Annexure-1.1

(As referred to in para 1.3)

Statement showing share of NHPC, SJVN, THDC and NHDC in country's total installed hydro power generation capacity as on 31 March and total hydro power generation for the years 2009-10 to 2014-15

Particulars	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Total installed hydro generation capacity in the country (MW)	**36863**	**37567**	**38990**	**39491**	**40531**	**41267**
Installed capacity of NHPC (MW)	3629 (9.84%)	3749 (9.98%)	3749 (9.62%)	4024 (10.19%)	4831 (11.92%)	4961 (12.02%)
Installed capacity of SJVN (MW)	1500 (4.07%)	1500 (3.99%)	1500 (3.85%)	1500 (3.80%)	1500 (3.70%)	1912 (4.63%)
Installed capacity of THDC (MW)	1000 (2.71%)	1000 (2.66%)	1000 (2.56%)	1400 (3.55%)	1400 (3.45%)	1400 (3.39%)
Installed capacity of NHDC (MW)	1520 (4.12%)	1520 (4.05%)	1520 (3.90%)	1520 (3.85%)	1520 (3.75%)	1520 (3.68%)
Total installed capacity of above four CPSEs (MW)	**7649 (20.74%)**	**7769 (20.68%)**	**7769 (19.93%)**	**8444 (21.38%)**	**9251 (22.82%)**	**9793 (23.72%)**
Total hydro power generation of country (MUs)	**103916**	**114257**	**130510**	**113720**	**134848**	**129244**
Power generation by NHPC (MUs)	16960 (16.32%)	18606 (16.28%)	18683 (14.32%)	18923 (16.64%)	18386 (13.63%)	22038 (17.05%)
Power generation by SJVN (MUs)	7019 (6.75%)	7140 (6.25%)	7610 (5.83%)	6778 (5.96%)	7193 (5.33%)	8096 (6.26%)
Power generation by THDC (MUs)	2117 (2.04%)	3116 (2.73%)	4591 (3.52%)	4266 (3.75%)	5582 (4.13%)	4214 (3.26%)
Power generation by NHDC (MUs)	3071 (2.96%)	3197 (2.80%)	4664 (3.57%)	4161 (3.66%)	5712 (4.24%)	3691 (2.86%)
Total hydro power generation of above four CPSEs (MUs)	**29167 (28.07%)**	**32059 (28.06%)**	**35548 (27.24%)**	**34128 (30.01%)**	**36873 (27.34%)**	**38039 (29.43%)**

Annexure-2.1

(As referred to in para 2.5)

Details of Power Stations selected for Performance Audit

S. N.	Name of Power Station	Date of commercial operation	Location	River	No. and size of unit in MW	Installed Capacity (MW)	Type of Power Station
1	Bairasiul	April 1982	Chamba (HP)	Baira, Siul and Bhaled	3 x 60	180	RoR with pondage
2	Tanakpur	April 1993	Champawat (Uttrakhand)	Sharda	3 x 31.4	94.2	RoR
3	Chamera-I	May 1994	Chamba (HP)	Ravi	3 x 180	540	RoR with pondage
4	Uri-I	June 1997	Baramulla (J&K)	Jhelum	4 x 120	480	RoR
5	Dhauliganga	Oct.-Nov. 2005	Pithoragarh (Uttrakhand)	Dhauliganga	4 x 70	280	RoR with pondage
6	Teesta-V	Mar.-Apr. 2008	East Sikkim (Sikkim)	Teesta	3 x 170	510	RoR with pondage
7	Chamera-III	Jun.-Jul. 2012	Chamba (HP)	Ravi	3 x 77	231	RoR with pondage
8	Chutak	Nov. 2012 to Feb. 2013	Kargil (J&K)	Suru	4 x 11	44	RoR
9	Nathpa-Jhakri	Oct. 2003 to May 2004	Kinnaur and Shimla (HP)	Satluj	6 x 250	1500	RoR with pondage
10	Tehri Hydro	Sept. 2006 to July 2007	Tehri (Uttrakhand)	Bhagirathi and Bhilangana	4 x 250	1000	Multi-purpose power project with storage
11	Indira Sagar	Jan 2004 to March 2005	Khandwa (MP)	Narmada	8X 125	1000	Multi-purpose power project with storage

