

**TWENTY-FIFTH REPORT**  
**PUBLIC ACCOUNTS COMMITTEE**  
**(1980-81)**

**(SEVENTH LOK SABHA)**

**SALAL HYDRO-ELECTRIC PROJECT**

**MINISTRY OF ENERGY**  
**(DEPARTMENT OF POWER)**



3

*Presented in Lok Sabha on 17.3.1981*  
*Laid in Rajya Sabha on .....*

**LOK SABHA SECRETARIAT**  
**NEW DELHI**

*February, 1981/Magha, 1902 (L.Sabha)*

*Price : Rs. 6. 00.*

CORRIGENDA

CORRIGENDA TO 25TH REPORT OF PUBLIC ACCOUNTS  
COMMITTEE PRESENTED TO LOK SABHA ON 20.3.1981.

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(1980-81)

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## INTRODUCTION

1. The Chairman of the Public Accounts Committee, as authorised by the Committee, do present on their behalf this Twenty-Fifth Report on Paragraph 40 of the Report of the Comptroller and Auditor General of India for the year 1977-78, Union Government (Civil) on Salal Hydro-Electric Project (Ministry of Energy).

2. The Report of the Comptroller and Auditor General of India for the year 1977-78, Union Government (Civil) was laid on the Table of the House on 9 May, 1979. The Committee (1979-80) examined the above paragraph (reproduced in Appendix I) at their sittings held on 17 and 18 August, 1979. The Public Accounts Committee (1980-81) further examined the paragraph at their sitting held on 27 October, 1980. The Committee considered and finalised this Report at their sitting held on 24 February, 1981. Minutes of the sittings form Part II\* of the Report.

3. Inadequacy of investigations at the pre-construction stage was in the main responsible for the "geological surprises" that were encountered during the execution of the Salal Project resulting in heavy over-runs of time as well as cost. The project is now estimated to involve a total outlay of as much as Rs. 350 crores at current prices, as against the original estimate of Rs. 55 crores. The Project Report of 1968 had visualised commissioning of the three units by June 1975, June 1976 and June 1979 respectively. The Project is still far from complete and the first unit is expected to be ready only by March, 1987.

4. For reference facility and convenience, the observations and recommendations of the Committee have been printed in thick type in the body of the Report, and have also been reproduced in a consolidated form in Appendix II to the Report.

5. The Committee place on record their appreciation of the commendable work done by the Public Accounts Committee (1979-80) in taking evidence and obtaining information for this report.

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\*Not printed. (One cyclostyled copy laid on the Table of the House and five copies placed in Parliament Library).

6. The Committee also place on record their appreciation of the assistance rendered to them in the matter by the office of the Comptroller and Auditor General of India.

7. The Committee would also like to express their thanks to the officers of the Ministry of Energy for the cooperation extended by them in giving information to the Committee.

NEW DELHI;  
March 3, 1981  

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Phalgunā 12, 1902 (S).

CHANDRAJIT YADAV,  
*Chairman,*  
*Public Accounts Committee.*

## REPORT

### INTRODUCTORY

1.1. Salal Hydro-electric Project is a run-of-the river scheme (i.e., without storage reservoir) located at the Dhyangarh loop of river Chenab near Reasi about 100 Kms. from Jammu. This project was originally taken up and approved as a State project on the basis of a project report prepared in 1968 which indicated the estimate cost as around Rs. 55 crores. In August 1970, the project was taken over by the Government of India for execution as a Central project. The project has been placed under the charge of National Hydro-electric Power Corporation Ltd., on "agency basis" w.e.f. 15 May, 1978.

1.2. The project as approved by the Planning Commission in 1970 envisaged an installed capacity of 270 MW (3x90 MW) in the first stage with an ultimate capacity of 540 MW (6x90 MW) in June 1971 the scope of the Project was enhanced by increasing the installed capacity of the project from 270 MW to 345 MW (i.e. 3x115 MW) in Stage I and 690 MW in Stage II by increasing the head for the turbines from 81m. to 93m. by depressing the location of the Power House below the river bed level and constructing a tail race tunnel to discharge water into the river at the next loop downstream. Exploitation of this additional head necessitated shifting of the Power House from its original location at the toe of the dam on the left bank to the right bank of the Southern limb of the Dhyangarh loop. The Project estimate was accordingly revised in March 1974 to Rs. 112.98 crores. None of the major works had been by then put to tender and, as such, the costs were tentative. The Ministry of Energy did not approve the revised estimate in 1974 and desired in March 1976 that the estimate should be revised on the basis of the latest indication of prices and rates. The estimate was further revised in September, 1976 to Rs. 222.15 crores and these revised estimates were approved by the Government in May, 1978. (As per latest estimates, the cost of the Project is likely to go up further to Rs. 350 crores at current prices). The Project, which was initially expected to be completed by June 1979 is now likely to be commissioned in 1987.

### Reasons for the increase in cost

1.3. At the instance of the Committee, the Ministry have furnished the break-up of the increase in the Project cost of Rs. 167.00 crores (Rs. 222.15—55.15 crores) as under:

	(Rs. i	s
<b>A. Increase due to escalation in cost</b>		
Escalation in labour and material cost . . . . .	76.07	
<b>B. Other Factors</b>		
1. Due to increase in scope of power generation (i.e. increase in power generation from 270 MW to 345 MW). . . . .	25.93	
a. Increase due to change in designs and quantities as per construction drawings	33.63	
3. Increase due to increase in length of transmission lines (length increased from 146 to 460 Kms.) This was necessitated to connect the power station to the Northern Grid . . . . .	4.81	
4. Non-provision and inadequate provisions . . . . .	14.06	
5. Increase due to increase in cost of Direction and Administration due to increase in various sub-heads of works and due to execution of Rockfill dam departmentally . . . . .	12.50	
TOTAL . . . . .	90.93	
GRAND TOTAL (A+B) . . . . .	167.00	

### Cost increase due to changes in designs and quantities

1.4. It would be seen from the above table that out of the overall increase in cost of the order of Rs. 167 crores, Rs. 33.63 crores are "due to change in designs and quantities as per construction drawings". In a note furnished to the Committee, the Ministry have indicated the following main changes in designs and quantities as responsible for this increase in cost.

#### Power House

1.5. The original project report and estimates of 1968 envisaged an installed capacity of 270 MW (3x90 MWs). In 1971, it was decided to increase the scope of power generation to 345 MWs (3x115 MWS) by utilising the additional natural drop available in the loop of the Chenab river just downstream of Dhyangarh loop, thereby necessitating depressing of the Power House by about 10.8 metres to gain the additional head. Consequent on this decision which involved the shifting of the Power House from the left bank to the right bank of the river, the designs and quantities of the Power House and the penstocks changed and the following works were necessitated:

- (a) Tailrace Tunnel.
- (b) Cofferdam for construction of Penstocks.
- (c) High concrete protection-cum-retaining wall around the

power house.

- (d) Cutting back and stabilising of the hill behind the Power House; and
- (e) Part provision for necessary works in the Tailrace tunnel and Penstocks for the second stage works of the project.

#### *Diversion Tunnel*

- (i) Shifting of the gate intake structure from the entry portal to the centre of the tunnel thereby involving, remodelling of the central portion of the tunnel.
- (ii) Provision of steel liners as invert cladding and steel lining in the gate chamber area.

#### *Concrete Dam*

1.6. The original design drawings of the Concrete dam had to be changed during construction from time to time due to the following reasons:

- (i) Treatment of shear zones/seams in the foundation of the dam;
- (ii) Change in grouting techniques;
- (iii) Increased provision of Crest Gates;
- (iv) Hydraulic hoists for Sluice Gates;
- (v) Lowering of some of the spillway blocks;
- (vi) Provision of drainage and grouting galleries.

#### *Transmission Works*

1.7. Based upon the detailed studies conducted by Central Electricity Authority for determining the transmission system taking into account, *inter alia*, the increase in the scope of power generation from 270 MW (3x90 MW) to 345 MW (3x115 MW), the scope of transmission works under the Project was substantially increased in June 1975 resulting in increase in total length of transmission lines from 150 kms. to 462 kms.



*Cost increase due to non-provision or inadequate provision in original estimate*

1.8. The increase in the estimated cost to the extent of Rs. 14.06 crores is indicated to be due to items not provided for, or not adequately provided for, in the original estimate. The break-up is shown as follows:

(i) Items not originally provided for . . . . .	Rs. 11.29 crores
(ii) Items inadequately provided for . . . . .	Rs. 2.77 crores
	<u>Rs. 14.06 crores</u>

The details of these items are as follows :

	Value of new items not provided for originally	Value of inadequate provision
	(Rs. in lakhs)	
Dams . . . . .	280.22	113.81
Water Conductor System . . . . .	175.26	19.26
Power House . . . . .	451.47	24.94
Communications and Buildings . . . . .	43.86	118.03
Ancillary Works . . . . .	45.90	..
Other expenditure . . . . .	132.87*	1.50**
	<u>1129.58</u>	<u>277.54</u>

\*This consists of the following items:

	(Rs. in lakhs)
(i) Investigations conducted by J&K Government . . . . .	66.00
(ii) Land for Power House, Tailrace Tunnel complex and Penstock fabrication yard of at Talwara . . . . .	3.60
(iii) Land for Talwara Colony . . . . .	3.27
(iv) Compensation to the State Govt. for submergence of bridges and roads, reconstruction of roads etc. . . . .	60.00
TOTAL . . . . .	<u>132.87</u>

\*\*This item comprised of Hydrological observations.

1.9. The steep increase in the estimated cost of the project came to up for discussion during evidence. It was pointed out that the steep rise in the estimated cost from Rs. 55.15 crores in 1968 to Rs. 222.15 crores in 1976 showed that the original estimate of 1968 was not realistic or was prepared without adequate investigation.

The Secretary of the Ministry of Energy, answering the point raised, stated (August, 1979):—

“I think it was based on the best available information at that time although as the note brings out, further investigations were required before detailed drawings were undertaken.”

1.10. The witness also pointed out that despite prior investigations on this site done at the time of preparation of project report, “there were a number of geological surprises and this had a vital bearing on the cost of the project.” Besides, according to him, “most of the cost had gone up by 3 or 4 times and this would get reflected in any estimate of that nature prepared in 1968”.

1.11. Asked if the cost of every hydel project was likely to go up by 3 or 4 times, what was the use of having that kind of investigation and preparation of the project report at the initial stage, he stated:

“In this case, we are comparing 1976 estimates with 1968 estimates. Over these 8 years, there had been substantial cost escalation. So, while a small part of it is due to changes in the scope of the project itself, the reason for the large escalation would be the inflation in prices.”

1.12. Pointing out the investigations done by the Geological Survey of India on which the project report was based, the Director General, Geological Survey of India said :

“A lot of drilling was done and the broad geological features of this site were established, the adverse shear zones in the foundations and other features were outlined. There are two points. One is the recognition of the features and the other is the provisioning that we make to meet the situation. In dealing with Himalayan sites, we are not in a position to appreciate fully the importance of these features from the design and construction point of view and make reasonable provisions in the estimate. In the case of the Bhakra dam, there were seven miles of drilling done and one mile of tunnelling, and yet at the construction stage as many as ten shear zones on one abutment and 12 on the other were discovered only during the excavation stage. In the Himalayan sites, you do develop information as you go along because there is a lot of over burden. That is where the difficulty comes in regard to preparation of the project estimate.”

### *Further revision of estimate*

1.13 During evidence in October, 1980 the Committee desired to know whether the sanctioned estimate of 1976 had been further revised keeping in view the cost escalation that had since taken place and if so, what the latest estimate was. The Secretary, Ministry of Energy stated :

“...According to our study, compared to the cost estimates of 1976....the total cost estimate has been broken down into 12 or 13 important elements. One finds from that, basically, there are three items where there is the cost increase. In the revised estimate of the order of Rs. 350 crores, the increases are of three types. One is, whenever an estimate is prepared, the normal practice in the Government is that the cost estimates are always prepared on the basis of basic costs as they are on that day in the country and, by the time the project is completed, naturally certain inflationary effects will come in. One type of increase would be purely on account of that.

Leaving aside inflationary effects which are not under the control of the Project authorities as such, there are two other areas where the increases take place. One is, in the concrete dam where the real problems started....particularly, in the power dam, after 1976. But today we are in a position to say—we have discussed in detail with our consultants, with the geologists, with everybody involved—that we all feel we have come to a point that we have found most economic solution for the power dam.....

If you compare the previous 1976 cost estimate of the concrete dam which was about Rs. 40 crores, the latest assessment is about Rs. 75 crores in which a part element is on account of inflation and a part element is on account of increase in the quantity of extra excavation and extra concrete.

The second area of increase, other than inflationary reasons, is the water conducting system.....There were six penstocks as against three in the original one..... Where the cost involved was Rs. 6½ crores, it is now Rs. 18 crores on account of doubling the water conducting system, that is instead of three, there are six penstocks. Secondly, the power house having gone across the river

and the capacity having been increased, an additional 20 per cent capacity is going to be generated.

Apart from this, we are confident that there is not likely to be any increase in the Project cost other than due to inflationary effects. We are still not submitting the revised cost estimate to the Government or outside our Department. There is only one reason for that. We feel, it is much better now to wait for some more time and finalise our estimates based on actuals because, in the near future, almost all the major contracts which have not been awarded would also have been awarded.

1.14 Asked if the revised estimate of Rs. 3.50 crores had been discussed with the Planning Commission, the witness replied :

"I would say, it has not been formally presented. In the sense that they are able to evolve the Plan, it has been discussed. As the revised cost estimate, it has not been formally presented to the Planning Commission."

1.15 Elaborating the position further, the Chairman-cum-Managing Director, NHPC stated :

"... the first estimate was sanctioned in 1968 for Rs. 65 crores; then the next landmark is Rs. 222 and odd crores which was sanctioned in 1976. As against that, we have spent about 140 crores and we have commitments upto another Rs. 30 crores; I think it means a total of 170 crores. We have a cushion in the 1976 estimate but there are certain major things of this project like the power house, penstocks etc. for which tenders have not been issued and unless we issue the tenders and award the contracts we will not be in a position to know the finally revised cost. We have had serious problems on the concrete dam for which happily we have found solutions since we met you last and excavation drawings have been issued and construction activity can start in a sustained manner. Under these conditions, it was our assessment that we can operate on Rs. 222 crores estimate for some more time till we get a solution on the technical problems and till we award some of the major contracts. In the meantime we have done an internal exercise which gives us a picture of about Rs. 350 crores."

1.16 The Committee desired to know if the latest cost estimate of Rs. 350 crores was not going to escalate further. The Secretary, Department of Power during evidence stated (October 1980):

"At present our assessment is Rs. 350 crores at today's prices. Naturally, some price escalation will take place which we cannot predict. I do not think that can be related. In terms of quantities we feel that we are not likely to go beyond what we have estimated at present... Some of the contracts are still to be awarded. So, we wanted to wait and see the actuals, then finalise the revised estimate and submit to the Government. We are reasonably sure that at today's prices the cost estimate which we have put at Rs. 350 crores is correct."

1.17 In a further note\* furnished to the Committee, the Ministry have stated :

"This revised figure of cost was prepared for the purposes of planning the financial outlay and projecting the same both for annual plan discussion in the Planning Commission as well as for projecting the resources requirement for the 6th Five Year Plan period. Hence the exercise was made based on the escalation that has taken place since 1976 estimate and subsequent increase in volume and scope of work due to various factors. It is as a result of this exercise that the indication of the revised estimate of Rs. 350.00 crores has been given. This estimate is an approximate one and regular revision of the estimate in all its details has yet to be finalised due to the fact that contracts for two of the major works namely Power House Switch-yard Complex and Penstocks have yet to be awarded.

The analysis below of increases is based on the progress figures which compose the revised estimate. An increase of Rs. 128.00 lakhs is presently envisaged over and above the sanctioned estimated cost of about Rs. 222.00 crores (1976). The main reasons for the increases in the cost are :

- (i) *Increase in the volume and scope of work due to design and other changes.*

The increase on this account is Rs. 31.00 crores which forms 24.21 per cent of the total increase.

- (ii) *Increase in the scope of work due to provision of new items.*

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\*Not vetted

An increase of about Rs. 8.00 crores is anticipated on this account due to provision of additional three Penstocks for Stage II development of the Project along with Stage I construction. This increase is about 6.25 per cent of the total increase.

(iii) *Increase in cost due to escalation.*

The increase on this account is estimated at Rs. 89.00 crores which forms 69.54 per cent of the total increase."

1.18. In reply to a further question regarding the major items of work for which tenders had yet to be issued, the Ministry have informed\* the Committee that contracts for the Power House sub-structure, Switch yard and other ancillary works, involved in this complex (costing Rs. 2235.5 lakhs) have yet to be finalised. Contracts for the Power house and ancillary works costing Rs. 2235.5 lakhs are scheduled to be finalised in June, 1981. Contract for the supply of equipment for switchyard is scheduled to be awarded in September, 1982 and contracts for the civil works of switchyard and other, ancillary works, costing Rs. 551.35 lakhs, are scheduled to be finalised in February, 1984. The contract for Penstocks and ancillaries costing Rs. 2350.00 lakhs is scheduled to be finalised by September, 1981.

1.19. All the above scheduled dates of finalisation of main contracts are as per the master control net work envisaging completion of the first unit by March, 1987. The following table\* shows the latest estimate (November, 1980) for different items of work as compared to (i) the original sanctioned estimate of 1968 (ii) the revised estimate of 1976 and the actual expenditure incurred upto August, 1980.

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\*Not vetted

Items of work	Original sanctioned estimate 1968	Revised Estimate 1976 (sanctioned)	Present Estimate	Expenditure upto August, 1980
Direction and Administration	375.70	1904.35	2550.00	712.41
Machinery and equipment stock suspense/receipts and recoveries on capital account	312.11 (- ) 206.89	1375.89 (- ) 679.01	2250.00 (- ) 700.00	2735.68 1126.04
Dams:				
(i) Rockfill dam	1451.63	4028.70	5,800.00	
(ii) Concrete dam	1,693.14	3959.36	7,750.00	2881.51
(iii) Diversion tunnel	47.14	595.48	630.00	1430.00
(iv) Maintenance during construction	30.55	85.83	150.00	
(v) Water conduit system, penstocks, etc.	110.85	641.55	2350.00	100.23
Power house	173.32	1,201.32	3300.00	542.01
Generating plant and machinery	772.11	3,276.70	3,350.00	1,486.21
Transmission and distribution	269.12	1,361.03	1,450.00	328.00 (Approx.)
Communications and buildings	257.52	1,187.55	1,370.00	1,111.22
Ancillary works	107.06	938.65	1,500.00	747.64
Other expenditure etc.	121.57	506.51	700.00	258.00
Tail race tunnel	..	1,831.07	2,350.00	406.95
TOTAL	5,514.98	22,214.98	35,000.00	12,935.90

1.20. The Committee desire to know the latest position regarding execution of the various components of the project and the efforts being made to ensure that the project is completed by the revised target date viz., March, 1987. In a note\*, the Ministry have stated:

"Work on all major components of the project is going on as per the Master Control Network of the Project to complete the Project by 1986-87. Diversion Tunnel has already been completed and commissioned, the work of Tail Race Tunnel is progressing to ensure its completion by March, 1984. The solution to the geo-technical problems of the Concrete Dam has since been evolved and excavation drawings have since been received from C.W.S. (Central Water Commission) and the work on excavation, concreting etc. is in progress. The consequent scheduling of the work projected with planning of necessary inputs has been finalised with a view to commissioning by March, 1987. Steps have been taken to prequalify dependable contractors for the remaining major items of work, namely, Power House complex and Penstocks to ensure the completion of these components to fit into the overall completion schedule of the Project.

Strict monitoring is being done at the Project level and at the Corporate level to ensure that all critical items are attended to at a appropriate level and at proper time so that no slippage is allowed to occur in the time schedule of the Project. Special steps are being taken to ensure supplies of essential materials like cement, steel, diesel and power, by maintaining continuous contacts with the concerned authorities, i.e. the Cement Controller of India, the SAIL and other authorities. It is expected that these steps and close monitoring, which are being taken, the Project will be completed as per the revised schedule of 1986-87."

1.21. In this connection, the Committee called for details of projects which had been commented upon by Audit in recent years and where there had been steep escalation in cost and inordinate delays in their completion. The Committee have accordingly been furnished the following information:

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\*Not vetted.



Sl. No.	Name of the Projects	(Rs. in crores)						
		1	2	3	4	5	6	7
		Original estimated cost and year in which approved	Latest estimate/ Actual cost	Percentage increase	Target date of completion as envisaged in the project Report	Actual likely date of completion		
1	Loktak H.E. Project	10.90 (1976)	80.63 (Gross) Plus 12.60 (Int. during construction)	855	October, 1976	March, 1982		
2	Baira Sual H.E. Project	20.40 (1976)	95.52 (Gross Plus 16.63 a (Int. during construction)	547	1974	I & II Unit-March, 1980 III Unit, June, 1981		
3	Badarpur Thermal Power Project Stage I	30.95 (1957)	59.87 (Gross) b	150	March, 1971	I Unit, July, 75 II Unit, August, 74 III Unit, March, 75		
	Stage II	28.19 (1973)	66.40 (Gross) c	235	1973-79	Commissioned in March, 1980		
	Stage III	63.86 (Gross) 63.69 (net) (1977)	88.06 d	138	1981-82	September, 1981		
4	Beas Project (Beas Sual Tank)	96.67 (1961)	382.57	306	About 10 years	6/77 11/77 to 6/79		
	Pong Dam	75.34 (1960)	259.80	345	About 8 years	6/74 1/78 to 3/79 5/76 to 8/79		
	Beas Transmission System	39.38 (1970)	72.94	183	1975-76			
5	Satiguda Dam	2.02 (1962)	11.05	547		1969		1983
6	Haldia Dock Project	39.44 (1966)	145.74	369		197		1977*

Note :- 1. (a) Proposal for revision of estimates to Rs. 140.15 crores (Gross) is under consideration.

2. (b) The final actual cost now works out to around Rs. 64.50 crores.

3. (c) The cost is expected to go up further to about Rs. 75 crores. The revised estimates are under consideration.

4. (d) The revised cost estimate (Rs. 88.06 Crores) is under consideration.

5.\* Except Fertiliser Handling System.

Fertilizer handling system is expected to be commissioned in 1981-82.

.. 1.22. Salal Hydro-electric Project was originally approved as a State project on the basis of a project report prepared in 1968 which indicated the estimated cost as around Rs. 55 crores. In August, 1970, the Project was taken over by the Government of India for execution as a Central project. The project estimate was revised to Rs. 113 crores in March, 1974 and further revised to Rs. 222 crores in September, 1976. The cost of the project as per latest estimates (November 1980), is likely to go up further to Rs. 350 crores at current prices.

1.23. The Committee note that the Salal Project has been beset with problems of heavy over-runs of both time and cost. As the later sections of this Report would show, inadequate investigations at the pre-construction stage and frequent changes in designs were in a very large measure responsible for this continuing delay of a vital project. The Committee would have expected that with experience of the execution of the gigantic Bhakra-Nangal project and the Sutlej-Beas Link Project (both in the Himalayan region) and with the expertise available in the country in the field of geological sciences and techniques, it should have been possible to use the latest available technology to facilitate proper planning and timely execution of this vital project. According to the Ministry of Energy, the scheme was full of "geological surprises" and consequently the project got delayed. The Committee note that this approach and process of trial and error would ultimately cost the Exchequer more than six times the original estimates.

