Deptt./ Org.	Status/ Representative
I. Committee Members				
1.	Sh. A.B. Pal	Member (D&R)	CWC, New Delhi	Chairman, NCSDP
2.	Sh. S.K. Sen Gupta	Chief Engineer (DSO)	CWC, New Delhi	Member
3.	Sh. Sujit Das Gupta	Director	GSI, Kolkata	Member
4.	Sh. I.D. Gupta	Joint Director	CWPRS, Pune	Member
5.	Dr. D.K. Paul	Professor	DEQ, IIT Roorkee, Roorkee	Member
6.	Sh. P.R. Baidya	Director, IMD	IMD Delhi	Member
7.	Sh. J. Jai Raju	Director, FE&SA	CWC, New Delhi	Member-Secy. NCSDP
II. Special Invitees				
8.	Sh. D.K. Mehta	Chief Engineer	CWC	
9.	Sh. T.P. Singh	Chief Engineer	CWC	
10.	Sh. S.K. Sibbal	Director	CWC	
11.	Dr. M.L. Sharma	Assoc. Professor	DEQ, IIT Roorkee, Roorkee	
12.	Sh. Manish Shrikhande	Assoc. Professor	DEQ, IIT Roorkee, Roorkee	
13.	Sh. V.C. Gupta	Dy. Director	CWC	
14.	Sh. Shibram Majhi	A.D.	CWC	
15.	Sh. A.P. Kandiyal	E.A.D.	CWC	
16.	Mrs. J.M. Peter	E.A.D.	CWC	
III. Project Representatives and Consultants				
17.	Sh. R.K. Vishnoi	Dy. Gen. Manager	T.H.D.C.	Vishnugad Pipalkoti Project
18.	Sh. J.K. Varshney	Manager	T.H.D.C.	Vishnugad Pipalkoti Project
19.	Sh. M.K.V. Sharma	Consultant	M/s Jaypee	Karcham Wangtoo H.E.P.
20.	Mr. Vipin Kumar	G.M.	M/s Jaypee	Karcham Wangtoo H.E.P.
21.	Sh. V.D. Ajmani	G.M.	U.J.V.N.LTD.	Palamaneri Project
22.	Sh. Ajay Patel	D.G.M.	U.J.V.N.LTD.	Palamaneri Project
23.	Sh. Dheeraj Chaudhary	Asstt. Engineer	U.J.V.N.LTD.	Palamaneri Project
24.	Sh. Shashikant Kumar	Asstt. Engineer	U.J.V.N.LTD.	Palamaneri Project
25.	Sh. Bharat Bhardwaj	Technical Laision Officer	U.J.V.N.LTD.	Palamaneri Project
26.	Dr. Durgesh Rai	Consultant	IIT, Kanpur	Chuzachen HE Project

27.	Sh. A. Rajgopalan		M/s GATI Infrastuctures	Chuzachen H Project
28	Miss Anupam Singh		M/s GATI Infrastuctures	Chuzachen H Project
29.	Sh. Sudarshan	Chief Engineer	A.P. Govt.	Nagarjuna Sag Tail Pond
30.	Sh. Sinachalpadhy		NGRI. Hyderabad	Nagarjuna Sag Tail Pond
31.	Sh. B.N. Malhotra	Superintending Engineer	Andaman PWD	Dhankari H. Project
32.	Sh. S. Chaudhary	Asstt. Manager	NHPC	
33.	Sh. Imran Sayeed	Chief Geologist	NHPC	
34.	Sh. Sharad Bhatnagar		NHPC	
35.	Sh. M.K. Sharma	C.E.O.	JPCL	Rangit Project
36.	Sh. Kazzol Guha	Consultant	JPCL	Rangit Project
37.	Sh. Rakesh Mahajan	Vice President	Indo Canadian Consultancy	Rangit Project
38.	Sh. R.S. Chadha	Vice President	JPCL	Rangit Project
39.	Sh. K.K. Bhandari	G.M.	JPCL	Rangit Project
40.	Sh. Venugopala	Vice President	Energy Info Tech	Malana Project
41.	Sh. P. Punnetha	Head	Energy Info Tech	Malana Project
42.	Sh. G.C. Panjaiem	Geologist	Energy Info Tech	Malana Project