Annexure 4.1

(As referred to in para 4.2)

Inadequacies in Planned/Capital maintenance carried out by power stations

Audit observation	Ministry/Management reply	Further remarks of Audit
Delay in treatment of excessive leakages from Pressure Shaft of Dhauliganga Power station of NHPC During initial charging of Pressure Shaft[1]-I of Dhauliganga power station (DGPS) in August 2005, heavy water leakage was observed. Though the defect liability period was still on, DGPS, instead of asking contractor to rectify the defect, awarded (March 2006) the work of treatment of Pressure Shaft to another contractor, who after observing heavy water leakages, abandoned the work (April 2006). This was followed by three inspections viz. (i) By Design Division of NHPC (February 2007), who observed structural disturbances in shaft (ii) By Committee of Corporate office who observed (May 2008) excessive seepage and change in colour of water in Adit[2] to Pressure Shaft Top which was a warning sign calling for early remedial measures (iii) by another committee constituted (July 2011) to suggest suitable remedial measures for this problem. However, remedial action was not taken by the Management despite examination and recommendations of above three inspections. The work was only carried out during restoration of DGPS after floods of June 2013 at a cost of ₹18.30 lakh. Thus, a problem which cropped up immediately after commissioning of power station in August 2005 and had a direct bearing on the safety of important structures was not solved for eight years though planned maintenance was carried out by the unit every year. The leakage also resulted in generation loss (during lean seasons alone) to the extent of 11.85 MUs[3] valuing to ₹94.80 lakh from 2006-07 to 2012-13.	NHPC stated (February 2015) that repeated attempts were made by the power station for repair without resorting to dewatering of water conductor system / complete shutdown of Power Station. It was also stated (August 2015) that it was not commercially prudent to take complete shutdown of power station.	Reply is not acceptable because: (i) It took eight years due to management's indecisiveness. (ii) NHPC did not offer any comment on not getting the leakage rectified from the contractor during defect liability period. (iii) Dhauliganga power station was commissioned without completing painting job of inner surface of pressure shaft steel liner 1 and 2 and leakages from pressure shaft were noticed during initial charging itself.
Delayed/non-receipt of spares in Dhauliganga power station of NHPC The runners of unit nos. 3, 4 and 1 were planned to be replaced during annual maintenance 2009-10, 2010-11 and 2011-12, respectively. However, due to non-receipt of new/repaired runner before annual maintenance of above units, these units were put into operation without replacement of runner. After receipt of runner, these units had to be taken out of generation again for three days to five days, resulting in loss on account of lower PAF amounting to ₹1.32 crore. Due to non-synchronization of receipt of spares and maintenance schedule, Dhauliganga power station suffered loss of ₹1.32 crore on account of lower PAF.	NHPC stated (February/ August 2015) that schedule of unit's shutdown and availability of spares shall be matched and optimized to avoid any generation loss. It shall also be monitored by O&M Division, corporate office.	Audit appreciates the assurance given which would be watched in future.

[1] A vertical or inclined shaft designed to take up high pressure. Pressure shafts are the closed conduits entirely confined between surge shaft and main inlet valve (MIV) and guides the movement of water under pressure. Surge shaft is located at the end of head race tunnel. It is a well type structure of suitable height and diameter to absorb the upcoming and lowering surges in case of tripping and starting of the machine in the power house.

[2] Audit is a type of entrance to underground tunnels which may be horizontal or nearly horizontal.