1.24. The Committee find that there has been a steep escalation due to labour and material costs since the project was taken over by the Government of India. The 1976 estimate had projected an increase of Rs. 76 crores over the original estimate of 1968 under this head. The latest estimate of November 1980 shows a further increase of Rs. 89 crores. Thus, out of a total increase of Rs. 295 crores (Rs. 350 crores—Rs. 55 crores), the escalation in labour and material cost alone amounts to Rs. 165 crores i.e. nearly 56 per cent of the total cost escalation. The Committee have learnt that this project which was initially estimated to cost Rs. 55 crores would ultimately involve an extra expenditure of Rs. 165 crores towards labour and material costs alone, not to mention other costs. The Committee would like to be apprised of the detailed reasons for such abnormal rise in cost. They would in particular like to be assured that all necessary steps have been taken for proper materials management at all stages of execution of the project.

1.25. The other areas where the original estimates of costs have registered a steep escalation due to increase in scope of power

generation and increases due to change in designs and quantities of work. The revised estimate of 1976 visualised increases of the order of Rs. 25.93 crores and Rs. 33.63 crores on these counts respectively over the original estimates. A further increase of Rs. 31 crores is anticipated under these two heads in the latest exercise carried out in November 1980. The Committee have commented on these increases in later sections of this Report.

1.26. The Committee are disturbed to find that yet another area where costs have gone up manifold is "Direction and Administration". The estimated expenditure under this head has jumped from Rs. 375.70 lakhs in 1968 to Rs. 1904.35 lakhs in 1976 and Rs. 2550.00 lakhs in 1980, showing an increase of 580 per cent within a span of 12 years. The Committee would like the Ministry of Energy to analyse in depth with the help of the Chief Cost Accounts Officer of the Ministry of Finance the reasons for the abnormal increase in expenditure under this head with a view to exploring areas where economies could be effected.

1.27. An increase of Rs. 14.06 crores in the revised estimates of 1976 over the original estimates, is attributed to non-provision and inadequate provisions in the original project report.

1.28. The Committee desire that more care should be taken in the preparation of detailed project estimates so that a clear picture is available to the Parliament of the cost-benefit ratio of a project before the same is sanctioned and pitfalls in planning are avoided. The Committee have discussed this aspect at greater length in a subsequent section of this Report.

#### *Selection of Project Site*

1.29. The Committee desired to know the nature of investigations carried out by the Government of Jammu & Kashmir while preparing the Project Report. The Ministry of Energy have stated that the investigations of Salal Hydro-Electric Project at the present Dhyangarh site were undertaken by the Government of J&K from 1965 onwards. The earlier investigations from 1961 to 1964 pertained to an alternative dam site at Aas. The investigations conducted at Aas were with regard to Topographic surveys, Geological Investigations, Hydrological—Meteorological Investigations, Geophysical investigations, Construction material surveys and Field tests on properties of rock and shear zones etc. These investigations were completed in May 1964 when Project Report was prepared. The Project report of May 1964 was examined by the Central Water and Power Commission and after site inspection by the then Union Minister for Irrigation and Power Dr. K. L. Rao, in June 1964 decision was taken that constructing the dam at Dhyangarh was a better alter-

native than constructing the same at Aas. Accordingly, investigations of the Dhyangarh site were taken in hand in June 1965 after a joint inspection by the officers of Central Water and Power Commission and Geological Survey of India in May, 1965. Investigations were conducted between June 1965 and March, 1968 when the project report for the present site was prepared.

1.30. The Committee desired to know if any investigations were conducted by the Government of India after the project was taken over by them for execution in August, 1970. The Ministry of Energy have in a note stated:

"The investigations carried out for preparation of project report of Hydro-electric Projects even though extensive in nature for purpose of preparation of Project reports are of a very broad and macro character. These investigations although suitable for preparation of a project report from a techno-economical angle would not be adequate for preparation of designs for foundation treatment works and construction drawings for major structures. This is more so in respect of the projects located in young Himalayas, the geology of which is extremely heterogeneous and complicated—design pre-requisites for preparation of detailed construction drawings, can be precisely known only after the foundations are exposed after actual excavation and geo-technical assessment thereof made. Accordingly side by side with the construction further detailed investigations were taken up as a continuous process. After the project was taken over by the Government of India for execution, detailed construction stage investigations were taken in hand and continued for each component of the project. Before the construction of each component of a project is taken in hand, investigations in sufficient detail, comprising detailed topographical surveys, progressive geological appraisals of exposed foundations, geo-physical, photo-elastic and geo-technical investigations and model tests, are required to be conducted to enable preparation of technically sound designs and construction drawings as well as for devising precautionary and protective measures for ensuring operational safety of the various components of the project. All the above investigations, in respect of the various components of the project, were taken in hand progressively side by side with the investigations for development of colonies, roads, bridges and other infrastructure for the project together with detailed surveys for land

acquisition for the above works and for submerged area of the reservoir. Besides, the following investigations, necessitated by the complex geological features of the project as were revealed progressively, were required to be undertaken.

Progressive excavation of various components of the Project helped in confirming the otherwise indicating nature of certain adverse geological features. These could be precisely delineated and their physical nature assessed from point to point only after the excavations were completed. A precise assessment of the extent and magnitude of the problem *vis-a-vis* safety of the various components called for a review of the designs. Investigations required for assessing the magnitude and extent of the problem and evolving satisfactory solutions therefor, were accordingly taken in hand from time to time.

Elaborate tests on the properties of foundation rock including determination of the shear-parameters of rock and shear zones were undertaken and are still continuing.

The Geological Survey of India had earlier (1961) observed some small caves outside the limits of the dam along the bank of the river at the water level which according to their report were presumably formed as a result of river erosion. After the excavations of the dam were completed to the originally contemplated foundation grades, the Geological Survey of India desired that the continuity of these cavities under the base of the dam as also the possible existence of similar cavities below the water level should be confirmed/proved because of their relevance to the stability of the dam. Necessary investigations were accordingly conducted to verify the same.

Photo-elastic studies on the various components of the dam foundations were got done through Central Water & Power Research Station, Pune.

Model tests on the Diversion tunnel, Concrete dam, Power House, Rockfill dam and the proposed bridge were got conducted at the CW&PRS, Pune, and for some structures at the University of Roorkee.

Finite element studies on the foundations of the dam were got done at Indian Institute of Technology, Delhi and CW&PRS, Pune.

Geo-physical investigations to determine the efficacy of grouting in the dam foundations were got conducted by Central Water & Power Research Station, Pune.

Elaborate studies on the stability of the dam foundations, under various conditions (including under earth-quake), were got done on a silting 3-dimensional model at the Roorkee University.

Detailed grouting experiments were conducted on the foundations of the Concrete and Rockfill dams when it was found that conventional techniques and parameters were not effective. These were continued for over two years till satisfactory techniques and parameters for the same were evolved."

1.31. During evidence (August 1979) it was pointed out that from the information furnished to the Committee in writing, it appeared that after inspection of the site by Dr. K. L. Rao, the then Union Minister of Irrigation and Power, a decision was taken to locate it at the present site and then investigations were made with regard to the geology of the site. The Director General, Geological Survey of India replied:

"On the consideration of topography and layout alone the site was chosen, and subsequently investigations were carried out."

1.32. Supplementing him on this point, a representative of the Project stated:

"Before the investigations of the site were taken up in 1961, the J&K Government had tried alternative power developments both at Dhyangarh as well as at Aas. A German firm was engaged to do the alternative studies at both the sites. At that time, the J&K Government wanted a limited power to be generated for the requirement of the J&K State keeping in view their limited financial resources. The German firm gave a project report for a limited run of the scheme without a dam.

Then, for the optimum development of power potential, the Expert Committee report was taken in hand and the Government of India decided that a site should be chosen for the optimum development of power generation. Detailed investigations of the Aas site continued from 1961 to 1964 and a project report was prepared in 1965. When this project report was scrutinised by the Commission and subsequent to Dr. Rao's visit, during the course of

investigations, it was highlighted that there was a major shear zone in the river bed and therefore a concrete dam was not a feasible solution and alternatively, we had to have a rockfill dam. For that, we wanted a spillway which should be concrete and there was no space for the concrete spillway at the Aas site. With these considerations in view, Dr. Rao at that time suggested that we should look again to the Dhyangarh site on which some preliminary investigations had been done by the German firm. Thereafter, from 1964 to 1968, detailed investigations were done at the Dhyangarh site which consisted of 6000 running metres of drifting besides other topographical and other surveys. It was only after this detailed survey which was as detailed as that of Aas site, that a project report for the Dhyangarh site was prepared in 1968 which was subsequently sanctioned."

1.33. Asked to confirm that detailed investigations carried out between 1964 and 1968 were with a view to locate the power station at the left bank of river and not for its location at the right bank, the witness replied that "for the power house in particular, they were confined only to the left bank", but maintained that "before shifting the power house to the right bank adequate geological investigations were conducted."

1.34. During evidence in October 1980, the Committee enquired whether the various problems faced during the course of execution of the project did not indicate that the earlier techno-economic survey and feasibility report was based on inadequate data. The Secretary (Department of Power) stated:

"If you are referring only to shifting of the power house, to that extent I would concede the point. But if you are referring to certain delays which have taken place on account of certain type of faults which were found, I would submit this. Even though the shear zones were known, the direction of the shear zones of seams, which is very important, could only be found when they started digging and they came across one after another the shear seams. The seams are very thin, about a millimetre, as was mentioned. The direction could not be found out in the initial drilling. But all the same, if you have the future in mind, we are studying this type of problems. Definitely, whatever equipment we have in our country, we are familiar with. But there are possibilities. In the recent past, in certain countries, they had gone in for a much

deeper drilling. But for deeper drilling, new equipment are needed. We are studying from that point of view. There may be a case for spending more money and doing much more drilling than what we do normally."

1.35. In reply to a further question regarding the tardy implementation of the project, the witness stated:

"I am prepared to concede that there were elements in the feasibility report which one might say were a little unrealistic. I would not accept or I would not say that the feasibility report was faulty..... Once this point accepted, no amount of investigation could tell the type of seams that could be formed and we have got to accept that this was the best which could be done."

1.36. The Committee are surprised to learn that the basic fact that the river bed had a "major shear zone" which subsequently necessitated a change of site could not be discovered during investigations conducted by the J&K Government over a period of four years (1961-64) but came to light only after the Project Report had been finalised. Normally, decisions in regard to the location of projects are taken only after evaluating the results of various investigations conducted on alternative sites. In the case of Salal Project, however, a decision was taken in June 1964 to locate the project at the present site (Dhyangarh) "on the consideration of the topo-graph and layout alone" and detailed investigations only followed this decision. The Committee feel that the project planning in the case of Salal Project left much to be desired right from the very beginning based as it was on inadequate data. Secretary, Department of Power conceded during evidence that "there were elements in the feasibility report which one might say, were a little unrealistic." No wonder, during the course of execution, the Project authorities had to face various "geological surprises" which led to prolonged investigations and experimentation in treatment of foundations with consequent escalation in cost.

1.37. The Committee cannot too strongly emphasise the need for undertaking detailed geological surveys and investigations and collecting/collating all relevant data before such projects are sanctioned. That this is not a solitary instance of this nature is clear from the observations made by the Y. K. Murthy Committee appointed to examine the procedure for investigation and implementing the multi-purpose and hydro-electric projects. In its report submitted in June 1978, the Murthy Committee had observed that a number of projects had taken longer to complete, benefits had come later than expected, the capital costs had been larger



than originally planned and consequently the returns on capital had been smaller than expected. The Murthy Committee had also observed that these difficulties could be traced largely to inadequate investigations, incomplete understanding of the geological problems and defective project planning. The above observations are equally valid in the case of Salal Project as well.

1.38. The Committee trust that the Ministry of Energy would draw suitable lessons from their experience of execution of the Salal Project while planning for such projects in the Himalayan region.

\* *Commissioning of the Project*

1.39. The anticipated dates of commissioning of the three power units of the project and their revisions in 1974 and 1976 were as follows:

	Anticipated date of commissioning		
	First Unit	Second Unit	Third Unit
Project Report of 1968 . . . . .	June 75	June 76	June 79
First Revised Estimates of 1974 . . . . .	March 79	Sept. 79	May 80
Second Revised Estimate of 1976 . . . . .	Feb. 82	June 82	August 82
Progress Report of March 1978 . . . . .	Nov. 84	Jan. 85	March 85
Construction schedule intimated to Audit by the Chief Engineer in December, 1979 . . . . .	1985-86		

1.40. In a note dated 28 July 1979 to the Committee, the Ministry indicated the latest anticipation for completion and commissioning of the Project as follows:

“The diversion tunnel which is the first major complex to be completed will be ready for effective use by October, 1980. The Rockfill dam, Power House, Switchyard and Tailrace tunnel are all scheduled for completion during the season 1985-86 but the concrete dam, which is one of the major complexes in the whole project, is causing some concern. Evolution of an economic solution for the foundation treatment for Blocks 16 to 25 of the dam is under study. The treatment for these blocks has bearing on the construction sequence and programme of the Rockfill dam and other related complexes, i.e. Penstock and Power House.

However satisfactory solutions for these foundation problems are emerging and firm decision in this respect is expected to be available in the next few months which would generally fit in with the commissioning schedule of 1985-86."

1.41. During evidence (October, 1980), the Committee desired to know the latest time schedule for completion of stage I of the Project. The Secretary, Department of Power stated:

"The earlier schedule which is already a couple of years old was 1986. We still feel because of the delay that had taken place during the last working year, partly on account of cement and partly on account of steel, there may be a set-back of, say, six months, which means 1987."

1.42. In reply to another question, the witness stated:

"..... Basically, in principle, I do concede the point that the cost over-run is a very major portion on account of the time over-run. That is totally conceded."

1.43. The Committee note that the Project Report drawn up in 1968 envisaged the commissioning of 3 units of 90 MW each in June 1975, June 1976 and June 1979 respectively. The dates of commissioning were, however, revised from time to time and according to the latest indications the first unit of the Project is now likely to be commissioned not earlier than 1987. This inordinate delay has been largely responsible for the enormous increase in cost estimate of the Project. As any further delay in the completion of the project would cause further escalation in the cost of the project, the Committee would like the Ministry of Energy to take all possible steps to complete the project at the earliest.

#### ) Machinery to Control and Monitor

1.44. The Committee desired to know what machinery existed for maintaining overall control and for monitor the progress of its execution of the Salal Project and how it had been effective in the discharge of its functions. In a note on the subject, the Ministry have furnished the following information:

##### (a) *Central Hydro-electric Projects Control Board*

1.45. The Central Hydro-electric Projects Control Board was set up under a Government resolution dated 14 July 1970 by the erst-

while Ministry of Irrigation and Power with a view to ensuring efficient economic and early implementation of hydro-electric projects taken up by the Government of India, Ministry of Irrigation and Power at Salal in the State of Jammu and Kashmir, Baira Siul in Himachal Pradesh and Loktak in Manipur. The Control Board then consisted of ten members with Secretary, Ministry of Irrigation and Power as its Chairman. By a resolution dated 6 July, 1976 the constitution and functions of the Control Board were slightly modified. The Board now consists of 14 members including the Secretary, Ministry of Energy (Deptt. of Power) as its Chairman. The functions of the Control Board as enumerated in the resolution dated 6 July, 1976 are as follows:

"The Central Hydro-Electric Projects Control Board shall:

- (i) Scrutinise the estimates of the Project, advise necessary modifications and recommend the estimate for administrative approval of the Government of India.
- (ii) Examine and decide all proposals for preparation of designs/and for obtaining expert advice.
- (iii) Examine and approve from time to time, the delegation of such powers, both technical and financial as it may deem necessary for the efficient execution of the Project to the Chief Engineer and other Officers concerned with the execution of the Project.
- (iv) Approve all Sub-Estimates and contracts, the cost of exceeds the powers of sanction of the Chief Engineer.
- (v) Approve all proposals for award of work or supplies on contract which are beyond the powers of the Chief Engineer of the Project.
- (vi) Frame rules as to delegation of Powers and procedure for the purpose of carrying out its business.
- (vii) Decide the programme of construction of different parts of the project keeping in view the funds available, the economics of the Project and the desirability of obtaining quick results.
- (viii) Receive such progress reports as it may prescribe both as to works and expenditure in the prescribed form from the Chief Engineer and other Officers, review the progress of different units of the Project and lay down steps to be taken to expedite the work."

1.46. During the period of eight years of its existence i.e. from July 1970 to March 1978 (when it was replaced by the National Hydro-electric Power Corporation), the Control Board held 11 meetings as under:—

1971	—	2
1972	—	2
1973	—	1
1974	—	3
1975	—	1
1976	—	1
1977	—	Nil
1978	—	1

(b) *Standing Committee*

1.47. In terms of the Government Resolutions dated 14 July 1970 and 6 July, 1976, the Control Board was authorised to constitute a Standing Committee and entrust it with such of its functions and delegate such of its powers as it may deem fit. The Standing Committee was authorised to take decisions on behalf of the Control Board on such technical, financial and other matters as delegated to it by the Board.

1.48. The Standing Committee also held 11 meetings till May 1978 (one in 1973, three in 1974, two each in 1975, 1976, 1977 and one in 1978).

(c) *Committee of Direction*

1.49. Government Resolution dated 14 July, 1970 and 6 July 1976 also envisaged the setting up of a Committee of Direction consisting of the Union Minister of Irrigation and Power/Energy, Union Deputy Minister of Irrigation and Power/Energy, the State Minister of Power J&K/Chief Ministers of Himachal Pradesh/ Manipur and the Chairman Central Hydro-electric Projects Control Board. The Committee was required to meet once every year or at shorter intervals whenever considered necessary. According to the Resolution "The Committee will lay down the policy in regard to the execution of the three hydro-electric Projects in accordance with the estimates as sanctioned from time to time and the sanctioned budget provision. The Committee will issue directions to the Central Hydro-electric Projects Control Board on such matters as it considers necessary or as may be referred to it by the Board."

(d) *National Hydro-electric Power Corporation*

1.50. As stated earlier, the NHPC has been entrusted with the responsibilities of execution of the Salal Project on an agency basis w.e.f. 15 May, 1978.

1.51. In this connection, the following extracts from the minutes of the 11th meeting of the Standing Committee held on 21 March 1978 are relevant:

“Secretary (Power) stated that the Government of India attached much importance to the successful and timely completion of the project and the efforts being made towards that end. He, however, expressed his concern that the Government was feeling greatly handicapped as, in the existing framework, enough flexibility for more expeditious decisions was not possible. The Government had set up National Hydro-electric Power Corporation for the construction, operation and maintenance of central Hydro-electric projects as the company form of Management was considered to be more conducive to quick decision making and effective implementation of the programme. He elicited the cooperation of J&K Government so that the Project could be transferred to NHPC as early as possible. The Chief Secretary assured that every effort was being made to locate the past Irshads, if any, in that regard and that the Ministry of Energy would be informed as early as possible.”

1.52. The Committee enquired during evidence (October, 1980) whether at any time during the period the Control Board was in existence the Ministry of Energy felt the need for reviewing the functioning of the Board. The Secretary, Ministry of Energy stated:—

“No sir, we do not have anything on record.....it has been the age old method of Organisation for handling the power projects of the country through the Control Board in which there was no very precisely defined accountability of certain individuals or any other organisation.”

1.53. On his attention being drawn to the terms of the Government Resolutions setting up the Control Board, the witness replied:—

“.....mentioning certain things does not mean that they always happen. There are certain forms in which things may happen and in certain other forms they might not.”

1.54. Asked if he agreed that the Control Board failed in its objectives, the witness replied:

"It may be so, because in my view the Control Board is not the right form of organisation.....If the meetings are held once or twice a year, obviously it is so."

1.55. Asked as to how many times the Committee of Direction had met since its constitution on July 14, 1970, the Secretary, Ministry of Energy stated:—

"To my knowledge, the Committee consisted of very senior Ministers from States and the Centre, and they could never find a time when all of them could meet."

1.56. In reply to a question as to which authority should be held responsible for the tardy progress of the Project, the witness stated:

".....may be there is a tardy progress. It is a matter of record that over the years Government came to the conclusion that the organisation to handle this Project should be changed. Obviously, it was based on a study that the earlier formation was not the right one."

1.57. The Committee desired to know whether there was any necessity for organisational or structural change in the set up for better and efficient execution of the project. The witness replied:

"With regard to the execution we have taken that step. That is why the N.H.P.C. is there for execution portion. The total responsibility is theirs on behalf of Government of India. As the owner of the project, it is their job to award the contract in time, it is their job to get the things done in time."

1.58. The Committee desired to know why the Salal Project was handed over to NHPC as late as in 1978 even though the Corporation was in existence since 1974. The Secretary, Department of Power stated during evidence (October, 80):—

"When the Corporation came it was in principle decided by the Government of India in 1974. They registered the Corporation towards the end of 1975. The first Chairman was appointed in April 1976 and he started forming the organisation. So, it is from that time the thinking started that this project should be handed. There were

certain statutory difficulties because in case of Salal Project there were certain decisions to be taken by State Government for which State Government inturn had to go to the Legislative Assembly of their own to pass a new resolution for handing over this authority to a company form of management rather than Central Government."

".....According to Article 370 of J&K Constitution except the President of India and the resident of J&K nobody can possess physical property in that State. So, only the President in his own name can have the property and have ownership of the project. To hand it over to a company, a special law had to be framed by the J&K Government in amendment to Article 370. This was in 1978."

1.59. Asked what their experience was over the last two years since the project was taken over by NHPC, the witness, replied:

"It is much better."

1.60. In a further note on the subject, the Ministry have informed the Committee that progress on Salal Project has been under continuous and close review since it was handed over to NHPC. A systematic monitoring of implementation of Projects under NHPC and critical appraisal of performance has been set up both at the Project level and at the Corporate office.

1.61. The Committee note that a Central Hydro-Electric Projects Control Board was set up in July 1970 with a view to ensure efficient, economic and early implementation of hydro-electric projects taken up by the Central Government at Salal, Baira Siul and Loktak in the States of J&K, Himachal Pradesh and Manipur respectively. The Control Board constituted a Standing Committee and authorised it to take decisions on behalf of the Board on such technical, financial and other matters as were delegated to it from time to time. A high powered "Committee of Direction" was also constituted to give directions on policy matters and to oversee the execution of the project in accordance with the sanctioned estimates.

1.62. The Committee deeply regret to note that during the period of 8 years of its existence, the Control Board met only once during each of the years 1973, 1975, 1976 and 1978, twice during 1971 and 1972 and thrice during 1974. The Committee find that it did not

meet at all in 1977. Thus, the total number of meetings of the Control Board which was put in charge of supervising this project, was 11 during a period of 8 years. The Standing Committee which was supposed to take decisions from time to time, also met only 11 times in 8 years. The Committee are deeply distressed to note that the Committee of Direction which was a high powered body entrusted with the task of overseeing the execution of the project within the sanctioned estimates, did not meet at all. No wonder, this elaborate machinery devised to control and monitor the execution of the project failed to deliver the goods and the project is now faced with problems of heavy over-runs both of cost and time.

The Committee consider it to be a serious lapse on the part of the Ministry that no meeting of the high powered Committee of Direction of which the Minister of Irrigation and Power/Energy was the Chairman, was convened during the period of as many as 8 years. The Committee expect that such lapses will not recur.

1.63. The Committee find that it was only in May 1978 that the project was handed over to NHPC for execution for the reason that "Government was feeling greatly handicapped as in the existing frame-work, enough flexibility for more expeditious decisions was not possible. The company form of management was considered to be more conducive to quick decision making and effective implementation of the programme".

1.64. The Committee cannot but express their deep distress over the failure of the Government to provide the basic organisational framework necessary for the speedy execution of the Salal Project. No review of the functioning of the Control Board was undertaken at the highest level and the project languished for want of direction and coordination among the various agencies involved in its execution.