[3] [{(70/26.8) x 0.15} x 24 hours x 30 days x 6] x 7

Non-maintenance of Main Inlet Valve (MIV) seal in Dhauliganga power station of NHPC During annual maintenance of 2011-12, maintenance team of DGPS found that leakage through MIV seals of unit no 3 and 4 of DGPS was at an alarming stage, but repair of the same was not undertaken because this required repair of Pressure Shaft-II also. Due to not carrying out repair of MIV during planned maintenance period, DGPS had to face forced outages of 164:48 hours in respect of unit no. 3 during 28 August 2012 to 04 September 2012, translating into generation loss of 11.54 MUs equivalent to ₹92.32 lakh (11.54 MUs x ₹0.80 per unit). Audit also observed that during this period due to non-availability of machine, power station was unable to schedule the desired level of power and also lost on account of lower PAF which worked out to ₹55.61 lakh[4].	NHPC stated (August 2015) that in spite of leakage in MIV, maintenance of same was not included during annual maintenance in 2011-12, as it could only be undertaken by emptying the pressure shaft for longer period. However, outages as reported cannot be attributed to leakage of MIV seal.	The reply is to be viewed against the fact that Daily Generation Report indicated that the reason for forced outage of DGPS were attributable to non-opening of MIV. Further, as the Management was aware of the leakage in MIV at the time of annual maintenance in 2011-12, it would have been appropriate to rectify the problem of MIV during the annual maintenance, which was undertaken during lean period. This could have avoided forced outage during peak period and consequent financial loss.
Improper annual maintenance in Tanakpur power station (TPS) of NHPC During the inspection of runner by Management in annual maintenance of 2013-14, crack on runner blade of Unit 3 was observed. The runner was sent to Bhopal unit of BHEL and the unit was put back into operation on 02 June 2014 by fitting an old repaired runner of this unit. However, immediately after synchronization, unit 3 developed problem of excessive shaft vibrations. After examination, TPS concluded that increased vibrations could be due to misalignment/unbalance. Since correction of misalignment/unbalance was a time taking activity, TPS decided to run the machine between 20-25 MW output (against 31.4 MW) so as to keep vibration within safe limit and carry out detailed analysis and corrective action during off peak season. However, the machine was repaired on 26 August 2014. Due to operating machine at reduced capacity, TPS lost on account of lower machine output of unit no. 3 to the extent of 12.58 MUs during peak period of 02 June-25 August 2014 valuing ₹1.01 crore (@ ₹0.80 per unit, the rate for secondary energy).	TPS stated (December 2014/June 2015) that had the machine been taken for repair, it would have taken 15-20 days approximately for repair. Accordingly, the machine was continued to run at 20-25 MW to avoid generation loss in peak period. The gap setting of Turbine Guide Bearing (TGB) was checked and got adjusted on 26 August 2014 after taking outage for 9:19 hours. Thereafter, vibration level was reduced and machine operated on full capacity. Complete realignment of the machine was planned during next annual maintenance for a period of 15- 20 days. NHPC stated (August 2015) that the Power Station has been cautioned to undertake such type of corrective measure without any delay in future. Ministry has not furnished any comment (August 2015).	As rectification of vibration level was a matter of around 9 hours, it was not clear as to why the same was not carried out on 02 June 2014 itself when excessive shaft vibrations were noticed. Between 02 June 2014 and 25 August 2014 (i.e. up to the date of repair) 12.58 MUs were lost due to running unit no. 3 at reduced load.

[4] [{₹27064.43 lakh(AFC)/2}/365]/4 x 6 (29 August 2012 to 03 September 2012)

Annexure 4.2

(As referred to in para 4.2.1.1)

Statement showing delay in procurement due to delay in initiation of proposal and processing award of Dhauliganga Power Station of NHPC

Sl No	Name of Contract	Budget Provision (1)	Date of proposal (2)	Date of award/ (3)	Period in months from date of PR to award) (4=3–2)	Value of award (₹ in lakh) (5)	Schedule date of Supply (6)	Actual date of Supply (7)	Delay in Supply (8 = 7– 6)
1	Runner Cone	2009-10	19.3.10	17.12.11	21	20.93	16.11.12	20.12.12	1
2	Complete set of upper & lower bush housing assembly (20 nos. each)	2010-11	29.10.10	25.3.11	5	12.04	20.9.11	9.8.12	10.5
3	Top cover and bottom ring comprising of wearing plates	2010-11	28.6.10	10.2.11	7.5	21.97	9.8.11	2.1.12	5
4	Fix and moving Labyrinth	2011-12	11.8.11	27.1.12	5.5	70.98	24.7.12	21.8.12	1
5	Top cover and bottom ring comprising of wearing plates	2011-12	9.8.11	21.01.12	5.5	33.75	20.7.12	16.03.12 and 21.08.12	-
6	GIS CB active part & its spares	2011-12	19.5.11	12.07.12	14	37.82	24.5.13	30.5.13	-
7	Guide Vanes for Power House	2012-13	14.09.11	29.04.13	19.5	56.94	28.02.14	06.10.13	-

Annexure 4.3

(As referred to in para 4.2.1.2)

Statement showing delay in procurement due to delay in initiation of proposal and processing award of Tanakpur Power Station of NHPC

Sl No	Name of Contract	Budget Provision	Date of proposal	Date of award	Period from date of Proposal to date of award (In months)	Value of award (₹ in lakh)
1	Aircell Type Conservator for 49.5 MVA Generator Transformer for Tanakpur Power Station	2012-13	13.1.12	10.1.13	12	12.65
2	Supply, Installation, Testing & Commissioning of 02 nos. 625 KVA Silent DG Set with AMF Panel and Accessories Conforming to CPCB Norms	2011-12	22.12.09/ 10.2.12	16.6.12	30/4	99.08
3	Digital Automatic Voltage Regulator	2008-09	14.11.07	25.5.10	30	60.03
4	Digital Governor, MAX DNA Version	2011-12	3.6.11	27.7.12	13.5	157.65
5	01 NO. 55 Ton Capacity (Rough terrain) Mobile Crane.	2012-13	27.6.12	29.1.14	19	237.00
6	Supply, Installation, Testing & Commissioning of 625 KVA Silent DG Set with AMF Panel and Accessories Conforming to CPCB Norms	2012-13	27.10.12	31.3.14	17	54.39
7	Stator Air Coolers & Bearing Oil Coolers for 31.4 MW Generator	2011-12	20.6.11	13.1.12	6.5	49.77
8	Purchase of Runner blades template for measuring Runner blades.	2012-13	02.02.12	07.08.12	6	8.48

Annexure 4.4

(As referred to in para 4.3.2)

Cases of recurring forced outages and delayed resolution of faults

Audit observation	Management reply	Further remarks of Audit
Outages due to fault in Gas Insulated Switchgear Circuit Breakers On 21 June 2006 the Gas Insulated Switch gear (GIS) Circuit Breaker (CB) of Unit no. 4 of Dhauliganga Power station failed to interrupt the flow of current. As no spare CB was available, the faulty CB was replaced with healthy CB pole of bus coupler[5] and generation from Unit no. 4 was restored on 06 July 2006. Faulty CB pole was sent to M/s Alstom (the manufacturer), who intimated (October 2006) that in the absence of a clearly identified cause for damage, other investigations were required. After this, six more faults occurred in CBs of Unit nos. 1, 2 and 3 up to December 2012 (*i.e.*, on 20 March 2008, 07 March 2011, 15 February 2012, 30 October 2012, 07 December 2012 and 10 December 2012) due to which DGPS faced forced outages of 2527 machine hours. Finally, after a follow up in October 2012 a meeting was held (April 2013) between NHPC and M/s Alstom to discuss the reasons and preventive action required to be taken to avoid the recurrence. In the meeting M/s Alstom intimated that as a result of detailed study, some modifications had been done in the assembly of CBs for trouble free operation. Accepting the problem in design, M/s Alstom replaced complete active part inside the CBs of all the four generating units, bus coupler and both the transmission lines (total 21 no. poles) in January-February 2014. Audit observed that in spite of the fact that CBs were so maintenance free and highly reliable equipment that maintenance manual of OEM recommended only minor inspection, that too after every four years to six years, DGPS did not follow up failure of CBs with M/s Alstom, after October 2006 till October 2012 due to which DGPS lost 2527:43 machine hours translating into generation loss of 105.91 MUs[6].	NHPC stated (November 2014, February 2015 and August 2015) that (i) since there was no recurrence of fault after 2006 in the following year it was not expected in future also. Further, change in design was not solely based on occurrence of single fault. The firm felt the need for change in design after observation of four similar faults in 2012 and on persuasion of the management they admitted the design mistake, (ii) minor/ major inspection of CBs was not solely based on periodicity of operation of equipment but also on its number of operations performed in a day or number of tripping that occur due to outages of machine or feeders which cause detrimental effect on moving and fixed contact in active part.	Considering the reliability and maintenance free nature of equipment and first fault occurring within one year of commencement of commercial operations followed by another fault in 2008, it was desirable for DGPS to expeditiously follow up the results of further investigation on faulty CB sent to M/s Alstom's workshop. Further, the reply regarding admittance of design mistake by M/s Alstom confirms the fact that occurrence of fault in maintenance free and reliable part at early stages of operation was unusual. (ii) DGPS did not furnish actual number of operations performed on CBs in support of its reply.