1.65. Now that the NHPC have been entrusted with the task of execution of the Salal Project, the Committee trust that no further slippages in the completion of the Project will be allowed to occur.

#### *DIVERSION TUNNEL*

##### *Award of Contract*

1.66. According to the Audit Paragraph, the work on Diversion Tunnel and Cofferdam was awarded to firm 'N' (M/s. NPCC) in March 1972 without settling before hand the additional conditions stipulated by the firm regarding price escalation in the cost of



labour and material and extra payment for dewatering. The Ministry have in a written reply to the Committee explained the reasons therefor as follows:

“On the consideration that valuable time would be lost in the process of obtaining fresh bids and that the tenderer was a public sector undertaking, the Tender Committee decided to negotiate with M/s. NPCC to bring down their rates. Negotiations accordingly were carried out with them on the 10th, 15th, 17th and 18th January, 1972, in the course of which they were persuaded to bring down their rates in respect of some of the items. Some other terms and conditions stipulated by M/s. NPCC were also negotiated with them and the final position as emerged from the negotiations was considered and the alternatives open then were to reject the tender as negotiated or to accept the same and award the work to M/s. NPCC. Under the circumstances, it was decided to follow the latter alternative and award the work to M/s. NPCC but on the consideration that they modify some of their special conditions. Based on the recommendations of the Tender Committee as contained in the Minutes of the Meetings held on 15th, 17th, 18th, 24th and 25th January, 1972, the contract of construction of Diversion Tunnel in favour of M/s. NPCC was sanctioned by the Government in March, 1972. Before the issue of letter of award, M/s. NPCC addressed a communication to Shri J. P. Naegamwalla, Member of the Tender Committee, on 25th January, 1972 giving their independent version of the results of negotiations held by the Tender Committee with M/s. NPCC on 17th and 18th January, 1972. Subsequently, a letter was also addressed by M/s. NPCC to the Chairman, Tender Committee on the 31st January, 1972 on the same subject. M/s. NPCC further addressed a letter to the Chief Engineer, Salal Project on 27th February 1972 reiterating their stand on their version of the negotiations. The Government did not, however, take cognizance of the various representations made by M/s. NPCC while sanctioning the letter of Award of work on 10th March, 1972. Subsequent to the issue of letter of award, M/s. NPCC again brought the subject of their disagreement to the notice of the Chief Engineer on the 12th April, 1972. These disagreements/controversies, however, remained unresolved despite exchange of

a number of letters between M/s. NPCC and the department till this matter, alongwith the case of award of additional works of Adit, Dome and Shaft to NPCC in continuation of their original contract, was also brought up before the Tender Committee, in its 62nd meeting held on 20th October, 1974. These objections of M/s. NPCC which were not entertained by the Government hitherto had to be considered at this stage while negotiating for increase in the scope of the original work within the overall framework of the original contract."

1.67. The additional conditions preferred by the contracting firm were finally discussed by the Tender Committee in October 1974 and, based on its recommendations, sanction was issued in February 1975 accepting the additional conditions including that relating to extra payment for dewatering. The extra payment for dewatering was limited to Rs. 7 lakhs for the whole work including Coffor Dam. Asked to indicate the basis for limiting the extra payment for dewatering to Rs. 7 lakhs, the Ministry have stated:

"In the 63rd meeting of Tender Committee held on 9th December, 1974, the Project authorities stated that at the time of settlement of award of work originally, the work of dewatering was not anticipated to be very significant and as such, the plea of NPCC on this account was not entertained."

However, subsequently, while negotiating with NPCC for the increased scope of work involving construction of additional works of Adit, Dome and Shaft within the scope of original contract increasing thereby the cost of the work from Rs. 170.23 lakhs to Rs. 220.95 lakhs, extra payment for dewatering merited consideration. The NPCC, at that point, raised a claim for extra payment on account of dewatering at the schedule rates limited to Rs. 8.00 lakhs for the entire work. During negotiation, as a matter of overall bargaining for getting the additional works included in the scope of the original contract, the Tender Committee accepted the extra payment on account of dewatering subject to ceiling of Rs. 7 lakhs."

1.68. Subsequently, in the revised sanction for the contract issued in July 1978, the lump sum for dewatering was increased to

Rs. 18 lakhs. Asked to indicate the reasons therefor, the Ministry have stated:

"The item of dewatering was one of the items of the "schedule of prices" of the original contract.....A lump sum of Rs. 7 lakhs on dewatering was fixed with reference to the estimated value of work of Rs. 170.23 lakhs. With the revision in the value of work to Rs. 356.14 lakhs, which is almost double of the originally estimated value, the Tender Committee (75th meeting), in December, 1976 decided that the ceiling of Rs. 7 lakhs on account of dewatering be increased to Rs. 14 lakhs. This was approved by the Standing Committee in its 9th meeting held on 1-2-1977.

The "schedule rates" refer to the rates provided in the schedule annexed to the original letter of award for the work.

Notwithstanding the above provisions of the agreement the matter was placed before the Tender Committee in its 75th meeting held in December, 1976. A final decision in this respect was taken in the 80th meeting of the Tender Committee held in June 1977 when it was finally recommended that payment of escalation on dewatering shall be made subject to the condition that overall payment on account of dewatering, including escalation thereon, should not exceed Rs. 18.00 lakhs. Pursuant to the recommendations of the Tender Committee sanction was accorded by NHPC on 22nd July, 1978."

1.69. In regard to another point also made in the Audit Paragraph that while awarding work in March 1972 the schedule of quantities in relation to Coffor Dam was not worked out, the Ministry have stated:

"The item rates for the construction of the Coffor Dam for the Diversion Tunnel were negotiated with the National Projects Construction Corporation (NPCC) and formed a part of the letter of award.....The N.I.T. (Notice Inviting Tender) for the work while envisaging an earthen Coffor Dam further stipulated that:

'The contractor shall submit details of Coffor Dam proposed to be constructed by him to be approved by the Engineer incharge.'

In response to the tender, M/s. NPCC quoted for a masonry Coffor Dam without giving any design and/or quantities

therefor. Accordingly the contract provided that the design of the Cofferdam would be furnished by the project and the same would be got executed through the NPCC at rates specified in the contract. Since the unit rates for this work were already negotiated with M/s. NPCC and provided in the contract and the quantities would be as per design to be given by the Project authorities, there was no scope of uncertainty contractually in this respect.

This explains the non-inclusion of quantities for the construction of Cofferdam in the schedule of quantities annexed with the letter of award."

1.70. It is established that when the contract for Diversion Tunnel was awarded to M/s. NPCC in March 1972, the additional conditions stipulated by the firm demanding price escalation in the cost of labour and material and extra payment for dewatering were not settled beforehand and the firm was allowed to proceed with the work "on the consideration that they modify some of their special conditions." The reason indicated by the Ministry to the Committee for taking this course of action was the consideration that "valuable time would be lost in the process of fresh bids and tenderer was a public undertaking." The additional conditions preferred by the firm had considerable financial implications for the project. Moreover, without assessing the financial implications of these additional conditions, it could not have been possible for the project authorities to make any worthwhile comparison with the rates quoted by other contractors. The Committee, therefore, consider that notwithstanding the contracting firm being a public undertaking, the Project authorities should have done the exercise of computing the value of the additional conditions in terms of money while deciding to award the contract to the firm and at the time of awarding the contract to the firm these conditions should have been duly incorporated in the contract so as to avoid any ambiguity and scope for controversy on this score.

### *Delay in Completion*

1.71. The work of diversion tunnel was awarded to M/s. N.P.C.C. in March, 1972 and was to have been completed in 18 months i.e. by August, 1973. The diversion tunnel was completed and thrown open for river diversion only in March, 1980. According to Audit Paragraph, the delay in completion of work was *inter-alia* due to (i) the delay in finalisation of drawings and designs, (ii) delay in placing of

orders for supply of gates and liners for the diversion tunnel, and (iii) lack of deployment of efforts on the part of the contractor (M/s. NPCC).

1.72. As for the delay in the finalisation of drawings and designs pointed out in the Audit Paragraph, Government have explained that the decision to shift the gate chamber from the inlet to the middle of the tunnel was taken by the Technical Advisory Committee in March, 1973 but the final decision regarding the steel liners and other details was taken by the T.A.C. in January 1974. The design drawings incorporating the tunnel design were, by and large available from May 1973 to November, 1974. The drawing pertaining to the modification of the reinforcement in the gate chamber was issued in December 1975.

1.73. Explaining the delay in the placing of orders for supply of gates and liners, the Ministry have stated that tenders for the embodied parts of the gates were invited in January 1974. Acceptance of the tender was recommended by the T.A.C. in August, 1974 and these were approved by the Government in September, 1974. The tenderer approved for award of work however backed out of its offer on 10 September, 1974. Tenders for hoists and gates invited earlier in July 1974 were approved by the TAC in March 1975 and by Government in April 1975.

1.74. In regard to the delay on account of lack of effort on the part of the contractor, the Ministry have stated as follows:

“Extension in the time period of completion of Diversion Tunnel in favour of M/s. NPCC was granted for a total period of 5 years but out of which, only 7 months were reported to be attributable directly to the lack of deployment of efforts by NPCC. In keeping with these considerations while granting the extension upto September, 1978, it was stipulated that no escalation will be paid to NPCC beyond September, 1976 and further more the rights of Government to claim compensation for delay was reserved.”

1.75. During evidence (October, 1980), the Committee desired to know the reasons for the delay of over 6½ years in completion of the diversion tunnel. The General Manager, Salal Hydro-electric Project stated:

“The long period of construction is, because of change of the location of the gate chamber from the entry face to the centre of the tunnel. The decision to shift the gate Chamber

to the Centre of the tunnel from inlet and was taken 8 months after the excavation of the tunnel for a length of 24 metres from the inlet and had been completed. At this point of time (due to encountering of an un-anticipated adverse geological feature) the location of the gate chamber had to be re-examined."

He further added:

"After the decision to shift the gate chamber from the entry portal to the Centre of the tunnel was taken, it took nearly 7 years to complete the tunnel and this delay was due to the additional works, necessitated as a result of the decision to shift the gate chamber from entry portal to the centre of the tunnel."

#### *Cost escalation*

1.76. In March, 1972, the contract for the work of Diversion Tunnel including Coffor Dam was awarded to firm 'N' (M/s. NPCC) at a cost of Rs. 170.23 lakhs. The value of contract was increased first in March, 1975 to Rs. 220.95 lakhs and then in July, 1978 to Rs. 365.14 lakhs. The increase is attributed to increase in quantities and extra items. The cost of the Diversion Tunnel as per revised estimate of 1976 is Rs. 595.48 lakhs.

1.77. Explaining the reasons for escalation in cost of diversion tunnel, the Chairman-cum-Managing Director, NHPC stated in evidence (October, 1980):—

"As a result of geological features, there was a change in the scope of the work...it was to an extent of almost 6 times and naturally the Contractor had to do six times the original work. It involved time and cost."

1.78. Elaborating the point further, General Manager, Salal Hydro-Electric Project, stated:—

"The work of the diversion tunnel was initially allotted to NPCC at a cost of Rs. 170.23 lakhs. When the scope of the work was changed the contract was revised and the increased cost of additional works was assessed at Rs. 50.72 lakhs, thus bringing the total revised value of the contract to Rs. 220.95 lakhs....."

1.79. He further added:

"The expenditure against NPCC works is Rs. 380 lakhs upto September, 1980. The difference between Rs. 220 lakhs and Rs. 380 lakhs is accounted for by payment for dewatering and price escalation which had to be paid extra as provided in the contract....."

1.80. In a further note\* on the subject, the Ministry have stated as under:

"The cost of the Diversion Tunnel was estimated at Rs. 47.14 lakhs in the original sanctioned estimate of 1968. Revised estimated cost of this work is Rs. 629.10 lakhs. This cost besides the contract of N.P.C.C. includes the cost of gates, liners and other ancillary works executed through different agencies. The total excess of Rs. 581.96 lakhs is mainly attributable to the following:

	(Rs. in lakhs)
(i) Increase due to change in the location of the gate structure on geo-technical considerations necessitating additional works resulting in more than six-fold increase in quantities . . . . .	434.61
(ii) Increase due to escalation . . . . .	115.03
(iii) Increase due to payment of dewatering charges to M/s NPCC as per terms of contract . . . . .	14.00
(iv) Workcharged establishment and other contingencies . . . . .	18.32
<b>TOTAL</b>	<b>581.96*</b>

1.81. As against the revised estimated cost of Rs. 629.10 lakhs the upto-date expenditure ending October, 1980 is Rs. 543.72 lacs as detailed below:

*Expenditure incurred on the diversion in Tunnel upto 31st October, 1980*

1. M/s. National Projects Const. Corpn.	4,00,29,515.00
2. M/s. Triveni Structural Limited . . . . .	49,42,615.00
3. M/s. Om Metals & Minerals Pvt. Ltd.	12,40,908.00
4. M/s. Major Gaiind	4,60,087.00
5. M/s. Zordar Industries . . . . .	33,123.00
6. M/s. National Engineering Works . . . . .	7,814.00

\*Not V etted.

7. M/s . Ujjagar Singh	11,295.00
8. M/s. Madan Lal	1,20,544.00
9. M/s. Surendra Gandhotra	14,808.00
10. M/s. Thomas Mathew	5,299.00
11. M/s. T.K. Mathew	2,271.00
12. M/s. Nangal Workshop	2,56,737.00
13. Cost of material due to excess over contract issue rates directly debited to works and other charges	72,47,480.00
TOTAL	5,43,72,496.00

1.82. The contract for diversion tunnel was awarded to M/s. National Projects Construction Corporation in March, 1972 for Rs. 170.23 lakhs. Subsequently, due to increase in the scope of work involving construction of audit, dome and shaft, the value of the contract was increased to Rs. 220.95 lakhs. In fact, the expenditure on these works completed by National Projects Construction Corporation amounted to Rs. 400 lakhs upto October, 1980. The total expenditure on the diversion tunnel is now estimated to be as high as Rs. 692.10 lakhs as against only Rs. 47.14 lakhs provided for in the original estimate and Rs. 595.46 lakhs in the revised estimate of 1976.

1.83. The Committee regret to observe that before giving the go-ahead to the contractor on the basis of the original design of installing the gate structure at the entry portal of the diversion tunnel, the Technical Advisory Committee (TAC) did not fully consider the implications of "slumped rock mass" indicated by the Geological Survey of India. The TAC, instead decided that with a modified design it could be possible to instal the gate structure at the entry portal which ultimately proved to be a total miscalculation. Apart from rendering infructuous the expenditure of Rs. 8.45 lakhs already incurred before shifting the gate structure to the middle of the tunnel, it resulted in a delay of over 6½ years in completion of the diversion tunnel thus throwing the entire project schedule out of gear, not to mention the huge escalation in costs all round.

1.84. The Committee trust that the unfortunate experience in this case would impel the planners to take geological investigations more seriously in future so that projects of this nature are not beset with difficulties in crucial areas the way Salal Project has been.



## CONCRETE DAM

### *Award of work without finalising designs*

1.85. It is seen from the Audit Paragraph that the tenders for the Concrete Dam were first invited in December, 1973. These were invited for the second time in June, 1975 and the work was finally awarded in July, 1976. In reply to a question from the Committee, the Ministry stated (28 July, 1979) that "an economical solution for treatment of the foundational problems from block 16 to 25 (of the Concrete dam) is still under study and solution is nearing finalisation." Since further investigations regarding the treatment of shear zones and foundation of the dam were still being conducted and foundation treatment for Blocks 16 to 25 of the dam was under study, the Committee enquired how tenders could be invited in December, 1973 without any firm design and drawings and how the work was awarded in July, 1976. In a note, the Ministry have stated:

"Tenders for the construction of Concrete dam were invited in December, 1973 on the basis of drawings, schedule of quantities and specifications incorporated in the "Book of Specifications, Schedules and drawings" for the Salal Project issued by Central Water & Power Commission in November, 1971, together with such modifications in drawings which were effected between 1961 to 1973 as a result of various TAC decisions.....The drawings and specifications incorporated in the said document were based on geological investigations conducted by the Geological Survey of India which are also included therein. The tender documents alongwith drawings and specifications included therein were further vetted by the CW&PC before issue to the intending bidders. Tenders were, therefore, invited on approved design drawings as were adequate for the purpose. Subsequently, i.e., after the Contract was awarded in 1976 and the contractor started the work, design changes took place because of the subsequent geo-technical assessment of certain adverse features in the dam foundation which could be picked up only after these were progressively mapped and assessed when the excavations were carried out and tests on the materials of these adverse seems completed... Such changes could be a general phenomena obtaining in all Himalayan Projects because of the young and

heterogenous geological formation. No amount of pre-construction investigations by drilling and drifting, which are only by way of sampling of the sub-soil, will precisely indicate the magnitude, disposition and physical nature of all the geological infirmities of the foundation. It is only after these features are exposed and their geo-technical assessment made that the construction drawings for the various components of the Project can be prepared. In sound rocky formation there are minor variations between the specification drawings and construction drawings but in adverse heterogenous geological formation the variation can be of a major degree."

1.86. In a further note submitted to the Committee in September, 1980, the Ministry have stated that the dam, comprising Spillway, Power dam and non-overflow blocks, is situated on a narrow ridge dividing the northern and southern limb of the Dhyangarh loop. Due to its unique location on a narrow saddle (of which there is no parallel) and the un-anticipated geological problems associated with any Hydel Project located in the young Himalayas, the structure has posed extra-ordinary design problems. Conventional grouting techniques used for the treatment of foundation had to be modified and new techniques evolved after repeated trials and tests to improve grouting efficacy on the dam foundation. The complicated foundation problem necessitated elaborate geophysical, geo-technical, photo-elastic studies and tests and repeated reviews of the designs and changes in specifications to evolve satisfactory designs solution. These elaborate scientific studies and repeated reviews have helped not only to evolve safe and sound design with indigenous know-how but also generated the necessary confidence for tackling such similar problems which may be encountered while constructing other Hydel Projects in the upper reaches of the young Himalayas.

1.87. In the above background the designs of the structure have necessarily undergone number of changes from time to time so as to ensure its safety. As of now the designs of blocks 1 to 15 have been finalised and the construction work is in progress. As regards the remaining Blocks 16 to 25 of the Concrete dam, proposals evolved after a number of tests and alternative studies are under examination by the Central Water Commission and are likely to be finalised shortly in consultation with the Technical Advisory Committee. In the meantime work on foundation excavation of these blocks in accordance with latest design proposals is in progress.

### *Increase in Quantity of work*

1.88. As a result of design changes quantities of a number of items of this structure namely, excavation, drilling & grouting and concreting have increased substantially from time to time. The present position is as under:

Item	Original estimated qty.	Revised qty. as per designs of 1976	Revised quantity as per latest design	Work completed ending August, 1980
Excavation	1539 TM <sup>3</sup>	1783 TM <sup>3</sup>	2243.052 TM <sup>3</sup>	1763.132 TM <sup>3</sup>
Concreting	1112 TM <sup>3</sup>	1014 TM <sup>3</sup>	1511.265 TM <sup>3</sup>	164.039 TM <sup>3</sup>
Drilling & grouting	81.3 TRM	200.6 TRM	401.202 TRM	126.579 TRM

### *Revised Cost Estimate*

1.89. The Committee have been informed that as a result of various design changes and in view of escalation in cost of labour and material, the cost of Concrete dam which was originally estimated at Rs. 1693.14 lakhs (1968) has been revised to Rs. 359.36 lakhs (1976). The increase in the cost is mainly attributable to:—

- (i) Increase in the spillway capacity from 6 lakhs cusecs to 8 lakhs cusecs and consequent increase in the length of spillway and number of crest gates.
- (ii) Change in designs and considerable increase in the volume and scope of work for treatment of un-anticipated geological features.
- (iii) Additional provision of abutment drainage and grouting etc.
- (iv) Escalation in the labour and material cost.

1.90. Asked to state the latest position regarding the estimated cost of Concrete Dam with reference to the present estimate of the total project cost which had increased to Rs. 350 crores, the Ministry have stated that the approximate provision for concrete dam is now Rs. 77.5 crores. The component of this cost as payable to Hindustan Construction Company on completion of the work is Rs. 35.37 crores excluding payment on account of escalation which is to be paid extra in accordance with a pre-determined formula provided for in the contract based on the increase in the various cost indices and the statutory increase in wages.

1.91. During evidence (October, 1980), the Committee desired to know for how long the problems posed by the Concrete Dam had been under investigation and whether they were anywhere near solution. The Chairman-cum-Managing Director, Salal Project, stated:

"Discussion has been going on ever since the problem was noticed and the problem surfaced. It is of such a great magnitude involving the stability of the dam; it is really the very basic question. It has been under discussion for a few years. As you perhaps know, various alternatives, various tests and analyses were proposed and that has taken sometime. After all, what we should really appreciate is the magnitude of the problem in this particular context. While saying this, I am not trying to brush this aside and justify anything that has happened. But the predominant factor is this technical problem where the stability of the dam has been involved and given these conditions, our experts have really battled hard and treated carefully. After many alternatives they have ultimately arrived at a final decision and we will have to work on this final solution.

We are in the happy position to say that excavation drawings have been issued formally. It means that a solution has been arrived at for the power dam which was holding up the work."

1.92. The Committee observe that the Concrete Dam comprising spillway, power dam and non-overflow blocks, posed "extra-ordinary design problems" due to its unique location on a narrow saddle and the "un-anticipated geological problems." It took several years for the concerned agencies to find out suitable solutions to these problems and in fact it was only in October, 1980 that the final excavation drawings for blocks 16 to 25 of the dam were released by the Central Water Commission.

1.93. The Committee find that as a result of design changes, quantities of a number of components of the concrete dam structure viz., excavation, drilling, grouting and concreting have increased substantially thereby pushing up the cost of the dam from nearly Rs. 17 crores (as per 1968 estimates), to Rs. 77.5 crores (November 1980 estimates) i.e. by nearly 356 per cent.

1.94. The Committee are not persuaded by the contention of the Ministry that "no amount of pre-construction investigations will

precisely indicate the magnitude, disposition and physical nature of all the geological infirmities of the foundation". As the heterogeneous formation of the Himalayas is well known, the Committee cannot resist the impression that adequate efforts were not made initially to pool the experiences of execution of other projects in the Himalayas, to sift the available data and to harness the latest techniques of pre-construction investigations. Had enough attention been paid to these aspects, the parameters of the problem could have been more easily delineated, solutions would not have taken so long to come by and considerable amount of time and money could probably have been saved.

1.95. The Committee do believe that the benefits of the studies made, the experience gathered and the processes employed in treating the foundations of the concrete dam would be fully made use of while taking up similar projects elsewhere.

#### *Utilisation of excavated material*

1.96. There has been an increase in the estimated cost of the concrete dam from Rs. 16.93 crores in the original estimate (1968) to Rs. 39.15 crores in the second revised estimate of 1976. The increase in cost is attributed *inter alia* to the elimination of savings anticipated on account of re-use of the material excavated from the concrete dam site in the rockfill dam—the extent of savings on this account were shown in the original estimate (1968) as Rs. 2.96 crores and in the first revised estimate (1974) as Rs. 4.24 crores, due to inflation and design changes.

1.97. Asked if direct utilisation of excavated material from the Concrete dam site in the rockfill dam was not possible, why did the sanctioned estimate (1968) provide for it and why was the saving on this account increased in 1974, the Ministry have stated:

"The original project estimate (1968) provided for re-use of 80—90 per cent of rock excavated material in the construction of Rockfill dam, partly by direct utilisation and partly by stock piling. Such a plan would require concurrent execution of Rockfill dam along with other works and in addition availability of adequate space immune from damage by floods for stock-piling the excavated material for subsequent re-use. Neither of these conditions held true for Salal Project except for availability of a small space in Dhyangarh area where not more than 5 lakhs cu. metre could be stock-piled. The concept of availing a credit of Rs. 296 lakhs from use of excavated

material in 1968 estimate was, therefore, not realistic. In 1974 this mistake was repeated at the planning stages i.e. before the revised estimate of 1976, but the mistake was spotted in time and corrected in the revised estimate of 1976.