[5] Bus coupler is a device which is used to switch from one bus to the other without any interruption in power supply and without creating hazardous arcs. It is achieved with the help of circuit breaker and isolators.

[6] 95.76 MUs in respect of first two outages occurring during peak season + 10.15 MUs in respect of other five outages occurring in lean period.

Outages due to non-opening of Guide Vanes (wicket gates) at DGPS DGPS started experiencing problem in automatic opening of wicket gates[7] after completion of first monsoon since its COD in October 2005. As the problem persisted for three years, General Manager/DGPS suggested (October 2009) replacement of existing servomotor with higher capacity servomotor in one of the units on experimental basis. However, no further action was taken in this regard. In the meantime an expert of M/s Alstom was called in October 2009, who suggested conditioning the greasing system of wicket gates. Despite conditioning, the problem of non-opening of wicket gates persisted during 2010. General Manager/DGPS reiterated (August 2011) his concern to O&M Division of the corporate office and requested for approval of proposal to increase the capacity of servomotors. As no decision was taken by O&M Division of NHPC on the proposal of GM/ DGPS, DGPS continued to experience problem of non-opening of wicket gates during monsoon season of year 2011 also. O&M Division, Corporate office suggested (October 2011) coating of underwater parts to prevent damages due to siltation and cinematic test (dry test) of wicket gates to verify the wicket gate angle (degree) movement with reference to servo motor stroke (mm). Action on these measures was not taken by DGPS and in the meantime, due to major flood occurring in the midnight of 16-17 June 2013, generation at power house was stopped. During restoration of power station, based on recommendation of M/s Alstom, NHPC procured (November 2013) and installed four sets of wicket gate servomotors at a cost of ₹52.92 lakh. Outage reports after restoration (i.e. from May 2014 to August 2014) did not indicate problem of non-opening of wicket gates. Audit observed that delayed decision on replacement of servomotors, in spite of protracted pursuance by DGPS resulted in frequent outage aggregating to 208:02 machine hours with a loss of 14.56 MUs (equivalent to ₹1.16 crore) due to non opening of wicket gates during five years ended 31 March 2013. Besides, due to not generating as per agreed generation schedule on those dates, DGPS had to bear penalty of ₹1.78 crore in the form Unscheduled Interchange[8] Charges.	NHPC stated (November 2014 and August 2015) that initially M/s Alstom informed that servomotors were not under- designed and the guide vanes were not opening due to damages of underwater parts by silt. During annual maintenance of 2012-13, M/s Alstom studied the problem and concluded that there was no other option, but to replace the servomotor. Implementation/ replacement of servomotor were not desirable without detailed study. The servomotor was replaced in 2014 and now the Guide Operation was trouble free.	In view of satisfactory operation of all other parameters of wicket gates, DGPS had concluded in October 2009 itself of the need for replacement of servo motors. Corrective action was, however, not taken timely. Final solution of problem by replacement of servo motor also substantiates the fact that problem was with the servo motor itself.

[7] In Dhauliganga Power Station (DGPS) there are 20 Nos. of wicket gates in a unit to regulate the flow of water as per load variation. The Wicket gates are operated by two servomotors.

[8] Unscheduled Interchange in a time block for a generating station means its total actual generation minus its total scheduled generation. Charge for Unscheduled Interchange for all time blocks shall be payable for under-injection by the generating station, worked out on the basis of rates prescribed by CERC for average frequency of time block.

Outages due to Rotor Earth Fault at Tanakpur Power station Between August 2009 and September 2014, TPS suffered forced outages of 537: 38 hours due to frequent Rotor Earth faults in Unit no. 1. In spite of problem of Rotor Earth fault persisting since August 2009, TPS took up with BHEL (*i.e.* OEM) for the first time in January 2014 and asked it to carry out detailed examination/inspection and testing of complete rotor to find out the exact reason of such frequent failures. BHEL in September 2014 recommended re-insulation of wound poles, replacement of coil leads and insulated clamp, *etc.* for joint supports. The work was yet to be done (February 2015). Thus, permanent solution to the frequent problem in unit no. 1 due to Rotor Earth fault could not be found though five annual maintenances were carried out during 2009 to 2014. As a result of this TPS suffered generation loss of 16.87 MUs valuing ₹1.35 crore.	NHPC stated (February 2015 and August 2015) that first time rotor earth fault was developed on 21 August 2009 after capital maintenance of Generating Unit no.1. Thereafter rotor earth faults developed during 2010-11 and 2011-12. The problem has already been telephonically discussed with OEM and their recommendation of September 2014 will be implemented in phased manner in TPS and duly monitored by O&M Division.	Reply indicates that NHPC failed to provide permanent solution to the recurring problem of rotor earth fault during last five years.
Generation loss due to delay in repairing of radial gates in Teesta-V power station of NHPC Leakage of water from the radial gates of the dam of Teesta-V power station was noticed in March 2009 leading to loss of generation of power. Temporary repair work to arrest the water leakage was carried out during annual maintenance of 2010, but the problem could not be fully rectified. Management initiated action for major repair of radial gates in October 2012 on urgent basis. However, approval for major repair job of radial gates was accorded after eight months in June 2013. The work was awarded (December 2013) to M/s Mungipa Trade Links Private Limited at a value of ₹8.04 crore and was completed in March 2014. Audit observed that due to delay of eight months (October 2012 to June 2013) in administrative approval of the urgent repairing job, the work which was possible to be completed in July 2013, was actually completed in March 2014 resulting in generation loss of 301.32 MUs valuing ₹40.59 crore during the lean period from September 2013 to February 2014.	NHPC stated (April 2015 and August 2015) that the repair/replacement work of Stop log sill beams was only possible with complete shutdown of machine. Further, repair and maintenance of Stop Log Sill Beams were in progress in phased manner.	Reply is silent on the reasons for avoidable delay in administrative approval which resulted in generation loss.

Annexure 6.1

{As referred to in para 6.6.2(ii)}

Statement showing observations of Dam Safety Team which were not complied by Tanakpur Power Station within time limit recommended by the Team

Inspection period	Observation	Action taken by TPS	Audit observation
7 & 8 May 2012	**Left Afflux Bund** During previous inspection concrete lining between RD 280 – 400 m was found to be settled associated with cracks over concrete lining and cavities below. The further subsidence associated with cracks were observed during present inspection also in a stretch of about 50 m upstream side. Temporary protection works are being carried out by placing Tetrapods and the cavities are left. It is suggested that, after placing the Tetrapods, the cavities should also be filled with boulders/available granite blocks RBM or sand bags to suit site condition so as to avoid sudden collapse of the embankment during monsoon floods. As this stretch is more vulnerable to severe erosion related damages, the work be taken up on priority and completed before onset of monsoon -2012. **Inspection carried out on 15 & 16 October 2012** Damages observed in concrete lining during previous inspection has been treated temporarily between 240 to 340 m to prevent further extension during the monsoon and the balance portion between RD 186 m to 240 m is to be taken up shortly as per the suggestion given in previous inspection. **Inspection carried out on 01 & 02 April 2013** Same status was reported as during inspection of 15 & 16.10.2012.	Permanent restoration works of damaged portion between RD 280 m to 400 m were carried out during closure period of power station between 11.01.2014 to 26.03.2014.	The stretch which were adjudged (May 2012) by Dam Safety Team to be more vulnerable to severe erosion related damages and, therefore advised to be taken up on priority and completed before onset of monsoon -2012, were not taken up even before onset of monsoon-2013.
15 & 16 October 2012	**Right Afflux Bund** It was observed that a branch of main river was taking turn towards right bank near Sharda Ghat; as such it was advised that the damaged nose of spur constructed to divert water from Sharda Ghat be restored. **Inspection carried out on 01 & 02 April 2013** It was reported that power station had informed that restoration of the nose of the low level spur near Sharda Ghat would be taken up shortly.	The nose of the low level spur near Sharda Ghat Bazar was restored by awarding work to M/s Hillman Enterprises, Meena Bazar vide Letter of award dated 31 March 2014.	Restoration work suggested in October 2012 was not completed before onset of monsoon-2013.