.... the increase in the credit on account of re-use of the excavated material as reflected in the unsanctioned estimate *vis-a-vis* the provision of sanctioned estimate of 1968, is mainly due to the revision in the unit price of its utilisation from Rs. 14.12 to Rs. 19.77 per cu.m. and marginally due to increase in the quantity."

1.98. According to Audit Paragraph, against 21.2 lakh cu.m of re-usable material anticipated to be recovered, the quantity stockpiled was 5.12 lakh cu.m. only. Want of adequate storage space, failure of the scheme to stock-pile it in crates along the bank and washing away of the material in the floods of August, 1973, are cited as the reasons for the same. Asked what were the measures taken for proper storage of the material the Ministry have stated:

"It was originally anticipated (1968) that the excavated material would be dumped in the river channel along the banks for utilisation subsequently. This anticipation did not, however, come true as the material so dumped could not withstand floods. Attempt was, therefore, made to retain the dumped material in a small portion along the bank of the river on an experimental basis, by crate protection at its toe. This experiment did not, however, succeed (1973) and accordingly the original concept of stockpiling the material along the banks for re-use was abandoned. Out of the entire excavated material only a part (to the extent of the space area available) was stockpiled for subsequent utilisation at the only available limited area near Dhyangarh. It is pertinent to point out that no other place immune from floods is available at the dam site or within 10 kms. of the same, to permit stockpiling of the entire excavated material re-use subsequently.

Considering the value of material intended to be stockpiled for reutilisation, crate protection at the toe of the stockpile was considered to be an economically reasonable proposal that could be adopted. This having not served the purpose, the material was stockpiled alternatively (to the extent of space available) at the only available place at Dhyangarh."

1.99. Asked what was the quantity stockpiled and washed away in 1973 and whether any damage report was sent to the Government for sanction, the Ministry have stated:

"The excavation of concrete dam comprised two distinct contracts, namely excavation of Spillway and excavation of Power Dam. The excavation involved in the former was about 8.0 lakh cu.m. and in the latter about 5.0 lakh cu.m. The contract for excavation of spillway was allotted in January 1972 on the premise that out of the total excavated material, about 6.71 lakh cu.m. had to be dumped at the inlet and ridge for creating enabling works like approach road and working platforms. In the absence of this facility it was not possible to do any work in the tunnel or on the Spillway excavation. But for the availability of this excavated material, these enabling works would have to be constructed with material borrowed from other places at a high cost. With the utilisation of this excavated material for these enabling works, no extra cost was incurred thereon. The balance of 1.2 lakh cu.m. of Spillway excavation was proposed to be stockpiled at Dhyangarh originally.

The enabling works constructed by using Spillway excavated material were subject to getting periodically damaged by the floods in the river and were being maintained in a serviceable condition by replenishment from Spillway excavation. The spillway excavated material (to the extent of 6.7 lakh cu.m.) as originally intended, was therefore, by and large, utilised, for construction and subsequent maintenance of these enabling works which were essential for the construction activity. The excavated material was, therefore, gainfully utilised (even though not for the purpose originally intended in the project estimate of 1968) for construction of enabling works in accordance with the detailed estimate of works sanctioned subsequently but before the start of work. The material, therefore, served its internal purposefully before the same got washed away.....

Out of the total estimated quantity of 21.2 lakh cu.m. (1968), 5.12 lakh cu.m. have been safely stockpiled for re-use, about 6.70 lakh cu.m. have been used on the construction and maintenance of enabling works during construction (e.g. approach roads working platforms, temporary Cofferdams etc.) and the balance which could neither be stockpiled

(for want of space) nor used directly was treated as a spoil. This factual concept was accordingly incorporated in the revised estimate of 1976.

In the above background the question of reporting any loss to Government did not arise."

1.100. Audit Paragraph states that out of 5.12 lakh cu.m. of material that was stockpiled for re-use, 2 lakh cu.m. were to be used in the main concrete dam as per contract with firm 'H' (M/s Hindustan Construction Co. Ltd) and the remaining 3.12 lakh cu.m. were meant for re-use in the rockfill dam. The Committee are informed that firm 'H' has already consumed 1.13 lakh cu.m. of material and the rest will also be utilised progressively.

1.101. As regards the material meant for re-use in the rockfill dam, the Audit paragraph states that the second revised estimate of rockfill dam did not provide for any credit for the use of this material nor has any material been taken over by the Construction Facilities Division for the rockfill dam. Asked to explain the position, the Ministry have stated:

"The material has been taken over in the books of the Rockfill Division. A processing plant is being assembled for processing this material for use as filter on the Rockfill dam.

In respect of non-provision for re-use of this material in the Rockfill dam estimate, it is stated that the revised estimate (1976) stipulates, as under, in this respect:

'Stockpile for re-use of excavated material for Rockfill Dam has been advertised as a quarry for concrete dam. As such the credit on this account has already got reflected in the Concrete Dam rate.'

As the entire stockpiled material was advertised as a quarry for concrete dam, no credit was given in the revised estimate for the rockful, on account of re-use of this stockpiled material. However, subsequently the actual requirement of concrete for the pre-diversion work was assessed at about 2 lakh cu.m. and accordingly, he was permitted to use 2 lakh cu.m. only out of the stockpiled material and the balance of 3.12 lakh cu.m. therefore, became available for use as filter material in the Rockfill dam. Necessary credit will accordingly be given to the concrete dam estimate in this respect."



1.102. Asked whether the comparative economics of the use of stockpiled material *vis-a-vis* material from the quarry has been worked out, the Ministry have stated:

“An assessment made in February, 1975, indicated a saving of Rs. 83.83 lakhs on account of reutilisation of a stockpiled quantity of 3.91 lakh cu. m.

This assessment does not, however, include the expenditure on “double-handling of material involved in stockpiling operation. However, achieving this economy is conditional to the availability of a safe and suitable stockpiling area near the dam site which is not available at Salal.”

1.103. During evidence (August 1979), the representative of the N. H. P. C. was asked as to why it was not possible to construct the Concrete and Rockfill dams simultaneously as originally envisaged, so that the excavated material could be directly utilised. He explained the reasons as follows:

“The rockfill dam can only be done when the diversion tunnel is completed and I am able to put a very quick dyke or a small coffer dam, diverting the water of the Chenab through the diversion tunnel. Till that stage comes about, the question of using the spoil from the sledge does not arise. It can only be stored. . . . . The spoil can not go on to the rockfill dam directly unless the diversion tunnel gets completed. The latter has been delayed, and is getting completed next year.”

1.104. The 1968 and the 1974 estimates of the Salal Project provided for savings of Rs. 2.96 crores and Rs. 4.24 crores respectively on account of anticipated re-use of the material excavated from the concrete dam site in the rockfill dam. This envisaged either simultaneous construction of the concrete and rockfill dams to enable direct use of the material or in the alternative, safe stockpiling of the excavated material for future use in the rockfill dam. The experience during construction has shown that it was not found possible either to synchronise the construction of concrete and rockfill dams or to safely stockpile or store all the material excavated from the concrete dam site as envisaged in the project estimates.

1.105. Out of a total of 21.2 lakh cum. of re-usable material anticipated to be recovered, only 6.70 lakh cum. are stated to have been used for creating enabling works (for the excavation work) such as approach road and working platform. 5.12 lakh cum. of material is

stated to have been stock-piled out of which 2 lakh cu.m. is proposed to be used in the main concrete dam and 3.12 lakh cu.m. is meant for reuse in the rockfill dam. Thus, only 11.8 lakh cu.m. of the excavated material out of anticipated total excavated material of 21.2 lakh cu.m. has either been utilised or will be utilised. The remaining 9.4 lakh cu.m. is reported to have been "washed away in floods" and is being treated "as a spoil".

1.106. The Committee also note that even for the 5.12 lakh cu.m. of excavated material which was stockpiled for reuse, no credit was shown in the estimate either for concrete dam or for the rockfill dam where it was intended to be used. The lapse is sought to be explained away by maintaining that the entire stock piled material was advertised as a quarry for concrete dam. The Committee consider that this was not a regular procedure to adopt.

#### *Consolidation Grouting*

1.107. The work of 'consolidation grouting of formation rock below spillway' was awarded to M/s NPCC in December 1974. The work was started on the basis of the parameters adopted after conducting trial grouting through another firm—M/s Cementation Co. at a cost of Rs. 1.43 lakhs. As the results of the grouting done by M/s. NPCC were not very effective, the parameters were revised. Even the revised parameters were not found satisfactory and in April 1976, the Technical Advisory Committee suggested further trial grouting with different parameters.

1.108. Asked why the parameters evolved on the basis of trial grouting were not adequate, the Ministry have stated:

".....the parameters laid down by Central water Commission for grouting were subject to a trial through M/s Cementation Co., one of the expert firms in the line. After completion of these trials, the contract for grouting was allotted to M/s National Projects Construction Corporation. While the work was in progress the results of grouting conducted by M/s NPCC were analysed and it was found that the same, though effective in some locations, were not generally effective in treating the entire foundation satisfactorily. A note on the evaluation of the results and comments thereupon were forwarded by the project authorities to Central Water Commission in July, 1975. Considering the ineffectiveness of grouting, by adopting the grouting parameters evolved as a result of first trial grouting, the subject came up for review in the meeting in Central Water Commission on 19-9-1975.

Besides the Central Water Commission Officer, technical experts of the leading grouting firms in India (M/s Rodio Hazarat and M/s Cementation) participated in the discussion. Pursuant to the discussions, detailed revised parameters and specifications for consolidation grouting were laid down by the Central Water Commission. Thereafter, National Projects Construction Corporation continued further grouting (on the revised parameters decided by Central Water Commission) as a part of their contract. In the meeting it was also decided that the results of the grouting based on the decision arrived at, would be again reviewed by the Central Water Commission. Further review of the results indicated that even with the revised parameters, the efficacy of the grouting was not satisfactory. This was due to the complicated geology of the foundations with special reference to the presence of thin joints in the rock mass, which though otherwise previous were not easily amenable to grouting by cement. The Central Water Commission, therefore, placed the problem before the Salal Technical Advisory Committee in 11th meeting hold in April, 1976. In view of the complicated nature of the problem and ineffectiveness of the normally accepted standard grouting parameters, the Technical Advisory Committee suggested further trial grouting, adopting different techniques and parameters. The trials suggested by the Technical Advisory Committee involved different techniques of grouting requiring inclined holes and air water washing of the holes under pressure prior to grouting.

This explains the complexity of the problem and the reason for inadequacy of the parameters evolved on the basis of initial trial grouting."

1.109. Asked further as to why trial grouting was not done on a more extensive scale to avoid the situation which developed after the award of the main work, the Ministry have stated:

".....trial grouting initially was done adopting prescribed parameters on a conventional size of test plot. Due to peculiar geological problems, these results were not subsequently found effective in most of the areas of dam foundations, leading thereby to further experimentation, on an almost continuous basis. The entire grouting work by National Projects Construction Corporation followed

by departmental work in fact, thus, became a wide-scale experiment leading to ultimate solution of this complicated problem."

1.110. The Ministry have further stated:

"Satisfactory parameters for the foundation grouting for both concrete and rockfill dams have already been evolved and production grouting is in hand. As of now no more uncertainties exist in this respect. However, experiments for determining the rock mass properties of certain adversely orientated cross shear seams are still in progress to evolve economical designs for Blocks 16 to 25 of the Power Dam."

1.111. It was pointed out during evidence that the fact that grouting techniques had to be changed frequently following a method of trial and error indicated that the higher technical advisory bodies were not able to give proper guidance to the project authorities. In this connection, the representative of the Central Water Commission stated in evidence (August 1979):—

".....the grouting that we do is in a definite pattern. Nobody knows in the beginning as to what should be the exact procedure to be followed. So, the grouting parameters are always found out by a trial and error method. The parameters depend upon the geological features of the site. In some places we did some trials and, after the trial, we had decided to follow the procedure at a nearby place. When we did the grouting by that method, we found that the procedure was not effective. That means we were not getting enough strength and impermeability by grouting. We had then to change the pattern of grouting. We have to follow this process in any trial grouting.

I want to say that whatever trial grouting we do, that forms part of the larger grouting. So, it is not that the trial grouting that was done is useless. It forms part of the main design. Therefore, it helps us and it is not a waste of money."

1.112. The Committee enquired why the work was awarded to a contractor before actually knowing what type of work was required to be done. The Secretary of the Ministry replied that

"the parameters could not have been established without a contractor mobilising some equipment and carrying out some tests. .... Even then we could not visualise the permeability characteristics there without undertaking the drilling and grouting."

1.113. According to Audit Paragraph, when in April, 1976 the Technical Advisory Committee suggested further trials on the basis of different parameters, M/s NPCC quit the job as they did not have "the requisite experience for the job and the contract with it did not cover the changed items" and the contract was terminated in August, 1976. Asked why was this work allotted to M/s NPCC when they did not have "the requisite experience", the Ministry have stated:—

".....they pleaded inability due to lack of appropriate equipment as well as due to change in scope of the contract, to undertake any further work of trial grouting involving changed technique and parameters. The contract was not terminated on the grounds of inexperience, but at the request of the contracting firm."

1.114 During evidence (August 1979) the Chairman, and Managing Director of NHPC admitted that in their replies to the Audit, they had made "a little mistake". According to him what the NHPC had actually stated was: M/s NPCC did engage M/s Cementation as Sub-contractor and therefore adequate experience was available with the contracting firm. But the change in the grouting technique necessitated some specialised equipment which the firm did not have. Now we are going in for specialised form of grouting after a lot of study and discussion with our Technical Advisory Committee.

1.115. In this connection, it is noted that the letter dated 7 May, 1976 from M/s NPCC expressing their inability to continue the work *inter alia* stated:

"Not only we do not have any equipment for such type of trials but also the whole trial work is completely a departure from the scope of work provided in our contract agreement.

While we do appreciate the eagerness of the department to have best possible conditions for increasing the cement intake appreciably in the rocky strata and its permeability reduced to an extent of one lugeon. We only

wish that these ideal conditions were established well before the award of contract to us."

1.116. Explaining the position further the Ministry have in a note stated:

"After the closing of the contract of M/s NPCC, further trial grouting was, thereafter conducted by the department with the help of Beas Project and a part of the work was given on contract to M/s Radio Hazarat. The bulk of work was, however done through Beas Project departmentally. The trial involved study of a number of alternative parameters and techniques. After completing the trials, the efficacy of grouting was further assessed by Dynamic Elasticity trials completed through Central Water and Power Research Station, Pune. The details of trials and the results thereof were again placed before the Technical Advisory Committee who finally decided on the techniques and parameters of grouting in the above meeting. The work is presently being done accordingly through M/s. Hindustan Construction Company to whom the contract for Concrete Dam has been allotted."

1.117. Asked why the Beas Project Organisation was not approached earlier for trial grouting, the General Manager Salal Hydro-Electric Project during evidence stated (October 1 80):

"We started the grouting with conventional grouting parameters and techniques. There was, therefore, no necessity to approach the Beas organisation for this job as other contractors in the country were equipped to take up this job. Accordingly, open tenders for this work were initially invited resulting in award of contract to M/s NPCC. With the change in the grouting parameters and technique each trial suggested by the Technical Advisory Committee involved use of different technique and equipment which was not in the possession of M/s NPCC or their sub-contractor M/s Comentation Co. The Project had, therefore, to approach the Beas organisation for supply of skilled men and equipment so that the entire grouting studies suggested by the Technical Advisory Committee could be undertaken."

1.118. The Committee enquired about the reasons for delay in completing the consolidation grouting. The witness replied:—

“With the change of parameters and techniques of grouting and non-availability of the required equipment with M/s NPCC we had approached the Beas Organisation for supply of some equipment which had been originally imported for the Bhakra dam. Mr. Chopra, the then Chairman of Technical Advisory Committee, who was at one time General Manager of Bhakra dam suggested that the required equipment would be available with Beas Project as it was originally imported for the Bhakra dam and had been subsequently transferred to the Beas Organisation. In case this equipment was not located, obtained and re-conditioned for use, the same would have to be imported.

1.119. In a note on the subject subsequently furnished to the Committee, the Ministry have stated:

“The experimental grouting suggested by the Technical Advisory Committee involved different techniques of grouting requiring inclined holes and air-water washing under pressure prior to grouting. M/s. National Projects Construction Corporation to whom the contract of grouting was allotted earlier, did not have requisite equipment for doing the job and their original contract did not cover such items of work, M/s National Projects Construction Corporation, therefore, expressed their inability to continue the work of trial grouting under the contract stating that “not only we do not have equipment for such type of trials but also the trial work is completely a departure from the scope of the contract agreement” and “in view of the circumstances mentioned above we have no other option left out but to request you to terminate our contract immediately”.

Accordingly the contract was terminated at the request of NPCC.

Subsequently the trial grouting was done utilising men and machinery loaned from Beas Organisation. The results of the trial grouting were placed before the Technical Advisory Committee in its 12th meeting held on 27th

September, 1977, wherein final parameters and techniques of grouting were finally decided. The Hindustan Construction Company in their current contract for the Concrete dam are doing grouting work on the basis of the above finalised parameters and techniques."

1.120. The Committee note that the work of consolidation grouting of formation rock below spill-way was awarded to M/s. NPCC in December, 1974 without prior thorough investigation and trials. As a result, the execution of the work by the contractors became "experimentation on an almost continuing basis" so much so that in May 1976, the contractor relinquished the work saying: "we only wish that these ideal conditions were well established before the award of work to us." The Committee learn that the trial grouting got done through M/s. Cementation Co. was confined to "a conventional size of test plot". No wonder the work parameters evolved did not suit the different rock strata encountered in the area of operations. Considering the varying nature of rock strata in the Himalayan Ranges, the only prudent course was to have trials done more extensively covering different rock formations in the area. Belatedly, the project authorities realised that the of the job required to be done needed skilled men and specialised equipment which were already available with the Beas Organisation. In the process valuable time was lost.

*Treatment of Shear zone in blocks 4 to 8 of Spillway portion*

1.121. The Audit Paragraph has pointed out that the work of treatment of shear zone in blocks 4 to 8 was awarded to a firm in January, 1975 on the basis of plug depth of 8 meters indicated in the study drawings of another reach (blocks 9 to 11). The drawings for this reach received in September, 1975 indicated a plug depth of 19 metres whereas in the final drawings received in December, 1976 it was indicated as 24 metres in certain locations. This led to payment to the contractor for increased quantity at negotiated rates. The paragraph points out that had the work been awarded after receipt of study drawings, the benefit of competitive rates for the whole work would have been obtained and the increased quantities would have been covered within the permissible deviation limit.

1.122. On enquiry, the Ministry have indicated the following reasons for the delay in the receipt of drawings:

".....impact of this major shearzone.....on the stability of the dam was under precise evaluation at the Earthquake School of Engineering, Roorkee University and



CW&PRS, Pune in view of its importance in relation to the overall stability of the dam. Based on the results of the study, the depth of the plug was increased to 16 metres and CWC issued an approved drawing in September, 1975. Side by side the presence of cross shear seams in these blocks, which were apprehended by the Geological Survey of India to cut across the main bedding shear zone, presented another important criteria for the treatment of this shear zone in these blocks as also for the overall stability of the main dam. Considering the importance and criticality of this factor, the CWC desired that the continuity or otherwise of these shear seams across the main bedding shear zone be confirmed. The Geological Survey of India accordingly desired excavation of a trial pit below 8 metres depth to ascertain the continuity or otherwise of these cross shear seams. After necessary investigations Geological Survey of India confirmed the continuity of these cross shear seams across the main shear zone. Accordingly, the proposed depth of plug for treatment of shear zone BS-6 in these blocks was increased to 19 metres.

Concurrently photo-elastic studies on the treatment of these shear zone were undertaken by CW&PRS, Pune at the request of the CWC. The results of this study were available by April, 1976. After the studies were completed, the site was jointly inspected by the Officers of the CWC, CW&PRS (Pune) and Director, Geological Survey of India on 18/19th April, 1976. It was only after this inspection that the proposed depth of the shear zone plug in some blocks was increased to 24 metres.

The design criterion for treatment of this shear zone was put up to TAC by CWC in April, 1976 and the same was approved by the TAC in its 11th meeting held on 24th April, 1976. Meanwhile approved drawings for treatment of shear zone (BS-6) in these blocks were issued by CWC in February, 1976 which were subsequently revised in September 1976 and December, 1976 incorporating the decisions taken after the site inspection in April, 1976 and subsequent design and model studies.

This explains why the drawings could not be issued by CWC earlier than September, 1976 and why the final drawings were issued in December, 1976."

1.123. Answering the question as to why the work was awarded when the drawings pertaining to the work were yet to be received, the Ministry have stated:

"The Central Water Commission issued a study drawing for treatment of this shear zone from block 11 to block 9 (10/74). With a view to save time, a conscious decision was taken to start work in all the blocks from 4 to 11 on the basis of the above study drawing in the background of the consideration that the work so done would ultimately form a part of the ultimate treatment of the shear zone. However, as a precautionary measure, it was stipulated in the contract of these works that the deviation in quantities could be +50% as against the approved provision of +20%, to account for any likely subsequent changes in design and quantities."

1.124. It was pointed out during evidence (August 1979) that in this case also, work was awarded to a contractor prior to the receipt of final drawings showing precisely the work to be done. The Secretary, Department of Energy admitted that "the point is quite valid that tender documents were issued on preliminary drawings prior to the design being prepared by the Central Water Commission but this had been done apparently to save time." The Chairman and Managing Director, NHPC, however, added:

"No work that we have done has been wasted. When the decision drawings came they asked us to go further down than 8 metres in shear zone in all blocks. We have not wasted any money due to this earlier decision making process."

1.125. Explaining the point made during evidence that if rate quotations were invited for different plug depths, it could have been possible to get rates cheaper than the rates negotiated with the contracting firm, the Ministry have in a note, submitted as follows:

"The rate for Shear Zone BS-6 in Blocks 4 to 8, for the increase depth of the plug from 8 metres to 16 metres, was approved in accordance with the contract provisions which, besides stipulating a deviation of +/- 50% in the quantities, laid down the procedure for determining the rate beyond these permissible deviations. The rate for the increased quantities was worked out in accordance with the provisions of the contract for determining the

rate for such deviated and extra items of work. Under these circumstances, the question of inviting separate tenders for 8 metres, 12 metres and 16 metres of the plug did not arise. Before the rate was approved, M/s. National Projects Construction Corporation (a Government of India Undertaking) was requested to undertake the deviated work and quote rates for the same. M/s. NPCC quoted a rate of Rs. 30 per cubic metre for rock excavation and de-watering extra at a rate of Rs. 1.75 per Kwh. Accordingly, the rates worked out for these deviated and extra items in accordance with the contract provisions, which were in line with the rates quoted by M/s. NPCC, were approved in favour of the contractor. De-watering was, however, restricted to a ceiling of Rs. 5.05 lakhs at the time of final payment."

1.126. The Committee view with concern the hurry in awarding the work for treatment of shear zones in blocks 9 to 11 before the drawings of the part of work were available even if it was done with a view to save time. They feel that had the work been awarded after the receipt of drawings, the benefit of competitive rates for the work would have been available.

### *Rockfill Dam*

#### *Increase in cost*

1.127. There has been steep increase in the estimated cost of the Rockfill Dam and the coffer dam for diversion arrangement from Rs. 14.52 crores in the original estimate (1968) to Rs. 40.29 crores in the second revised estimate (1976). According to the latest estimate (November, 1980) the Rockfill Dam is now expected to cost Rs. 58 crores.

1.128. One of the reasons for this wide variation in the estimates indicated to Audit was that the quantity of material had increased from 2.9 million cu.m. to 7.73 million cu.m. Subsequently, in reply to a question from the Committee, the Ministry have stated that this reason given to Audit was an "inadvertant conclusion arising out of a computational error in abstracting the detailed estimate of the Rockfill Dam given in the same revised estimate". According to them, the total quantity indicated in the 1968 estimate was 7.07 million cu.m. and therefore the increase was only 0.66 million cu.m.

1.129. Asked about the reasons for steep rise in the estimated cost dam, the Ministry have in a note stated as follows (September, 1980):

"The increase in the cost is due to the following:

- (i) Increase in the cost for replacement of material in the dam and increase in the rates for drilling and grouting etc.
- (ii) *Increase in the cost of indigenous and imported machinery:*

The cost of indigenous machinery has increased by about 80 per cent between 1968 & 1976, the cost of imported machinery has also increased considerably during the period due to overall inflation. The cost of spares has also increased considerably.

- (iii) *Increase in the price of POL required for operation of Earth moving machinery:*

The cost of POL has increased considerably during the period 1968 to 1976. The cost of Diesel oil has increased by about 114 per cent and that of lubricants by about 257 per cent.

- (iv) *Increase in the wages and other prices:*

There has been considerable increase in the wages of unskilled and skilled workers and other commodities during the period 1968—1976. All India Average Consumers Price Index registered an increase of 38 per cent where as index for all commodities has increased by 89 per cent. Cement registered an increase of 93 per cent and steel of 120 per cent.

- (v) *Increase on account of treatment of adverse geological features:*

Treatment of adverse geological features under the base of the dam including modified proposals for drilling & grouting for efficacious foundation treatment have also contributed to increase in the cost.

Due to similarity of the geological features in the foundation of the Rockfill dam to those of the Concrete dam,

the design for the foundation treatment in the dam posed a number of problems. The problems were, however, of lesser magnitude than those of Concrete dam which is perched on the top of a narrow ridge. For ensuring the safety of the structure, considerable amount of test grouting had to be carried out on the advice of the Technical Advisory Committee and Central Water Commission to arrive at satisfactory parameters for effective consolidation grouting under the dam base."

#### *Execution of the Work Departmentally*

1.130. In 1974, it was decided that the construction of the Rock-fill dam might be carried out departmentally by the project organisation. Asked what were the considerations on which it was decided to carry out the construction departmentally, the Ministry have stated:

"This was in pursuance of the decision taken in the second meeting of the Standing Committee held on 1st February 1974—in the background of the fact that sufficient expertise for construction of such dam was not available in the Private Sector and by then two major Rockfill Dams i.e. Ram Ganga and Beas Dam were nearing completion generating thereby confidence of tackling such works departmentally. This decision incidentally helped in utilisation of the surplus men and machinery from Beas Project."

1.131. It was noted that initially the idea was to get the work done through contractors and accordingly tenders were invited in February, 1974. These were, however, kept pending as the question of carrying out the work departmentally was under consideration and it was finally decided in October, 1974 to do so. Asked whether the comparative economics of the work if done by the contractors *vis-a-vis* that done departmentally was gone into at any stage, the Ministry have stated:

"...on a preliminary examination of the tenders received for the Rockfill dam, on the basis of the evaluation done by the project, the tender value ranged between Rs. 32.5 crores and Rs. 30.2 crores as against the estimated price cost, duly loaded for estimated increase of 20 per cent, of Rs. 26.9 crores. Such evaluated cost of the tenders did not, however, take into consideration the financial implications of certain special conditions quoted by the different tenders which were of indeterminate and uncertain.

nature. The usual procedure of quantifying the implications of such special conditions is to hold negotiations with the tenderer. However, as by then, the decision in principle had been taken to construct the Rockfill dam departmentally such an evaluation was not pursued and a study of comparative economics based on precise evaluation of tenders was, therefore, not done and is not available."

1.132. The progress made so far in the construction of the Rockfill Dam has been indicated by the Ministry in a note as under:

"Constructing the Rockfill Dam departmentally, which involves a work magnitude of about Rs. 41.00 crores, \*requires considerable effort in building up of the necessary organisational set-up and adequate infrastructure of stores, workshops, labour colonies, development of quarries, construction of haul roads and other preliminary and enabling works. The pre-construction activity besides completion of the above infrastructure, includes procurement of adequate equipment, spares and development of adequate facilities for repairs and maintenance for smooth and dependable operation of the equipment Recruitment of suitable trained and skilled workmen and training of certain categories in specialised skills is also an important construction pre-requisite for a dam of this magnitude.

As of now the development of the entire infra-structure required for this major construction, as mentioned in the aforesaid para, has already been completed. Besides fill placement in the dam has also been started on the right flank outside the river section and above the high flood level. The progress on construction upto end of August, 1980 is as under:

Sl. No.	Item of work	Total estimated quantity	Quantity completed
1.	Excavation . . . . .	1185.0 TM <sup>a</sup>	695.78 TM <sup>a</sup>
2.	Foundation treatment Drilling & grouting . . . . .	93.0 TM	39.00 TM
3.	Treatment of shear zone a/Excavation . . . . .	35.0 TM <sup>a</sup>	15.10 TM <sup>a</sup>
	b/Concreting . . . . .	40.0 TM <sup>a</sup>	11.13 TM <sup>a</sup>
4.	Fill Placement . . . . .	7494.0 TM <sup>a</sup>	679.69 TM <sup>a</sup>

\*Since revised to Rs. 58.00 crores.

1.133. The Committee note that the estimated cost of Rockfill Dam has increased successively from Rs. 14.52 crores in the original estimate of 1968 to Rs. 22.89 crores in the first revised estimate of 1974 and further to Rs. 40.29 crores in the second revised estimate of 1976. The cost is estimated to go up still further to Rs. 58 crores as per latest available indications. The fivefold increase in the cost is attributed to the increase in (i) the cost of replacement of material in the dam, (ii) wages, (iii) cost of indigenous and imported machinery, (iv) increase on account of treatment of adverse geological features etc.

1.134. In this context, the Committee notice that in February, 1974 it was decided to undertake the work departmentally. The Committee were informed during evidence that "a study of comparative economics based on precise evaluation of tenders was ..not done and is not available". They further note that one of the considerations for taking a decision to get the work done departmentally was to utilise the surplus men and machines from the Beas Project.

1.135. It is surprising that although tenders were invited, they were not evaluated with a view to ascertaining whether it would at all be more economical to get the work done departmentally and that a decision in this regard was taken without evaluating the cost involved. The Committee consider it to be a very casual way of taking decisions in matters where expenditure of crores of rupees is involved. Considering the huge escalation in costs, the Committee would like the Ministry to enquire as to whether it would have been more economical to get the work done through contract labour taking into account the cost of machines, haulage, establishment of workshops, expenditure on overhauling, repair and maintenance, the wear and tear of machines, extra labour force employed thereon etc. The Committee would like to emphasise that decisions in matters like this should be taken after a careful study of the economics of the proposal.

#### *Construction of a haul road*

1.136. For haulage of fill material to the rockfill dam, a road was constructed upto a width of 20 ft. approximately, in October, 1974. This road was widened to 40 ft. in straight reaches and 46 ft. in curves, in March 1975. In December, 1976, an estimate was prepared to further widen the road to 59 ft. According to this estimate the width of the road already achieved was only 17 to 20 feet. The Ministry was asked to explain the discrepancy between the width shown as achieved on the basis of the work completed and paid for in March, 1975 and the subsequent observations as regards the width

of the road actually existing on the ground, made by the authorities while presenting the estimate for its further widening. They have replied as follows:

"The observation made in the covering report of the estimate prepared in December 1976 by the Rockfill Division of the Rockfill circle, for the widening of the road that "at present the road width available is between 5 to 6 metres" is a mis-statement as it does not corroborate with the factual position as brought out in the cross-sections appended to the project estimate on which the estimate for widening is based. Perusal of the cross-sections, attached with this estimate, clearly indicate that the available road width was generally 10 metres, and was 5 to 6 metres only in about 33 per cent of the aggregate length. The relevant data, as abstracted from the cross-sections attached with the revised estimate, is given in the enclosed table—Annexure 19.1 (not printed). The reduction in the available road width in certain lengths of the road (about 33 per cent) is attributable to the washing away of the filling portion of the road in the two intervening rainy seasons (between March, 1975 and December 1976). The estimate for the road (March 1975) envisaged construction of the road formation, partly in filling and partly in cutting (about 2/3rd in cutting and 1/3rd in filling) without any retaining walls. No payment was made for the road in the filling portion as the same was obtained by the disposal of the excavated material from the cutting zone. The filling portion could not stay in the absence of retaining walls in the two monsoon seasons between 3/75 to 12/76 i.e. between the date of completion of the original work and the date for proposals for subsequent widening, more so when the road alignment was hugging the river bank."

1.137. Questioned on this subject during evidence (Augst, 1979), the Chairman and Managing Director of NHPC stated that the cross sections of the Haul Road attached to the estimate of December, 1976 "show that only 33 per cent of the road is 17—20 feet wide". He also drew the attention of the Committee to the annexure to the estimate according to which "33 per cent of the road has actually been washed away during the monsoon" and maintained:

"I would like to say that in a haulage road of this nature, we do not build retaining walls generally and the extra width we get by filling material. A certain portion would



go during the monsoon... Where roads are little verticle and the angles are sharp, there will be certain portion of the road losing its width."

1.138. Questioned further as to whether in view of the report emanating from the Superintending Engineer that the road was within 5 to 6 metres, could it not be concluded that the first stage of widening was not carried out and was merely shown as carried out. He was also asked whether there was any inspection report and completion report in respect of the first stage of the widening of the road. The Chairman and Managing Director of NHPC stated:

"We will have it checked.....There is obviously a wrong statement that the road was 17—20 feet. The point we are trying to make is—on our detailed cross section available it is very clear that 70 per cent of the road was more or less O.K. and about 33 per cent of the road was not there."

1.139. Asked why the width of the road was not determined correctly in the very beginning, the Ministry have stated:

"The haul road was originally planned.....to meet the requirements of the hauling equipments available at that point of time. Final decision on the type of equipments to be used for haulage of fill material for the dam, was taken in consultation with Central Water Commission and finally approved by the Government on 28th July, 1975..... Accordingly the already constructed road width was widened."

1.140. Answering a question on the same subject during evidence, the Chairman and Managing Director of NPCC said:

I agreed that with better planning we could have gone on with one specification in the earlier stages, but in actual fact we have not lost any money by changing the specification."

1.141. The width of the road now actually constructed is stated to be 50 feet in the straight reaches and 59 feet on curves as provided in the widening proposals.

1.142. During evidence it was pointed out that the estimate of December 1976 envisaged widening of the road to 59 feet at an estimated cost of Rs. 12.54 lakhs. The actual expenditure against the estimate was however a sum of Rs. 3.5 lakh paid to the contractors

and Rs. 1.5 lakhs spent on executing a part of a work departmentally, making a total of about Rs. 5 lakhs. Asked how an estimate for Rs. 12.5 lakhs was prepared for the work when the actual expenditure for the work was only about Rs. 5 lakhs, the Chairman and Managing Director, NHPC said:

“The Superintending Engineer will have to give estimates at the scheduled rates but the rates which were given to the local contractors were very much lower.”

1.143. The Committee note that the road for haulage of fill material to the Rockfill Dam was constructed upto a width of 20 feet approximately in October 1974. In March 1975 it was widened to 40—46 feet and in December, 1976 it was further widened to 50—59 feet. This indicates lack of planning on the part of project authorities.

1.144. Regardless of the observations of the local project officers regarding the short width of the road actually found by them on the spot, the Ministry has relied upon the cross-section of road appended to the Project Report and also on the surmise that the filling portion of the road in certain lengths must have been washed away by two intervening rainy seasons. The Committee consider that the matter calls for a probably NHPC management with a view to dispelling impression that the previous widening of the road was actually not carried out, but was shown to have been carried out and paid for accordingly.

#### *Power House*

1.145. In a note, the Ministry have stated that a special feature of the Power house construction is that it is a semi-underground structure located about 27 metres below the average river bed level. The Power house is divided into two parts. The downstream portion being constructed for Stage-I development of the Project and the upstream for Stage-II development. Each stage is further subdivided into two sub-stages i.e. sub-structure and super-structure. On design and practical considerations it would be necessary to construct the sub-structure of Stage-II side by side with the sub-structure and super-structure of Stage-I of the Power house so that future extension of the Power house can be effected without interfering with the operation of the Stage-I Power house. For accommodating the Power house on the right bank of the river, the right bank hill slope had to be cut back involving rock excavation of about 1.1 million cu. m. This work was completed in March, 1977. For isolating the Power house in the river bed, a permanent protection wall around

the Stage-I of the Power house has already been constructed. The protection wall for the Stage-II of the Power house can be constructed only after the river is diverted. Till the Stage-II protection wall is constructed, a temporary Cofferdam has been constructed to permit the construction activity of Stage-I works for the maximum available working period during the non monsoon months. The work on the sub-structure of Stage-I Power house was started in December 1978 through M/s. National Projects Construction Corporation who had to complete the work as per an agreed time schedule. However, their actual progress was found to be far below the targets. When this was brought to their notice with a request to improve the progress, M/s. National Projects Construction Corporation offered to withdraw from the work. To avoid any further delay in the construction of the work, the offer of M/s. National Projects Construction Corporation was accepted and the contract was allotted to the next lowest tenderer namely the Hindustan Construction Company in March 1979 on the same terms and conditions as agreed to with M/s. National Projects Construction Corporation. The upto date progress on sub-structure is as under:—

*Sub-structure construction Stage-I of Power house*

Sl. No.	Item of work	Estimated quantity	Completed ending August 1980
1.	Excavation	54.00 TM <sup>3</sup>	32.74 TM <sup>3</sup>
2.	Shortcreting	2000 Bags	1536 Bags
3.	Concreting	24.00 TM <sup>3</sup>	6.00 TM <sup>3</sup>

The sub-structure works of Stage-I of Power house are expected to be completed by September 1981. Tenders for super-structure of Stage-I work and sub-structure for Stage-II are due to be finalised by January 1981. The original cost of the construction of the Power house was Rs. 173.32 lakhs (1968) which has been revised to Rs. 1201.32 lakhs (1976). Reasons for increase in the cost mainly are:—

- (i) Increase in the scope of power generation from 270 MW to 345 MW necessitating shifting of power house from the left bank to the right bank and depressing its level by about 27 metres below the river bed resulting *inter-alia*.

in the increased cost of right bank hill excavation, permanent protection wall around the Power house and other additional design features which were not required to be provided if the Power house was constructed at the toe of the dam as originally proposed.

(ii) Escalation in the labour and material cost.

#### *Change in Location of Power House*

1.146. Apart from escalation in cost of labour and material the major reasons for increase in cost of the Power House is the change in its location from the left to the right bank of the river Chenab and depressing it to gain a certain additional head. Indicating the considerations on which it was decided to change the location, the Ministry have stated:

“The original Project estimate (1968) envisaged an installed capacity of 270 MW (3×90 MW). In 1971, it was decided to increase the scope of power generation to 345 MW (3×115 MW) by utilising the additional natural drop available in the loop of river Chenab just downstream of the Dhyangarh loop. This necessitated shifting of the Power house from the left bank to the right bank of the river and depressing the same by about 10.8 metres to gain the additional head.”

1.147. Asked whether the increase in the installed capacity from 270 MW to 345 MW justified the increase in cost due to change in location, the Ministry have stated:

“The estimated cost of the Project for an installed capacity of 270 MW according to the estimate of 1968 was Rs. 55.15 crores. This estimate was revised to Rs. 222.15 crores in 1976 for an installed capacity of 345 MW. Out of the total increase of Rs. 167.0 crores, an amount of Rs. 26.0 crores was due to increase in the Power generation from 270 MW to 345 MW. The balance increase in cost was due to price escalation, changes in designs and inadequate/non-provisions etc. The estimated cost for an installed capacity of 270 MW as per 1976 estimate would thus have been about Rs. 196.15 crores (i.e. Rs. 222.15—Rs. 26.00 crores). The cost of generating per KW would thus work out to Rs. 7265.01 per KW of the installed capacity.

As against this, the cost per KW of generation for the full installed capacity of 345 MW would be Rs. 6439.00 per KW

of installed capacity. The increase in the installed capacity from 270 MW to 345 MW was, therefore, an attractive proposition as it resulted in decrease in the overall cost of generation per KW of the installed capacity. Considering the cost of generation per unit of power, the same was reduced from 9.57 paise per unit to Rs. 9.23 paise per unit (at generation end with increase in the installed capacity. The increase in the cost for generation of additional power was, therefore, financially justifiable and attractive."

1.148. Asked whether the change in location of the power house and the consequent increase in cost was brought to the notice of Planning Commission and their clearance obtained, the Ministry have stated:

"After a Central project is cleared from techno-economic angle by the CWC/CEA (Central Water Commission Central Electricity Authority) the investment decision was earlier (upto Sept., 1972) taken by the Expenditure Finance Committee, but subsequently for schemes costing more than Rs. 1 crore the investment decision is to be taken by the PIB (Public Investment Board), constituted vide Government of India's Memo No. 26(6)/P-II/70 dated the 30th September, 1972. No doubt the Planning Commission is associated at all levels, i.e. at the techno-economic clearance by the CEA, at the appraisal stage by the Ministry and finally at the approval stage by the PIB. No separate clearance from the Planning Commission is required for the change in the scope or for increase in the project cost as is required for the State projects.

The Salal Project was a state Government project when it was initially cleared in 1968 and accordingly the investment decision had to be taken by the Planning Commission after its techno-economic clearance by the erstwhile CW&PC. After the project was brought in the Central Sector in 1970 no specific clearance from the Planning Commission for change in scope or increase in cost was required to be obtained. The revised project (1976) was techno-economically cleared by the CEA wherein Planning Commission was associated. Subsequently the revised project estimate was processed in the Ministry of Energy (Department of Power) where

also the Planning Commission was associated and thereafter it was submitted for clearance to PIB in which the Planning Commission is represented at the level of the Secretary of the Commission. After clearance by the PIB the revised project was approved by the Cabinet and Government sanction was issued by the Ministry of Energy (Deptt. of Power)."

1.149. During evidence (October 1979) the representative of the Ministry was asked whether, in view of the fact that the shifting of the Power House from left to right bank of the river involved substantial additional expenditure, the approval of the Planning Commission was obtained before taking final decision to shift the Power House. The Chairman and Managing Director of N.H.P.C., while admitting that "it was not approved (by the Planning Commission) at that stage but was approved later", said:

"Both CPWC and the Ministry of Power were wholly in the knowledge of what was going on then. We will accept the charge you are making that it did not go formally to the Government and get formally sanctioned. We do not want to justify that."

1.150. The representative of the Planning Commission informed the Committee during evidence as follows:

"There was one circular letter which the Planning Commission had circulated to all the States (and) Central Administrations.....Circular letter had said that whenever a project was cleared and after the project estimate increased by about 10 per cent.....and there was substantial modification in the project report, the States etc. had to re-submit the project for consideration by the TAC and approval of the Planning Commission. This was the standing instruction which was issued to all the States. They were to follow this procedure."

1.151. In regard to Salal Project, he said:

"The costs were escalating from year to year when the project came up for discussion during the Annual Plan meeting.....It was only in 1976-77 that a concrete shape was given to the project as a whole. Then only the estimates would have been prepared.....It came up for the consideration of the PIB (Public Investment Board) sometime in early 1978. The PIB is now the

forum for any central project to be got cleared before it goes to the Cabinet. The Planning Commission's approval would be issued after the Cabinet had cleared."

1.152. The representative of the Ministry of Energy informed the Committee of the procedure for clearance of the Project as follows:

"A project costing more than Rs. 5 crores is subject to a PIB exercise. Before the administrative Ministry takes the project to PIB it has to obtain the comments of the concerned Ministries/Departments (including the Planning Commission) and incorporate them along with its own further comments.....in the PIB note. It is then discussed at the formal meeting of the PIB. The Secretary, Planning Commission is a full member of the PIB. After the PIB clears it, concerned Ministry/Department takes it to the Cabinet."

1.153. It was pointed out to the representative of the Planning Commission that the project must have come up for consideration before them every year at the time of Annual Plan discussions for provision of funds. To this he replied:

"In the absence of any scope of the project being finalised, in the discussions only further escalations in cost were indicated. Based on the escalated cost, provisions were being made in the Annual Plans so that a certain work schedule could be maintained."

1.154. Asked whether he agreed that the initial investigations were faulty due to which they had to change the design from time to time, the Secretary of the Ministry said:

"When the project was taken up in the Himalayas, our experience of Himalayan geology was not adequate.....  
The same mistake will not be repeated in future because in the meantime we have gained experience...."

1.155. Supplementing him, the Chairman and Managing Director of NHRC said:

"After the investigations have been done at the project report level which are of marco nature, they have to be examined from the techno-economic feasibility angle. After that, we have to go through a very large number of investigations. Investigation does not stop after the preparation of the project Report. We have got to carry

out a large number of research laboratory tests, model tests etc. These are not done before at the stage of the preparation of the Project Report..... Unless the tests were done, we would not arrive at the design criteria for the designers to give the executive the right picture. Till that emanates, the tender documents cannot be prepared. Today our draft project reports sanctioned do not have adequate data for the detailed designs to be prepared for design specifications on the construction drawings..... There is a meeting in the next week to examine how this system could be changed. There are 2 or 3 alternatives being examined by the Government. Unless a really major system change is done, I do believe as Chairman of NHPC we will face the same problems we are having today. The Government is fully seized of the problem and we would make the necessary changes."

1.156. Questioned further as to what concrete steps Government propose to take to meet the problem, he said:

"We have constituted two Committees already. One of the Committees has recommended that all projects costing over 30 crores of rupees should require a more strict treatment. What they meant is that the first stage, i.e. the sanction of an investigation estimate should invariably be on the basis of a preliminary project report or a reconnaissance report. The investigation money should be upto a maximum of 5 per cent of the project report cost.

They further say after a study of the hydro-electric projects in India that this margin of error will continue... Then, there is the Marathe report 1978 which has been discussed very recently. They have said about the procedures of investigation and implementation of multipurpose hydro projects. They have recommended that first we should go for reconnaissance report, then for a feasibility report and finally for a definite project report. HPC have certain ideas which I have not put across to the Government, but this is the broad basis on which we believe, we ought to go to make sure that we do not fail.

.....we will put in our best endeavour to overcome this by bringing about a system change."

1.157. Asked during evidence as to why it was not possible for the Geological Survey of India in the course of their investigations,



to point out the problems which arose later, the Director General, Geological Survey of India replied:

"Whatever investigations were carried out to the extent indicated in our reports, made us wise about the type and nature of weaknesses presented in the foundations in terms of shear zones. As far as this is concerned, there have been no surprises during the construction stage. What was required was the testing of materials in the shear zones and trial grouting and other experiments. After all these tests and the field experiments are completed, we are in a position to give quantified recognition to the weaknesses which we knew existed. We recognised these weaknesses in this project. These surprises that came and other experiments. After all these tests and the field experiments were completed, we are in a position to give qualified recognition to the weaknesses which we knew existed. We recognised these weaknesses in this project. These surprises that came about were not any new feature so encountered, but the surprises were to the extent to which treatment was necessitated. For this we did not have sufficient data."