Inspection period	Observation	Action taken by TPS	Audit observation
01 & 02 April 2013	**River bank protection works** Damages to nose and other portion of spurs at nine locations (parallel to Power Channel) at RD 2150, 2400, 2575, 2650, 4250, 4350, 4550, 4650 and 4880 reported during previous visit (October 2012) be taken on priority before onset of monsoon especially in MES area.	In compliance to above, the work has been executed before onsets of monsoon vide LOA no. 3115 dated 20.1.2014.	Works which were recommended by Dam Safety Team to be carried out before onset of monsoon 2013 were carried out before onset of monsoon 2014.

Annexure 7.1

(As referred to in para 7.3.2)

Statement showing external inspection's observations and status thereof in respect of NJHPS of SJVN

S. No.	DSO Nasik post monsoon inspection 2009 observations	DSO Nasik post monsoon inspection 2012 observations	DSO Nasik post monsoon inspection 2013 observations
1	–	National Committee on Dam Safety documents (as per Point no. 4.3, mentioned in Form of periodical inspection of Large Dam) should be prepared according to the guidelines of CWC and approved copy of the same should be sent to this organisation for record. Preparation of Emergency Action Plan (EAP) should be attended on priority. The EAP should be strictly prepared according to CWC guidelines.	Same observation as noticed during inspection of 2012
2	–	Data logger was observed out of order due to humid conditions in the gallery as the uplift measurement is important factor so the data logger should be repaired earlier.	Data logger was sent for repair. Hence reading could not be taken due to non-availability of portable data logger. (Final compliance report was awaited)
3	–	The water level measuring gauge was seen in illegible conditions. Separate readable and water proof gauge should be provided and the water level reading should be cross checked with the reading of automatic water stage recorder.	Same observation as noticed during inspection of 2012.
4	–	Three strong motion accelerographs are observed in foundation gallery, inspection gallery & top of dam. However, the storage and acquisition module (SAM) are out of order hence the accelerographs are also not in working condition. As the dam site is in Earthquake zone no. IV it is very essential to keep watch on the seismic activity.	Same observation as noticed during inspection of 2012.
5	No meteorological instruments (such as rain gauge, wind velocity recorder etc.) are installed on dam site.	Same observation as noticed during inspection of 2009.	Same observation as noticed during inspection of 2009.

6	–	The staff should be properly trained to monitor & operate the entire instrumentation of dam to ascertain the actual behaviour of dam under various operational conditions. Hence, it is recommended that visit to Koyna hydroelectric project, Maharashtra, may be sought for the official concerned where the instrumentation scheme was monitored & operated very well by trained authorities.	Same observation as noticed during inspection of 2012.
7	–	Data Acquisition System (DAS) is installed on top of the dam for vibrating type instrument readings. It is not connected to computer for real-time monitoring. It is suggested to connect the same with computer for continuous monitoring.	Same observation as noticed during inspection of 2012.
8	–	Model study of EDA needs to be carried out for the present condition. Further result of actual performance of EDA should be compared with designed results.	Same observation as noticed during inspection of 2012.