1.158. Asked whether the history of the river for the last 20—30 years was not known to the project planning authorities beforehand, he replied:

"They would have enough hydrological record.....The conditions of the rock were known but in what manner we were going to treat them to render these weaknesses innocuous—that required a lot of testing and experimental grouting which were carried out later. The provisions made were found to be adequate. There is no single surprise in terms of level at which the rock would be encountered or the number of shear zones or the nature of the shear zones."

1.59. It is admitted that after the Salal Projects was approved in 1968 as a State Project, the Planning Commission has had no occasion to review the project until 1976 when a revised estimate indicating a more than four fold increase in cost of the project was cleared by the Public Investment Board (PIB) and approved by the Cabinet. Between 1968 and 1976 several important decisions were taken which had changed the entire complexion of the project involving manifold cost increase over that envisaged in the original

proposal cleared by the Planning Commission in 1978. One such decision was to take over the project as a Central project in 1970. Another major decision taken in 1971 was the change in the location of power house from left bank to the right bank of the river as a corollary to the increase in the proposed capacity of the Power House from 270 MW to 345 MW. The Committee are surprised as to how such decisions involving major financial commitments not originally envisaged, could be taken without consultation with, and approval of, the Planning Commission. The Committee are of the firm opinion that this was a serious lapse on the part of the administrative Ministry. Since cost escalation had already taken place, the approval of the PIB in 1978 was more or less a formal affair. There was at that stage hardly any choice with the Planning Commission, the PIB and the Cabinet 'except to approve the on-going project.

1.160. The Committee would like to emphasise that proper policies and procedures should be evolved with a view to ensuring that whenever any State project is proposed to be taken over for execution by the Government of India, prior approval of the Planning Commission and PIB is obtained. Further, as soon as it is found that the project cost is likely to exceed more than 20 per cent of the approved estimated cost of the project, the fact should be brought to the notice of the Planning Commission, PIB and the Cabinet for review and approval.

1.161. In this connection, the Committee find that at present there is no method by which Parliament is concurrently kept apprised of the progress in the implementation of various Central Sector projects and programmes in which huge amounts have been voted by Parliament. The Committee find that the information made available to Parliament through the budget documents or annual reports of the concerned Ministries is sketchy and quite inadequate for making a proper appraisal of the progress of various on-going projects.

The Committee, therefore, strongly recommended that in the cases of all Central sector projects/programmes where the estimated outlay is Rs. 100 crores or more and also in cases where the estimated outlay investment subsequently exceeds the above figures, a separate Project/Programme appraisal report should be placed before Parliament during every budget session. Such report should indicate clearly the physical and financial targets, progress made and reasons for delays, non-fulfilment of targets etc. (year-wise). These Reports,

project-wise/programme-wise, should be made available before the debates on the Demands for Grants start, so that Parliament is fully kept apprised of all such projects/programmes.

### Cost benefit ratio

1.162. The Ministry were asked whether the cost benefit ratio and/or the economic viability of the Project justified the increase in the installed capacity at a substantially high additional cost. In reply, the Ministry have stated:

"The project estimate (submitted by J&K Government) of 1968 stipulated a generation cost of 1.94 paise per unit at the generation end. While sanctioning the estimate this figure was corrected to 2.66 paise per unit at the generation end and 2.97 paise per unit at Madhopur i.e. boundary of the—J & K State (Northern Zonal Grid Station did not exist at that point of time). In the sanctioned estimate (1968) the unit cost of energy was based on 5 per cent interest charges. Subsequently, the norms for calculating the cost per unit of power were changed and the unit cost in all subsequent estimates was worked out accordingly. Based on these revised norms, the unit cost of power as per 1968 and 1976 estimates was worked out as under:

	At Generation end			At Grid station		
	As per sanctioned estimate	Based on 6% interest	Based on 8% interest	As per sanctioned estimate	Based on 6% interest	Based on 8 per cent interest
1968 Estimate	2.66	2.77	3.37	2.97	3.07	3.73
1976 Estimate		9.23	11.24	..	10.43	12.70

(All figures in paise)

1.163. The increase in the cost of generation as reflected in the revised estimate (1976) in comparison to the original estimate (1968) is stated to be primarily due to increase in cost on account of price escalation and changes in design etc. According to the Ministry, due to increase in the scope of generation from 270 MW to 345 MW at

a cost of about Rs. 26.00 crores, the unit cost of generation was in fact lower by 4 per cent than it would have otherwise been if the installed capacity remained at 270 MW and the Project cost increased to Rs. 196.15 crores (Rs. 222.15—Rs. 26.00 crores) for reasons other than due to increase in the installed capacity. In support, they have furnished to the Committee, the following comparative table:

*Comparative unit cost of power*

Location	Installed capacity	345 MW	Installed capacity	270 MW
	Estimated cost (Rs. in crores)	222.15	Estimated cost (Rs. in crores)	(Rs. 222.15— Rs. 26.00)= Rs. 196.15
	Units generated annually (Million)	2062	Units generated annually (Million)	1740
	@6% interest on capital	@8% interest on capital	6% interest on capital	8% interest on capital
At Generation end	9.23	11.24	9.57	11.65
At Grid station	10.43	12.70	10.91	13.29

1.164. In view of the above, the Ministry maintained that the increase in the installed capacity of the Project was fully justifiable from economic viability angle.

1.165. Asked whether the return anticipated on the basis of the revised cost of generation has been worked out, the Ministry have stated that the Project will yield a return of 8.39 per cent in the second year of its commissioning which will increase to 10.27 per cent in the 10th year of its commissioning.

1.166. During evidence in October, 1980, the Secretary, Ministry of Energy when specifically asked about the generation cost, stated:

“.....the cost of generation would be about 20 paise per unit in this project and it would go down further after the second stage of the project is taken up.”

1.167. The Committee desired to know if any study had been made to determine the cost benefit ratio or cost effectiveness of the project. In reply, the Secretary, Ministry of Energy stated:

“In the case of power project we determine unit cost of generation plus internal rate of return in a year. These are the

two criteria considered by the Public Investment Board... It is some form of the cost-benefit ratio. It may not be exactly the same."

1.168. The Committee observe that between the years 1968—1976, the estimated unit cost of power generation from Salal Project has gone up from 3.37 paise to 11.25 paise at the generation end and from 3.73 paise to 12.70 paise at the grid station (based on 8 per cent interest). The latest estimate, however, shows a further increase in the anticipated cost of power generation to 20 paise per unit at the generation end.

1.169. Considering the steep escalation in the anticipated cost of the project from Rs. 55 crores in 1968 to Rs. 350 crores at present, the Committee desire that a detailed study of the cost effectiveness of the project should be undertaken. The Committee would like to be apprised how the Salal Project compares in this respect with other hydro-electric projects in the country.

#### *Tailrace tunnel*

1.170. The Committee have been informed that in the original Project estimate of 1968 there was no provision for a Tailrace tunnel. The construction of this structure became necessary due to the increase in the scope of power generation from the project by increasing the installed capacity from 270 MW to 345 MW in Stage-I. For the first stage development of the Project only one Tailrace tunnel would be required but for the second stage development, which increases the installed capacity to 690 MW, a second tunnel of the same dimension would be required. The estimated cost of the first stage Tailrace tunnel (2.4 km. long) along-with a 50-metre length of the second stage tunnel (required to be constructed right now) is Rs. 1831.07 lakhs as per estimate of 1976.

1.171. Before starting the construction of the tunnel a Cofferdam was constructed at the exit portal to enable excavation of the tunnel from the exit end. This work was completed in April 1977. Side by side with the construction of this work tenders for the main work of the tunnel construction were also invited. The initial difficulties with regard to processing of tenders, negotiating tender rates and conditions and awarding the work have already been overcome. The work has been finally awarded to M/s. Gammon India.

(a) *Premature issue of NIT*

1.172. According to Audit Paragraph, tenders for the tailrace tunnel were invited in October, 1975 with date of opening as 31 December, 1975. The date was extended from time to time and the tenders were finally opened in September, 1976. Asked to explain the delay of about one year in opening the tenders, the Ministry of Energy have stated as follows:

"A press insertion, inviting tenders for the above work, was issued on 17th October, 1975. The press insertion was merely on advance notice for issue of tenders, which could not be compiled without detailed quantities and specifications due to on-finalisation of designs and drawings, which became available in July 1976. Pending finalisation of the quantities and specifications, which were required for framing the tenders documents, the date of receipt of tenders was extended from time to time and finally fixed for 27th September, 1976. The tenders were, therefore, received and opened on 27th September, 1976."

1.173. Asked as to how the press insertion was issued when designs and drawings were not finalised the Ministry have replied that the press insertion was issued in October, 1975 with the anticipation that the designs, drawings and specifications required to be incorporated in the tender documents, would be available in time. Since the same took longer than expected, the date of receipt of the tender was extended upto September, 1976.

1.174. During evidence (October, 1979), the Secretary of the Ministry agreed that the press insertion in October, 1975 was "premature". Supplementing him, the Chairman and Managing Director of NHPC said:

"It would have been very good to have all designs completed. Sometimes what happens is this. If you were to wait for all the designs to come to issue the NITs, it may take a little time longer. As I explained earlier, the power house is a critical point and I can only think of this that they wanted to get the tunnel work done quickly and get down to the final level. This is the only explanation that I can think of."

(b) *Award of contract to M/s. Gammon India Ltd.*

1.175. Government had approved the award of work to M/s. Gammon India Ltd, on 26 August, 1977 with the stipulation that the

special conditions to be included in the agreement be got vetted by the Ministry of Law before incorporating them in the agreement. The Government had also agreed to the payment of an interest-free advance to the firm upto Rs. 150 lakhs. The acceptance of the offer was communicated to the firm on 27 August, 1977. While the terms of the agreement remained under dispute, interest-free advance totalling Rs. 50 lakhs had already been paid to the firm during February-March 1978. The agreement was finally signed in August, 1978. Audit has pointed out that the firm had got an unintended benefit of Rs. 2.81 lakhs, being the interest (computed at the rate of 12.5 per cent) on Rs. 50 lakhs till July, 1978.

1.176. The Committee desired to know on what considerations the work was awarded to M/s. Gammon India Ltd. In a note,\* the Ministry have stated:

"Tenders for fixing the contract for the construction of Tailrace tunnel were initially received in September 1976 from the following firms at the evaluated prices shown hereunder:

Name of the firm	Total value of loaded offer (Rs. in crores)
M/s. N.P.C.C.	16.17
M/s. Gammon India Ltd.	13.42
M/s. H.C.C.	16.28
M/s. Jai Prakash Associates	11.49
M/s. Hydle Const. Company	18.72

The Tender Committee conducted negotiations with M/s. Jai Prakash in their capacity as lowest tenderer. While the negotiations with the lowest tenderer were on, the validity expired. The lowest tenderer while extending the validity, revised his offer, incorporated additional conditions involving extra financial implications which were not acceptable. Accordingly, it was decided by the Standing Committee to invite fresh bids from the original tenderers on the basis of a common set of special conditions. Fresh bids were received from the following

\*No. vetted.

tenderers in June 1977 and the value of these bids was as under:

Name of the firm	Face value of offer
M/s. N.P.C.C.	Rs. 10.20 crores
M/s. Gammon India Ltd.	Rs. 9.49 crores
M/s. H.C.C.	Rs. 12.01 crores
M/s. Hydle Const. Company	Rs. 12.38 crores

The offer of M/s. HCC and Hydel Construction being higher and their having given a large number of special conditions, having financial bearing, were not considered for evaluation. M/s. Gammon India Ltd. being the lowest tenderer was awarded the contract vide Govt. Order number 4/208/77-CHE dated 26th August, 1977."

1.177. Asked about the reasons why interest free advance of Rs. 50.00 lakhs was paid (February|March, 1978) when the draft contract was under dispute, the Ministry of Energy have stated:

"In this connection it is stated that after negotiating with the firm 'G' a letter of Award, incorporating all special terms and conditions was issued in favour of M/s. Gammon India Ltd. The firm accepted the letter of award. The issue of letter of award and its unconditional acceptance by the firm legally constituted contract between the parties. The letter of award *inter-alia* provided for the following:

- (a) Payment of lumpsum advance of Rs. 15.00 lakhs for accommodation and service sheds within 15 days of submission of layout of the same.
- (b) Payment of lumpsum advance of Rs. 15.00 lakhs for construction aids within 15 days of commencement of installation of first plant item at site.
- (c) Payment of lumpsum advance of Rupees 20.00 lakhs for the mobilisation within 15 days from the date of acceptance of tender.



M/s. Gammons had met all the pre-requisites laid down under (a), (b) and (c) above after the letter of Award had been issued to them, thus entitling them to the payment of advance stipulated under the above cited conditions. It is clear from the above provisions of the letter of award that the release of the advances under these conditions was not conditioned to signing of the contract deed."

1.178. During evidence (August, 1979) the Secretary of the Ministry clarified:

".....there is an annexure to a letter of award which sets out the terms of the contract till a final document is concluded and this annexure provided for secured advance payment..... Money was paid under the terms of annexure....."

1.179. In reply to a question whether the conditions on which the advance was payable were actually fulfilled the representative of the NHPC stated:

"The contractor fulfilled all these conditions. We have verified that payments were made only after each of these conditions was complied with."

1.180. Asked what was the urgency for advancing Rs. 50 lakhs when tailrace tunnel was the last item in power generation and was needed only after the power house was erected, the representative of the NHPC stated:

"This was in terms of the letter of intent placed on the contractor. Thereafter it was a legal obligation to make the payments."

1.181. The Ministry of Energy have further stated.

"The recovery of interest charges amounting to Rs. 2.81 lakhs on this interest-free advance would be in contravention of the provisions of the contract and question of its recovery, therefore, does not arise."

1.182. Clarifying the position further during the evidence in October, 1980, the Secretary, Ministry of Energy stated:

"It is a mobilisation advance. In large civil construction contracts there is mobilisation advance which is paid which is generally interest free."

1.183. Asked why the advance was paid even before the agreement was finalised, the witness stated:

"This was part of the letter of intent. It is quite possible if advance was not there the contractor would have asked for higher rate."

1.184. In reply to a question if there were any precedents of this nature, the Director, Finance (NHPC) replied:

"We have precedents from any number of cases.....some are interest free."

1.185. In a further note on the subject the Ministry have stated (November 1980):

"In response to the original call of tenders for the work, all the 5 tenderers had asked for interest free advance in their offer as under:

	Interest free advance for mobilisation and preliminary works	Interest free advance for machinery
M/s. N.P.C.C. . . . .	Rs. 100 lakhs	Without limit
M/s. Gammon India Ltd. . . . .	7-1/2% of the contract value. (computed as Rs. 79.20 lakhs) .	Without limit
M/s. H.C.C. . . . .	Rs. 50 lakhs	Rs. 250 lakhs
M/s. Hydle Cont. . . . .	Without Limit	Without Limit
M/s. Jai Prakash Assocites . . . . .	Rs. 50 lakhs	Rs. 50 lakhs

1.186. It would be seen from the above that all the tenderers had stipulated interest free advance both for mobilisation and preliminary works as well as for machinery. During negotiations it was evident that none of the tenderers was prepared to relent on this condition of interest free advance. Accordingly while inviting fresh bids for the work it was considered inevitable to accept this position in the interest of receiving competitive offers on a uniform basis. Hence a common set of special conditions was

offered to the various tenderers by the department envisaging payment of the following interest free advances:

- (i) Advance against mobilisation, preliminary & enabling works . Rs. 50 lakhs  
 (ii) Advance against machinery . . . . . Rs. 150 lakhs

As provided for in the revised N.I.T. all the above advances were to be released initially against bank guarantee bonds but advances against machinery were to be subsequently replaced by a hypothecation deed in favour of the Government.

1.187. The condition of interest free advance was, therefore, offered as a special condition by the department to all the tenderers in the revised N.I.T. and was not a special consideration granted to M/s. Gammon India Ltd. A comparative picture in respect of the lowest two tenderers, whose offers have been evaluated is as under:

Name of the firm	Original value of offer (loaded) (Rs. in crores)	Revised value of offer
M/s. N.P.C. C.	16.17	10.20
M/s. Gammon India Ltd.	13.42	9.49"

1.188. Asked whether the Law Ministry had been consulted in the matter, the Ministry of Energy have stated that the draft Contract agreement including the clause on issue of interest free advance was vetted by Ministry of Law before the agreement was signed with M/s. Gammon India Limited and they did not raise any objection on this.

1.189. The Committee do not find any merit in inviting tenders for the tail race tunnel and issuing the tender documents without the drawings and designs of the work required to be done and thereafter extending the date of receipt of tenders, as was done in the present case. In future, tenders for works should be invited only after the designs and drawings of the work proposed to be done are complete in all respects and these should be made available to the prospective tenderers along with other Tender Documents.

1.190. The Committee feel that payment of advance of Rs. 50 lakhs without interest to M/s. Gammon India Ltd. without settling before-hand certain special conditions of the agreement was imprudent as in the event of contractor's refusal to agree to the special conditions the money advanced would itself have become difficult to recover. The Committee consider that in such cases, the conditions of the agreement should invariably be settled prior to payment of advance. The Committee would also like that this matter is examined in depth in consultation with the Ministry of Finance and suitable guidelines issued so that the interests of Government are adequately safeguarded.

*Anticipated delay in the completion of tunnel*

1.191. As per terms of contract drawn with the contractor (M/s. Gammon India Ltd.) the work is scheduled to be completed within a period of 58 months from the date of start i.e. from 24 November, 1977. Excavation tunnel bring has to be completed in 40 months. The scheduled date of the completion of work as per the contract, is therefore, 24 September, 1982. The progress of the work upto October 1980 is as under:

Item of work	Estimated quantity	Progress ending October, 1980
1. Open platform cutting	..	Work completed.
2. Construction of shaft for Tunnel No. 1	..	Work completed.
3. Construction of shaft for Tunnel No. 2	40 M depth	32 metres completed.
4. <i>Excavation of tunnel boring</i>		
(a) <i>Exist face</i>		
(i) Heading	1510 M	200 M
(ii) Benching	1510 M	6 M
(b) <i>Interface</i>		
(i) Heading	900 M	50 M
(ii) Benching	900 M	Nil
5. Concrete lining	2410 M	Nil

1.192. The Committee enquired when the work of the tailrace tunnel is expected to be completed. The Ministry of Energy in a note\* have stated:

\*Not vetted.

"The progress of the work of M/s. Gammon India Ltd. has not so far been up to the schedule and it is now expected that the tunnel would be completed by March, 1984 according to the construction programme submitted by M/s. Gammon India."

1.193. Asked about the efforts being made to ensure that the work is completed according to the revised schedule, the Chairman-cum-Managing Director, NHPC stated in evidence (October, 1980):

"There is separate monitoring done for the project. At the project site we have the monitoring team. At corporate level every month meetings are there with project officers.

Progress of the work is reviewed—bottlenecks and criticalities are studied; what resolutions are required are discussed. I am personally aware of the delay and I have requested the Chief Executive of Gammons to come; but unfortunately he could not respond so far to my ..... for discussion, may be due to other commitments and so on he is not able to come and meet us for discussion. All the same, we are concerned about the slow progress of the works..... On present indications given by M/s. Gammons they hope to complete the tunnel by 1984. But I am very doubtful if they would adhere to the revised schedule. We are watching it very carefully. We will take action if they do not stick to the target."

1.194. The Committee desired to know about the penalty clauses provided in the contract agreement which could be invoked in case the contractor delayed the work beyond the target date. The Director, Finance replied:

"Compensation for delay is there. It is in terms of liquidated damages to be imposed on them due to delay that is beyond control or to the extent of 25 lakhs. This is the total."

1.195. Asked how there could be a blanket provision like this in a crucial part of the project, the Secretary, Ministry of Energy stated:

"Normally liquidated damages are per week's delay—that is subject to a maximum of so and so."

1.196. In reply to a further question regarding the total cost of the tunnel, the total expenditure incurred so far and the amount already paid to M/s. Gammon India, the Director Finance (NHPC) stated:

"The revised figure now is roughly about Rs. 21 crores. So far, the total expenditure on the tunnel is Rs. 4 crores. Gammons alone were paid about Rs. 2 crores."

1.197. In a further note on the subject, the Ministry have stated:

"The contract has adequate provisions for dealing with the firm in case the work is delayed beyond the target dates. The Project authority, besides levying compensation for delay upto a limit of Rs. 25.00 lakhs under Clause 2 of the contract can determine and terminate the contract, under Clause 3 of the contract. Clause 3 of the contract provides for the following alternatives to the department in case of delayed completion:

- (i) To rescind the contract and get the balance work done at the risk and cost of the original contractor after giving 15 days notice to the contractor.
- (ii) Supplement the resources of the contractor by employing labour and other resources directly on the work and recovering the cost of such additional inputs from the dues of the contractor. The contract in this clause further provides that in the event of any one or more of the courses being adopted by the Engineer-in-charge, the contractor shall have no claim for compensation or any loss sustained by him as a result of such action."

1.198. The Committee find that the work of construction of the tail race tunnel was scheduled to be completed within 58 months of the start of the work i.e. by 24 September, 1982. However, the progress is very slow as only 256 metres of tunnel boring has been completed till October 1980 out of the total length of 4820 metres required to be excavated. In fact the excavation work of tunnel boring was originally scheduled for completion by January 1981 i.e. within 40 months of the start of excavation work as per the terms of the contract. The firm has submitted revised target date for the completion of Tailrace tunnel by March 1984. The Chairman-cum-Managing Director, Salal Project was candid enough to inform the Committee during evidence that the Chief Executive of

the firm had not responded to his invitation for discussion and that he was doubtful if they would adhere even to the revised schedule.

1.199. The Committee take a serious view of the whole matter and desire that this should be sorted out at the earliest with the contracting firm. In case the firm expresses its inability to adhere even to the revised schedule, notwithstanding the facility of interest-free advance of Rs. 50 lakhs given to it, the Committee would like the Ministry to invoke the penal provisions in the agreement and take alternate steps to get the work done by the stipulated date.

### *Miscellaneous*

#### *Shortage of Cement and Steel*

1.200. Any construction programme depends, apart from design and other inputs, on the timely availability of the required quantities of material such as cement, steel, explosives, POL etc. Any shortfalls in the scheduled receipt of these materials can vitally affect the progress of construction. The Committee were informed that "unfortunately such a situation has prevailed on this Project from 1979 onwards. While the acute shortage of explosives was over-come by imports and the POL shortage also resolved due to extra-ordinary efforts, the shortage of cement and steel has seriously upset the construction programme during 1980. The position even as of now is extremely critical."

1.201. During evidence (October 1980), the Committee desired to know the procedure for procurement of cement and steel and steps being taken to obtain the requisite supplies in time and as per requirements. In reply, the Secretary, Ministry of Energy during evidence stated:

"In regard to cement and steel we do not select the sources. In case of cement, the Cement Controller who coordinates for the whole of India is located in the Ministry of Industrial Development. He gets the indents from all over the country and he decides and links the requirements with the producing centres. But during the last one year and particularly during the last working season, prior to the recent monsoon the cement shortage on the whole in the country was so great and it affected a project of this type much greater. In case of cement in 1979, the position was reasonably good. The shortfall is 5000 tonnes against the requirements of 56,000 tonnes. That works out to 10 per cent as of date. There is still more than a quarter. We

have received a supply of only 15,000. We should be receiving about 35,000 tonnes. Consuming 35,000 tonnes would not be possible because it has to be spread over."

1.202. Asked about the places from which supplies of cement were received, the Chairman-cum-Managing Director, NHPC stated:

"From all over the country and primarily from southern factories.... from Tamil Nadu."

1.203. The Committee enquired how much time it takes for a wagon to reach Salal from Tamil Nadu, the witness replies:

"About 2 to 3 weeks."

1.204. In regard to Steel supplies, the witness stated:

"The process is basically the same. SAIL coordinates and the indigenous capacity not being adequate they also import steel....but the problem is that in theory this process went on but the shortage in certain sections particularly was so great that many of the projects did not get adequate quantity."

1.205. The Committee are disturbed to find that a major Project like the Salal Project has of late been facing acute shortage of critical items like cement and steel. Only 10 per cent of the requirements of cement were met during 1980 (upto October 1980) and what is worse the supplies were not evenly spread over. The Committee were informed that even the sources of supply are the Southern State like Tamil Nadu which is more than two thousand kms. away from the project site. The Committee do not find any rational justification in allocating cement for Salal Project from such far off places which not only adds to the cost of inputs on account of higher transportation charges but also leads to delays. The Committee recommend that the Ministries of Steel and Industry should make arrangements for supply of steel and cement for the project from the nearest available sources and as per schedule of requirements. The Committee further recommend that for such a critical project, Government must ensure timely supply of essential inputs like steel and cement. This is a serious matter which needs immediate attention of the concerned authorities so that such deficiencies do not hold up the progress of the Project any further.

#### *Conclusion*

1.205. The Salal Project presents a typical example of vital projects getting bogged down during construction for various reasons.



some of which could have been easily foreseen. The Project has shown heavy over-runs of time and cost as can be seen from the fact that whereas it was initially expected to have been commissioned by June 1979 at an estimated cost of Rs. 55 crores, the latest anticipation is that the first unit of the project would not be Commissioned before March 1987 and the total expenditure involved would be as high as Rs. 350 crores provided further delays do not occur. What comes out prominently from the Committee's enquiry is the utter inadequacy of pre-construction investigation which resulted in frequent changes in designs and construction drawings. In fact, geological, geo-physical and geo-technical investigations had to be continued over the years in respect of several major components of the project during execution. This resulted in substantial increases in the quantities of work required to be done with consequent increases in cost and delay in execution. Had adequate investigations for preparation of detailed designs and drawings been conducted before awarding the work for various components of the project, the parameters of the problem could have been more precisely delineated and numerous changes that had to be made therein resulting in higher costs, could have been avoided.

1.207. Yet another unfortunate aspect of the history of this project is the lack of direction from the top and insufficient coordination among the various agencies involved in its execution. It was only as late as in May 1978 that decision was taken to hand over the Project to the National Hydro-electric Power Corporation—a public sector undertaking for execution on agency basis since it came to be realised that execution of such projects through departmental efforts was not conducive to expeditious decision making. The tardy implementation of the project is therefore the direct result of the failure of management at the top level to come to grips with the complexity of the job they had undertaken upon themselves. The Committee trust that the lacunae pointed out by them in this report would be gone into in depth so that suitable remedial measures can be taken for the future.

NEW DELHI;  
 March 3, 1981  
 Phalguna 12, 1902 (S).

CHANDRAJIT YADAV,  
 Chairman,  
 Public Accounts Committee.

## APPENDIX-I

*Audit Paragraph*

(Vide para of Introduction)

### *Salal Hydro-Electric Project*

1.0. *Introductory*—The Salal Hydro-Electric Project is a 'run-of-the river' scheme (i.e. without any storage reservoir) on the river Chenab located at Dhyangarh loop near Reasi, about 100 kilometres from Jammu. Investigations for the project were started by the Government of Jammu and Kashmir in 1961 continued till August 1970 when the project was taken over by the Government of India for execution. The ultimate installed capacity of 690 megawatts (MW) of power and is to be implemented in two stages, the second stage being dependent on storage schemes to be executed in the upper reaches of the river Chenab. The first stage of the project which is under execution, provides for an installed capacity of 345 MW of power. It consists of the following major components:—

- (a) a diversion tunnel 184 metres long with a diameter of 9.14 metres;
- (b) a concrete dam 106 metres high and 451 metres long comprising 25 blocks, of which 12 blocks constituting the spillway, 6 blocks the power dam and the remaining 7 blocks the non-overflow dam;
- (c) a rockfill dam 115 metres high and 615.7 metres long at the top;
- (d) six penstock pipes each of diameter 5.23 metres;
- (e) a power house on the right bank of the river below the natural surface to gain an additional head of 10.8 metres and three generating units, each of 115 MW;
- (f) a tail race tunnel 2.4 kilometres long and of diameter 11 metres to discharge water from the power house into the river down-stream; and
- (g) four 220 kv transmission lines of a total circuit length of 462 kilometres for transmission of power from the project to the northern grid.

1.1. *Organisation.*—The construction organisation for the project was set up in August 1970 when the construction of the project was taken over by the Government of India. An independent Chief Engineer for the project was posted in January 1971. The overall control of the project, along with other central hydro-electric projects, was entrusted to the Central Hydro-Electric Projects Control Board, with the Secretary, Department of Power as Chairman, which was set up in 1970 by the Government of India. There was a standing Committee to assist the Board; the Standing Committee had three committees, viz. the Tender Committee, the Technical-Advisory Committee and the Purchase Committee to assist it. The Chief Engineer stated (December 1978) that only skeleton staff was in position between 1970 and 1973 and that even after sanction of more posts paucity of suitable personnel led to delays in getting officers in position.

The control of the project, along with its assets and liabilities, was transferred on 'agency' basis to the National Hydro-Electric Power Corporation from 15th May 1978.

The powers of the Chief Engineer included:

- acceptance of the lowest tenders in respect of works upto Rs. 50 lakhs without the approval of the Control Board, tenders for works in excess of Rs. 25 lakhs being accepted in consultation with the Financial Adviser and Chief Accounts Officer (FA and CAO) of the Control Board;
- acceptance of single tenders or award of work by acceptance of a tender other than the lowest upto Rs. 30 lakhs without the approval of the Control Board, such tenders in excess of Rs. 15 lakhs being accepted in consultation with the FA and CAO;
- award of work without call of tenders on work orders up to Rs. 2 lakhs under certain conditions;
- award of contracts against "split-up" sub-heads of work up to Rs. 0.50 lakh in consultation with the FA and CAO; and
- full powers for accord of technical sanction to detailed estimates.

1.2. A project accounts office, headed by a Project Accounts Officer was set up from April 1973 for exercising pre-check of payments and keeping the accounts of the project. Cases requiring consultation with the FA and CAO were to be referred to him at Delhi till June 1977 when a Deputy Financial Adviser and Chief Accounts Officer was posted at Salal.

1.3. The accounts of the project until 31st March 1978 were test-checked in audit. Subsequent development, wherever considered appropriate, have also been referred to.

2.0. *Project estimates.*—The original project estimate of Rs. 55.15 crores for the first stage was prepared by the Directorate of Designs and Planning, Government of Jammu and Kashmir, in October 1968 on the basis of analysis of rates prepared in April 1968 for some items and the rates of Ramganga Project estimate (1965-66) for other items. The project originally envisaged an installed capacity of 270 MW (3x90 MW) in the first stage with an ultimate capacity of 540 MW (6x90 MW) this revised in June 1971 to have an installed capacity of 345 MW (3x15 MW) by increasing the head for the turbines from 81 metres to 93 metres by depressing the location of the power house below the bed of the river and constructing a tail race tunnel to discharge the water into the river at the next loop downstream. The project estimate was accordingly revised in March 1974 to Rs. 112.98 crores. The rates adopted in this estimate were based on the analysis of rates prepared in 1973. None of the major works had by then been put to tender and, as such, the costs were tentative. The Ministry of Energy (Department of Power) did not approve the revised estimate (1974) but desired (March 1976) that the estimate should be revised on the basis of the latest indication of prices and rates. The estimate was further revised to Rs. 222.13 crores in September 1976 after taking into account change in the design of the diversion arrangement, escalation of prices, increase in the scope and cost of electrical works, etc. The revised estimate was approved by Government for Rs. 222.15 crores in May, 1978.

2.1. The following table shows the revised estimates for different items of work as compared to the Original estimates and the expenditure incurred upto December 1978:—

Items of work	Original sanctioned estimate 1968	Revised estimate		Expenditure upto to December 1978
		1974 (not sanctioned)	1976 (sanctioned)	
<b>Direction and administration</b>	375.70	735.67	1,904.35	423.76
Machinery and equipment.	312.11	5.86	1,375.89	2,239.4
Stock suspense/receipts and recoveries on capital accounts	(—) 206.89	(—) 8.00	(—) 679.01	559.43
<b>Dams:</b>				
(i) Rockfill dam	1,451.53	2,289.31	4,028.70	
(ii) Concrete Dam	1,693.14	2,300.17	3,959.36	
(iii) Diversion tunnel	47.14	288.60	595.48	
(iv) Maintenance during cons truction	30.55		85.83	
Water conductor system, penstocks, etc.	110.85	183.56	641.55	100.2 <sup>3</sup>
Power house	173.32	163.43	1,201.32	366.6 <sup>0</sup>
Generating plant and machinery	772.11	3,188.69	3,276.70	1,014.96
Transmission and distribution	269.12	316.13	1,361.03	23.40
Communications and buildings	257.52	824.55	1,187.55	948.16
Ancillary works	107.06	133.21	938.65	368.01
Other expenditure, etc.	121.57	203.89	506.51	186.86
Tail race tunnel	..	672.81	1,831.07	190.13
<b>TOTAL</b>	5,514.93	11,297.88	22,214.98	8,090.81

2.2. *Reasons for increase in cost.*—The increase in cost of Rs. 167 crores as compared to the original estimate has been broadly classified in the second revised estimate (1976) as under:

	(Rupees in lakhs)
(i) Increase in cost due to change in location of power house from left to right bank (Rs. 571.12 lakhs), provision of tail race tunnel (Rs. 1,331.07 lakhs), provision for concrete coffer dam between pen-stocks and spillway (Rs. 101 lakhs) and additional length of penstocks (Rs. 53 lakhs) and other factors	2,592.68
(ii) Increase in cost due to change in design and quantities as per latest design and quantities as per latest drawings of Central Water Commission (CWC)	3,363.37
(iii) Increase in cost of electrical works due to increase in total length of transmission lines from 150 kms. to 462 kms	480.57
(iv) Increase in cost of account of items not provided or inadequate provisions made in the original estimate	1,406.69
(v) Increase in cost due to escalation in labour and material cost:	
Civil works	4,190.31
Electrical works	3,416.43
(vi) Increase in provision for direction and administration due to increase in wages and departmental execution of rockfill dam	1,250.00
<b>TOTAL</b>	<b>16,700.05</b>

Increase in the cost of various components of the project has been discussed at appropriate places in this review.

3.0. *Progress of work.*—The progress of work on the main components of the project up to December 1978 was as under:

- (i) **Diversion tunnel**—Out of 3.16 lakh cubic metres, excavation of 2.92 lakh cubic metres had been completed; concreting had been completed for 0.35 lakh cubic metres out of 0.36 lakh cubic metres. The entire work including grouting and erection of gates was expected to be completed in 1980.
- (ii) **Concrete dam**—Out of 18.99 lakh cubic metres, excavation of 16.50 lakh cubic metres had been completed; concreting had been completed for 0.73 lakh cubic metres out of 13.97 lakh cubic metres, grouting had been completed to the extent of 22.5 per cent.
- (iii) **Rockfill dam**—Out of 11.85 lakh cubic metres, excavation and stripping of 6.83 lakh cubic metres had been completed;

“fillplacement” of 3.25 lakh cubic metres had been done out of 74.94 lakh cubic metres.

- (iv) Power house—Hill side excavation of 10.69 lakh cubic metres had been completed but construction of the building had not (December 1978) been taken up.
- (v) Access roads to site—Two site roads (27 kms. long), link roads (8 kms. long) and pre-stressed bridge at Dhyangarh had been completed.
- (vi) Out of 3.347 residential houses, 2.652 had been completed.

3.1. *Commissioning.*—According to the Project Report of 1968, it was anticipated that the three units of 90 MW each would be commissioned in June 1975, June 1976 and June 1979 respectively. In the first revised estimate (1974) envisaging an installed capacity of 345 MW ( $3 \times 115$  MW), the target dates of commissioning of the three units of 115 MW each were shifted to March 1979, September 1979, and May 1980. In the second revised estimate (1976) the target dates of commissioning the three units were indicated as February 1982, June 1982 and August 1982. According to the progress report of March 1978, these units were expected to be commissioned in November 1984, January 1985 and March 1985. According to the latest construction schedule (as intimated by the Chief Engineer in December 1978), river diversion is to take place in October 1980 and the first unit is to be commissioned in 1985-86.

The reason for delay in completion of the project were stated by the project authorities to be:

- (i) frequent changes in the design of the diversion tunnel resulting in delay in its completion. The work awarded initially in March 1972 for completion by August 1973 had not been completed (December 1978);
- (ii) change in the location of the power house from the left to the right bank and construction of tail race tunnel;
- (iii) delay in finalisation of designs of major structure, viz. rockfill dam and concrete dam;
- (iv) more shear zones in the concrete dam site noticed during execution and longer time required in deciding method of grouting and foundation treatment; and
- (v) delay in allotment of major works like concrete dam, power house and tail race tunnel.

Tender for the concrete dam were first involved in December 1973 but no decision was taken as negotiations with the lowest tenderer, firm 'C', failed on the question of compensation to be paid to the firm in the event of delays in the progress of work attributable to the department and in the event of shortfalls in the matching progress of rockfill dam. Fresh bids were called in June 1975 and the work was awarded to firm 'H' in July 1976. Tenders for the construction of the first stage power house sub-structure, etc. were invited in June 1977 and the work was awarded to firm 'N' in June 1978. Likewise, for the tail race tunnel, tenders were invited in October 1975 and the work was awarded in August 1977.

Delay in finalisation of designs, etc. had been attributed (December 1978) by the Chief Engineer to unanticipated technical and geological factors which came to light only during construction though investigations had covered a period of 9 years from 1961 to 1970. As regards delay in awarding of major works, repeated negotiations examination and approval of complicated conditions put forth by tenderers, etc. were stated to be the main reasons.

Points noticed in audit of the various tenders and works are mentioned in the succeeding paragraphs.

#### 4. Diversion tunnel

4.0. Award of contract.—In response to notice inviting tenders for the diversion tunnel and Coffor Dam issued in October 1971, a single tender from firm 'N' was received for Rs. 176.62 lakhs. As a result of negotiations held by the tender committee, firm 'N' agreed to reduce its rates for some of the items, the total reduction amounting to about Rs. 1.74 lakhs, on the basis of advertised quantities, but the firm stipulated additional conditions demanding price escalation in the cost of labour and material and extra payment for dewatering. Without settling aforesaid conditions, the contract was awarded to firm 'N' in March 1972 at the negotiated cost of Rs. 170.23 lakhs for the diversion tunnel including Coffor Dam. The schedule of quantities in respect of the Coffor Dam was not worked out. The additional conditions of firm 'N' were discussed by the tender committee in October 1974. Based on its recommendations, sanction of Government was issued in February 1975 accepting the additional conditions regarding (i) price escalation and (ii) extra payment for dewatering limited to Rs. 7 lakhs for the whole work including Coffor Dam.

Meanwhile, a number of changes were effected (March 1973 onwards) in the design of the tunnel including construction of adit and



shaft for installation of gates, necessitating remodelling of the section of the tunnel already bored (mentioned in paragraph 4.1) and a longer and more elaborate downstream exit structure.

The alignment of the tunnel which was originally designed to be straight, was given a turn in the middle in the revised design due to the geological conditions met with the work of adit and shaft was also awarded (March 1975) to firm 'N' for an estimated cost of Rs. 50.72 lakhs. Thus, the total value of the contract increased to Rs. 220.95 lakhs.

In November 1976, an increase of Rs. 187.17 lakhs over the sanctioned contract amount was reported to the Control Board for approval. The increase in cost was attributed to increase in quantities and extra items.

Since, in the meantime, the execution of the project had been transferred to the National Hydro-Electric Power Corporation (May 1978), the Corporation accorded (July 1978) sanction of Rs. 365.14 lakhs against the total contract amount of Rs. 408.12 lakhs (i.e., Rs. 220.95 lakhs + Rs. 187.17 lakhs) for which sanction was sought, the difference being due to price escalation included in the project proposal but not included in the sanctioned amount. The sanction also stipulated payment of dewatering charges at the contract rate up to Rs. 14 lakhs plus escalation on dewatering charges subject to an overall ceiling of Rs. 18 lakhs.

As against the sanction of Rs. 365.14 lakhs, Rs. 348 lakhs had been paid to firm 'N' up to August 1978. This included Rs. 33.78 lakhs on account of price escalation and Rs. 10.50 lakhs for dewatering charges.

In respect of a number of items, the payment made to the contractor as per the last running bill (i.e. 37th paid in September 1978) had exceeded the amount sanctioned by the Corporation owing to increased quantities/extra items. The excess still (December 1978) to be regularised worked out to Rs. 13.67 lakhs.

4.1. *Dismantling of portions of work done.*—The alignment of the diversion tunnel was finalised by Central Water and Power Commission (CWPC) in September 1971 on the basis of which tenders had been invited and work awarded. The alignment was, however, changed in August 1972 on geological considerations, the change also resulting in reduction of the length of the tunnel. On the basis of the revised alignment, the work was started in August 1972. As per original designs, the gate structure was to be located at the inlet

of the tunnel. The detailed progressive geological mapping of the tunnel excavation commenced in November 1972, however, indicated that the rock at the inlet was not sound enough for locating the gate structure of the type designed. After considering alternative proposals, the Technical Advisory Committee approved (March 1973) construction of the gate chamber in the centre of the tunnel involving construction of an underground shaft, hoist chamber with a suitable approach adit tunnel opening on the downstream side. By this time, the tunnel had been bored and permanently supported with steel ribs and ROC laggings. The revised designs necessitated dismantling of a portion of work done. The expenditure on dismantling was stated (July 1977) to be Rs. 2.67 lakhs and the cost of the portion dismantled was Rs. 5.78 lakhs. The project authorities stated (December 1978) that the geological features necessitating the change in the design could not be foreseen by the preliminary investigations.

The flood level of the river was EL 422 metres and the tunnel invert was at EL 405.4 metres. As against this, the top level of the Cofferdam was at EL 417.7 metres and that of its foundation at EL 406.1 metres. The project authorities stated (July 1977) that it was impossible to found the Cofferdam at a lower level at the inlet portal and that due to inadequate foundations, it could not be raised above the flood level of EL 422 metres. As a result, the tunnel had to be plugged with a concrete wall every year in June and the wall had to be dismantled in October. On this work, Rs. 3.81 lakhs were spent from 1974 onwards, i.e. after the expiry of the original stipulated date (August 1973) of completion of the tunnel. The project authorities stated (December 1978) that the sequence of construction of the tunnel was such that it involved dismantling and rebuilding of the up-stream plug wall year after year.

4.2. *Damage to downstream Cofferdam.*—For facilitating the work of construction of diversion tunnel, the downstream Cofferdam designed to withstand a discharge of 4 lakh cusecs of water, was constructed in February 1972 at a cost of Rs. 24.20 lakhs. In August 1976, a portion of the Cofferdam, about 30 metres in length, was washed away owing to floods in the river. The river discharge during the flood was reported to be 2.78 lakh cusecs. The extent of damages was Rs. 6.20 lakhs.

On restoration and protection of the Cofferdam, Rs. 13.53 lakhs were spent (March 1977). An enquiry officer appointed by Government to look into the reasons for the damage to the Cofferdam reported (June 1977) that the Cofferdam, being a temporary structure, was meant for a short duration of three years during which

period the diversion tunnel was to have been completed and the Coffer Dam dismantled. But due to delay (as explained below) in completion of diversion tunnel, it was not dismantled. It was stated in the report that the Coffer Dam served its purpose satisfactorily for 4 rainy seasons, viz. 1972—75.

Nevertheless, the fact remains that the tunnel had not yet been completed (December 1978) and the Coffer Dam did not serve the intended purpose fully.

4.3. *Delay in completion.*—The work awarded in March 1972 was to have been completed by August 1973. It was still (December 1978) in progress and extensions of time had been sanctioned up to September 1978 on the following grounds:—

- (a) increase in the quantities of the work;
- (b) alterations in the alignment, section, design and location of the tunnel and inlet as well as outlet structures during execution;
- (c) award of additional works of difficult nature, such as, adit, shaft, hoist chamber, etc.;
- (d) delay in finalisation of drawings, last revised drawing of the shaft finalised in February 1975 by CWC;
- (e) delay in placing orders for the supply of gates and liners;
- (f) delay in finalisation of designs of holsts; and
- (g) hold-ups due to shortage of steel, collapse of downstream Coffer Dam, etc.

The delay was also attributed (September 1977) by the Superintending Engineer, Civil Circle No. 1, to lack of adequate efforts on the part of firm 'N'. The delay in completion of the diversion tunnel resulted in—

- (i) payment for price escalation (Rs. 33.38 lakhs up to August 1978) and increase in limit of dewatering charges from Rs. 7 lakhs to Rs. 18 lakhs (Rs. 10.50 lakhs paid up to August 1978);
- (ii) an expenditure of Rs. 13.53 lakhs on the restoration of the Coffer Dam which was washed away;
- (iii) nugatory expenditure on repeated dismantling and re-constructing the plug wall (Rs. 3.81 lakhs); and

- (iv) delay in diversion of the river without which post-diversion works in rockfill dam and concrete dam could not be done.

4.4. *Purchase of steel.*—To meet the urgent requirements of steel for the diversion tunnel, the Chief Engineer placed (January 1973) an order on the lowest tenderer, firm 'A', for the supply of 800 tonnes of tor steel at the rates of Rs. 2,062 per tonne for 160 tonnes (20 mm). and Rs. 2,095 per tonne for 640 tonnes (28 and 32 mm). Government approval was not obtained for placing the order outside the Joint Plant Committee (JPC) rates. The Standing Committee of the Board, however, ratified the purchase in its meeting held on 21st May 1974 subject to the Chief Engineer certifying that the material was according to specifications.

Against 782 tonnes of tor steel despatched by the firm (according to despatch documents) between 5th February 1973 and 25th October 1973, the project received 720 tonnes and Rs. 14.68 lakhs (being 95 per cent of the price of the quantity despatched except 55 tonnes of which payment had been withheld) were paid to the firm through a bank. In February 1974, when the steel was used, the Assistant Engineer, Dam Sub-Division No. 1, reported to the Executive Engineer that the steel bars broke on bending. Samples of the steel bars were then got tested (April 1974) in the Delhi College of Engineering. According to the test report, one sample out of the five failed in bend test. Elongation test could not be conducted on five out of seven samples mainly because the samples fractured outside the gauge length marked. In one case, the test report indicated that the steel seemed to be very brittle. Notwithstanding this test report, most of the steel was used on the work as the Chief Engineer considered that the failure of a sample in bend test was a stray case.

Against Rs. 15.10 lakhs payable to the firm for the quantity of 720 tonnes actually received, after adjusting Rs. 0.37 lakh on account of demurrage and wharfage recoverable from it, Rs. 14.71 lakhs (including Rs. 4.03 lakh being part of 5 per cent price) were paid.

#### 5. Concrete dam

5.0. Increase in cost.—The increase in the estimated cost of concrete dam from Rs. 1,693.14 lakhs in the original estimate (1963) to Rs. 3,959.36 lakhs in the second revised estimate (1976) was attributed mainly, besides escalation in cost of labour and material, to the following:—

- (i) increase in cost of spillway due to lowering of some blocks for diversion arrangement and concreting (Rs. 177.50 lakhs);
- ....

- (ii) increase in cost of shear zone treatment and grouting including chemical grouting Rs. 344.41 lakhs);
- (iii) increase in the number of crest gates and their cost as well as the cost of hydraulic hoists (Rs. 332.39 lakhs);
- (iv) non-provision of abutment drainage and grouting in the earlier estimates (Rs. 66.25 lakhs); and
- (v) elimination of a saving of Rs. 296 lakhs anticipated in the original project estimate on account of re-use of the material excavated from the concrete dam in the rockfill dam. The amount of saving was shown as Rs. 424 lakhs in the first revised estimate (1974—not sanctioned) on account of increased quantity of excavation. The saving had, however, been eliminated in the second revised estimate (1976) on the ground that excavation for concrete dam had to precede construction of rockfill dam and the two works could not be executed simultaneously to permit such direct utilisation of excavated material.

Against 21.20 lakh cubic metres of re-usable material for which credit of Rs. 424 lakhs was anticipated in the first revised estimate (1974), the quantity stockpiled was 5.12 lakh cubic metres only. The project authorities explained (July 1978) that (a) the entire quantity could not be stored for want of adequate space, (b) stockpiling by the side of the river bank by use of crates tried in early 1973 did not succeed, and (c) the material was washed away in the floods of August 1973. Of 5.12 lakh cubic metres of material that was stockpiled for re-use, 2 lakh cubic metres were to be used in the main concrete dam as per contract with firm 'H' and the remaining 3.12 lakh cubic metres were meant for re-use in the rockfill dam. The second revised estimate of rockfill dam however, did not provide for any credit for the re-use of this material nor had the material been taken over (December 1976) by the Construction Facilities Division for the rockfill dam.

5.1. Consolidation grouting.—The work of 'consolidation grouting of formation rock below spillway' was awarded to firm 'N' (a Government Undertaking) at its tendered cost of Rs. 32.65 lakhs in December 1974. The work was started on 10th December 1974 on the basis of drilling and grouting parameters adopted after conducting trial grouting through another firm. The results of the grouting were not very effective and a note on the evaluation of results was sent to the Central Water Commission (CWC) in July 1975. The matter was discussed by the CWC in September 1975 and detailed

parameters/specifications were laid down. Grouting work was continued thereafter on the basis of the revised parameters. As the effectiveness of the grouting, when reviewed for the second time, was still not satisfactory, the matter was referred by the CWC to the Technical Advisory Committee who considered it in April, 1976 and suggested further trial grouting with different parameters. As firm 'N' did not have the requisite experience for the job and the contract with it did not cover the changed items, the contract was terminated by the Chief Engineer in August, 1976 when Rs. 16.06 lakhs had been spent.

It would thus appear that the trial grouting on the basis of which the parameters had been evolved was not adequate enough to derive dependable results and thus, the main work itself (cost: Rs. 16.06 lakh) became a continuation of the experiment.

5.2. Treatment of shear zone in block Nos. 4 to 8 of spillway portion—Detailed estimate for the work of treatment of shear zone involving excavation drilling, concreting, placing of re-inforcement bars, grouting, etc. was sanctioned by the Chief Engineer in January 1975 for Rs. 43 lakhs on the basis of parameters indicated in the study drawings of another reach (block Nos. 9 to 11), the drawings of blocks 4 to 8 having not been received from the CWC. After inviting tenders, the work was awarded by the Chief Engineer to firm 'T' in January 1975 for Rs. 22.12 lakhs (labour items only). The study drawings of the relevant reach were received from the CWC in September 1975 wherein the depth of the plug was increased from 8 metres to 19 metres. In July 1975 firm 'T' requested the project authorities to revise the rates for the increase in quantities. The approved drawings were received between February 1976 and December 1976. In the approved drawings, the depth of the plug was further increased to 24 meters in certain locations.

The increased quantities beyond the stipulated deviation limit of 50 per cent of contract quantities were got done by firm 'T' at fresh negotiated rates. Up to 16th running bill (May 1977) the contractor had been paid Rs. 21.50 lakhs in all. The following points were noticed in audit:—

- (a) Up to 16th running bill, excavation of 23,150 cubic metres beyond the stipulated deviation limit was paid at Rs. 30 per cubic metre (composite rate for excavation by controlled blasting including wedging and barring) against the original rate of Rs. 15 per cubic metre for excavation by wedging and barring. Had the work been awarded

after receipt of study drawings, the benefit of competitive rates for the whole work would have been obtained and the increased quantities would have been covered within the permissible deviation limit.

- (b) In terms of the contract, the rates of excavation, concreting and grouting included "cost of all other operations necessary for the execution of work". No separate payment for enabling works like dewatering was contemplated. While demanding increased rates for extra quantities, the contractor had also asked for payment of dewatering charges over and above the increased basic rates. The department agreed to pay dewatering charges at the rate of Rs. 1.75 per kwh; rupees 6.04 lakhs had been paid up to September 1978 to the contractor for dewatering. The department had accepted the extra liability for dewatering charges without any ceiling.

## 6. Rockfill dam

6.0. *Increase in cost.*—The increase in the estimated cost of rockfill dam and the coffered dam for diversion arrangement, from Rs. 1,451.63 lakhs in the original estimate (1968) to Rs. 4,028.70 lakhs in the second revised estimate (1976) had been attributed mainly to, besides escalation in cost of labour and material, the following:—

- (i) increase in quantities of material from 2.90 million cubic metres to 7.73 cubic metres on account of changed section and length and increase in rates of hire of machinery (Rs. 2,380.39 lakhs);
- (ii) increase in rates of drilling and grouting (Rs. 89.06 lakhs); and
- (iii) increase in cost of dewatering (Rs. 37 lakhs).

Technical sanction for the rockfill dam was accorded by the Chief Engineer in March 1974 for Rs. 2,439.67 lakhs on the basis of a provision of Rs. 2,289.31 lakhs in first revised estimate (1975). Further revised detailed estimates had not been prepared (December 1978) for technical sanction.

6.1. *Execution of work departmentally.*—In February 1974, the Standing Committee decided that construction of the rockfill dam be carried out departmentally by the project organisation with the

help of surplus men and machinery available from Beas Project. This decision necessitated the following:—

- (i) establishment of organisational set-up together infra-structure facilities, such as workshops, laboratories, etc.;
- (ii) procurement of equipment in bulk including import of equipment worth about Rs. 16 crores; and
- (iii) delegation of enhanced powers to the Chief Engineer and other executive officers of the project.

For maintenance, repair and overhaul of equipment, field and base workshops were stated (December 1978) to be practically completed. Heavy earth-moving equipment and machinery worth about Rs. 1.83 crores were procured from Beas Project between June 1975 and June 1976 (mentioned in sub-paragraph 11.2). Orders for most of the required equipment and spares (worth Rs. 2,137 lakhs), both indigenous and imported, had been placed by December 1978. Of this, machinery worth Rs. 1,312 lakhs had been received and that worth Rs. 330 lakhs was in transit. Powers of the Chief Engineer for purchase of machinery spares, etc. and to make advance payments to suppliers, among others, were also enhanced after February 1974.

6.2. *Area grouting and grout curtain.*—To reduce the seepage from reservoir and to provide an effective barrier in the path of percolation, the foundation beneath the rockfill dam was required to be grouted and a grout curtain provided along the core trench. The total drilling involved was 65,000 metres. The experimental grouting in core trench of main rockfill dam from RD 1,350 to RD 1,450 was allotted (February 1975) to firm 'RH'. The work was started in February 1975 and completed in October 1975 at a cost of Rs. 3.43 lakhs. Subsequently, tenders for the main work were invited in October 1975 and the work (labour cost: Rs. 18.77 lakhs) was awarded (December 1975) to the same firm 'RS' which had earlier done the experimental grouting. The entire work involving about 12,000 mtrs. of drilling was to be completed by the middle of June 1976. The work was, however, suspended in April 1976 when, on the basis of check holes provided to test the efficacy of grouting, it was noticed that the grouting of the foundation was not effective and no improvement in checking the permeability of rock mass could be attained. It thus appears that in spite of the known heterogeneous geology of the area, the grouting experiments were not broad-based enough to produce dependable results for enabling the production works to be started.



In its meeting held in April 1976, the Technical Advisory Committee advised a number of tests to be carried out to determine the parameters to be adopted for future grouting. The results of the test grouting were discussed and evaluated in a meeting with the CWC held on 31st January 1977 when the parameters were finalised and it was decided that the grouting work might be resumed on the basis of modified parameters. Firm 'RH' resumed the work in June 1977 and completed it in March 1978, at a cost of Rs. 22.37 lakhs (quantity: 14,968 metres) against the amount of Rs. 18.77 lakhs (quantity 12,094 metres) provided in the agreement.

The remaining work of drilling and grouting in the rockfill dam of about 50,000 metres was (December 1978) being done departmentally. Information regarding rates at which drilling was being done departmentally was awaited from the project authorities (December 1978). The Chief Engineer stated (December 1978) that considering the limited time available for drilling and grouting and the job being a specialised one, part of the work would have to be got executed through contractors.

6.3. *Construction of a haul road.*—For haulage of fill material to the rockfill dam, detailed estimate for the construction of a haul road (3,500 feet long) leading to quarry site at Khad Nallah was sanctioned (January 1974) by the Chief Engineer for Rs. 2.62 lakhs. The road was to have a width of 30 feet in straight reaches and 35 feet at sharp curves. Tenders for the work were invited in December 1973 by the Executive Engineer, Building Division and the earthwork was awarded (March 1974) to firm 'S' at the rate of Rs. 4.50 per cubic metre for completion by May 1974. In October 1974 when the road was stated to have been constructed up to a width of 20 feet approximately, the Superintending Engineer sanctioned a revised estimate for Rs. 3.67 lakhs based on a width of 40 feet in straight reaches and 46 feet at curves. The increase in width was attributed to 'new proposals' (details not recorded). The work was, however, completed in March 1975 at a cost of Rs. 3.25 lakhs and the width achieved according to subsequent (December 1976) reports of Rockfill Dam Circle was only 17 to 20 feet.

In December 1976, the Superintending Engineer sanctioned a revised estimate for Rs. 12.54 lakhs to widen the road to a width of 59 feet. The increase in width was considered necessary for heavy

hauling and movement of earth-moving equipment. The work was divided into four sections of which three sections were allotted (January 1977) to two firms at rates of Rs. 12.35 and Rs. 12.65 per cubic metre (fourth section was taken up departmentally). The work was completed by these firms in May 1977 at a cost of Rs. 3.51 lakhs. Information regarding the cost at which the work was completed departmentally was awaited (December 1978). In reply to an audit observation, the project authorities stated (May 1977) that widening of the road had to be done on receipt of the decision to execute the rockfill dam works departmentally, to accommodate movement of dumpers of heavy capacity and that the size and capacity of dumpers had not been finalised when the work was originally taken up. The decision to construct the rockfill dam departmentally was taken in February 1974 and the road work for a width of 30 feet was allotted to the contractor in March 1974.

The road width was not correctly estimated keeping in view the requirement of movement of heavy earth-moving equipment before the allotment of the work in March 1974. The advantage of competitive composite rates for the whole work was thus forgone.

#### 7. Power house

7.0 Increase in cost—The increase in estimated cost of power house from Rs. 173.32 lakhs in original estimate (1968) to Rs. 1,201.32 lakhs in the revised estimate (1976) was attributed mainly, besides escalation in cost of labour and material, to the following:—

- (i) change in location of the power house from the left to the right bank of the river Chenab and depressing it to gain additional head of about 10.8 metres resulting in increased quantities of hill excavation (Rs. 571.12 lakhs); and
- (ii) provision for a platform to accommodate 220 kv switch-yard adjacent to the power house (not envisaged earlier) (Rs. 120 lakhs).

7.1. Excavation for the power house—Tenders for the work 'excavation for the power house' were invited (December 1974) by the Executive Engineer in anticipation of technical sanction which was accorded by the Chief Engineer in January 1975 for Rs. 133.63 lakhs.

Three tenders were received. The rates after evaluation of the special conditions mentioned by the firms were worked out as under:

Name of firm	As tendered (Rupees in lakhs)	As evaluated (Rupees in lakhs)
N	291.48	295.95
J	209.85	245.62
T	145.26	190.32

In its meeting held on 15th February, 1975, the tender committee rejected the lowest offer of firm 'T' as the rates quoted by it were considered unworkable and the special conditions mentioned by it impracticable. Besides, the tender committee noted that firm 'T' had not executed any earth-moving job in the past and the value of any work done by it did not exceed Rs. 15 lakhs. The Committee recommended award of the work to the second lowest tenderer, firm 'J' subject to negotiation of the special conditions on the following points:—

- (a) withdrawal or modification of the special conditions to bring them as close to those in the notice inviting tenders as possible; and
- (b) reduction in the rate of dewatering.

After negotiations, the rate of dewatering was reduced from Rs. 2 to Rs. 1.75 per kwh and certain special conditions were modified or withdrawn. As a result, the reduced value of the tender came to Rs. 209.10 lakhs (and Rs. 233.28 lakhs after evaluation of special conditions).

In March 1975, Government approved award of work to firm 'J' for completion by December 1976. As per agreement, out of 9.60 lakh cubic metres of excavation, 8.60 lakh cubic metres of earth were to be carried to distances ranging from 50 metres to one kilometre. The work was started by firm 'J' in March 1975. Revised detailed estimate for Rs. 268.83 lakhs was sanctioned by the Chief Engineer in November 1976. In January 1977, the department asked firm 'J' to restrict the excavation up to EL 383 metres instead of EL 378 metres in the Power House stage I and up EL 400 metres instead of EL 380 metres in the service bay. The work, thus, modified was completed in March 1977 at a cost of Rs. 207.38 lakhs.

The first revised project estimate (1974—not sanctioned) which was prepared after the decision (July 1971) to shift the power house to the right bank, provided for a saving of Rs. 255.06 lakhs for the re-use in the rockfill dam of the excavated material obtained from the power house excavation. This saving was, however, eliminated from the second revised project estimate (1976) without recording any reason. The detailed estimate of the power house excavation sanctioned by the Chief Engineer in January 1975 (i.e. after the receipt of tenders but before the award of the work) provided for a lead up to 500 metres only for the carriage of the excavated material. There was nothing in the sanctioned estimate to show whether the lead of 500 metres was for stocking the material for re-use or for facilitating its disposal in the river. The agreement executed with the contractor in April 1975, however, provided for extra leads ranging up to 1 km. for 8.60 lakh cubic metres of excavated material. For the remaining one lakh cubic metres of material, no lead was provided as it was to be disposed of within 50 metres. In the revised detailed estimate sanctioned in November 1976 extra leads up to 1 km. for 11.76 lakh cubic metres were provided and about 0.94 lakh cubic metres were to be disposed of within 50 metres. It was for the first time made clear in the revised sanctioned estimate (November 1976) that dumping was being done only to facilitate washing away of the material in the river.

According to the final bill, Rs. 36.57 lakhs were paid to the contractor for extra leads up to 1 km. for dumping 9.88 lakh cubic metres of material. Out of this, 1.26 lakh cubic metres of material were carried beyond 500 metres up to 1 km. for which Rs. 8.80 lakhs were paid. If the intention of dumping the material in the river had been made clear in the very beginning, Rs. 8.80 lakhs could have been saved by dumping the material in the river within 500 metres as per the lead provided in the original sanctioned estimate (January 1975). Besides, the quantity of material disposed of within 50 metres was 0.62 lakh cubic metres as against one lakh cubic metres provided in the agreement. Had the quantity of one lakh cubic metres been disposed of within 50 metres, a further amount of Rs. 1.90 lakhs could have been saved.

#### 8. Tail race tunnel

8.0. Increase in cost.—In the first stage of the project it had been proposed to construct one tail race tunnel (2.4 kms. long) and 30 metres of the second tunnel for the second stage. The increase in the estimated cost of the tail race tunnel from Rs. 672.81 lakhs

in the first revised estimate (1974) to Rs. 1,831.07 lakhs in the second revised estimate (1976) was attributed mainly, besides escalation in cost of labour and material, to the following:—

- (a) increase in quantity of excavation from 2.84 lakh cubic metres to 3.486 lakh cubic metres and increase in tendered rates from Rs. 126.43 to Rs. 175 per cubic metre (Rs. 250.99 lakhs);
- (b) increase in quantity of steel required for ribs from 2,000 to 6,000 tonnes (Rs. 119.60 lakhs);
- (c) provision of reinforcement not provided in the first revised estimate (Rs. 106.25 lakhs);
- (d) increase in quantity of plain cement concrete (Rs. 317.20 lakhs); and
- (e) increase in length of the tunnel from 2.2 to 2.4 kms.

8.1. Award of contract.—Tenders for the tail race tunnel were invited in October 1975 with date of opening as 31st December 1975. This date was extended from time to time and the tenders were finally opened in September 1976. Of five firms which tendered, the lowest offer (Rs. 11.48 crores) was from firm 'J'. The offers were valid up to 31st March 1977. The proposal with comparative statement was sent to the Control Board in December 1976. Since no decision was taken by the Control Board till March 1977, the tenderers were requested (March 1977) to extend the validity of their offers up to 31st May 1977. In the meantime, the lowest tenderer, firm 'J', revised its offer by incorporating a number of additional conditions involving extra expenditure. Thereupon, the tender committee decided (May 1977) to obtain fresh tenders from all the five tenderers.

Fresh tenders from four of the five firms (except firm 'J') were received and opened on 30th June, 1977. The lowest offer (Rs. 9.48 crores) was from firm 'G'. The offers were valid up to 31st August, 1977. The tender committee recommended (18th July 1977) the award of work to firm 'G' subject to certain stipulations which were further discussed with firm 'G' and finalised on 9th August, 1977. Government approved award of the work to firm 'G' on 26th August 1977 with the stipulation that the special conditions to be included in the agreement be got vetted by the Ministry of Law before incorporating them in the agreement. On 27th August, 1977, the Chief Engineer communicated acceptance of offer

to firm 'G'. While Government agreed to the payment of interest-free secured advance on presentation of documents to the extent of 90 per cent of the cost of new plant and machinery purchased by firm 'G' and 75 per cent of the cost of old plant and machinery subject to a ceiling of Rs. 150 lakhs, firm 'G' instead, requested (August-September 1977) that the advance might be paid against bank guarantee without proof of purchase of new plant and machinery and valuation of old plant and machinery. The matter was discussed by the tender committee on 9th, 20th and 21st September, 1977 with firm 'G' and the grant of interest-free advance up to Rs. 150 lakhs against bank guarantees without linking it with the value of plant and machinery was recommended on the following considerations:—

- (a) negotiations with the second lowest tenderer (firm 'N'— a Government undertaking) would involve an additional burden of Rs. 1.20 crores;
- (b) invitation of fresh tenders would delay award of the work and might result in increased rates;
- (c) equipment valued at about Rs. 150 lakhs would actually be required and the only benefit to the contractor was of about Rs. 40 lakhs, being the amount of interest at 12.5 per cent per annum for three years.

Government approved (November 1977) payment of advance on the condition that interest at the rate of 8 per cent per annum be charged until documents showing the value of the plant and machinery were produced. Firm 'G' finally accepted the terms on 2nd December, 1977.

The draft agreement, as redrafted by the Ministry of Law after discussions with the Control Board, was approved on 28th December, 1977. Firm 'G', however, declined (January 1978) to sign the agreement on the plea that 'the draft was in consonance with the terms and conditions mutually agreed earlier'. While the terms of the draft contract remained under dispute, interest-free advances totalling Rs. 50 lakhs had already been paid (February-March 1978) to firm 'G'.

Computed with reference to the rate of 12.5 per cent per annum (at which the tender committee had worked out the financial implications) firm 'G' had got an unintended benefit of Rs. 2.81 lakhs, being the amount of interest on Rs. 50 lakhs till July 1978. The agreement was signed in August 1978.

Due to delay in commencement of works on tail race tunnel, out of 1,000 tonnes of steel costing Rs. 36.70 lakhs, purchased during January to June 1975 for the tail race tunnel, 561 tonnes were still unutilised (December 1978), 440 tonnes having been consumed on the diversion tunnel.

### 9. *Generating plant and machinery*

9.0 Purchase of generating equipment—A letter of intent for the supply of 3 generating sets of 90 MW each was placed on Bharat Heavy Electricals, Hardwar (BHEL) in March 1970. Consequent upon change in specifications of generators from 90 MW to 115 MW each (July 1971), CWPC worked out the landed cost of three sets at Rs. 604 lakhs and Rs. 752 lakhs based on two alternative considerations. The price was again reviewed by a committee consisting of representatives of the Bureau of Public Enterprises, the Central Electricity Authority and BHEL, on the recommendations of which the price of three sets was revised (February 1976) to Rs. 1,417.68 lakhs (at Rs. 472.56 lakhs each). In March 1976, Government sanctioned the purchase of three sets from BHEL for Rs. 1417.68 lakhs for manufacturers' works with a provision for price escalation on the labour and material. Fifty per cent price was to be paid in three instalments before despatch of equipment and the remaining 50 per cent after despatch of the last substantial component. Between February 1971 and March 1978, Rs. 848.34 lakhs had been paid to BHEL. Up to November 1978, supply of the first set had almost been completed with the last substantial component expected in December 1978 and parts of the second and third sets had also been received.

For 1978-79, BHEL had demanded a further sum of Rs. 900 lakhs including price escalation. No contract had been executed (December 1978) with BHEL. The project authorities wrote to BHEL (July 1978) to take up the manufacture of the third set at a later stage as the erection work was not likely to be started in the next three years. Delay in completion of project had led to increase in cost of three generating sets from Rs. 604 lakhs (1971) to Rs. 1,758.84 lakhs (December 1978).

10.0. Communications.—A lump sum provision of Rs. 120 lakhs (excluding work-charged establishment, contingencies, etc.) was made for communications in the original project estimate of 1968. It was intended mainly for the following:—

- (a) left bank road from the 8th kilometre of Reasi-Arnas Road to the sit of the dam; and

- (b) bridge near the site of the dam and a road from the bridge to power house along the right bank of the river.

The second revised estimate (1976) provided Rs. 480.19 lakhs for "communications". The increase in cost was attributed to the following:—

- (i) increase in the scope of the works owing to provision of a road 11 metres wide 11 kms. long along the right bank of the river from Talwara to Dhyangarh, road from power house to rockfill dam (right bank) and from rockfill dam to concrete dam (left bank) not provided originally; and
- (ii) increase in cost of material and labour.

10.1. Road from Baradari bridge (Talwara) to Dhyangarh (right bank road).—According to the original project report, the left bank road was to be treated as the main project road; it was taken up for construction in August 1979 and completed in January 1972. In September 1973, the proposal for the construction of the right bank road from Baradari bridge to Dhyangarh was made its parameters approved (December 1973) by the Technical Advisory Committee. The construction of the road was commenced in December 1973 and completed in March 1977. The delay in completion was mainly due to slow progress of work by certain contractors and problems arising from termination of their contracts (mentioned in sub-paragraph 10.3).

Since it was decided in June 1971 to locate the power house on the right bank of the river and the rockfill dam works were also on the right bank, early construction of the right bank road connecting the major work sites at Dhyangarh to Reasi-Jammu Road at Baradari bridge would have reduced the distance by 18 kms. from Baradari bridge to Dhyangarh as compared to the left bank road. Moreover, had the right bank road been completed before calling for tenders for major works like power house excavation, excavation for spillway and power dam blocks, the main concrete dam, etc. it was likely that more favourable rates could have been obtained. Besides, if the right bank road had been taken up for construction soon after the decision (June 1971) to locate the power house on the right bank, there would have been saving in the cost of transport of departmental material machinery, etc. which had to be transported by left bank road and then ferried across to the right bank for works on that side.



The Chief Engineer stated (December 1978) that before deciding to construct the right bank road, detailed studies had to be conducted in consultation with the geologists of the Geological Survey of India on various alternatives. These studies could not be completed earlier than September 1973.

Nevertheless, the fact remains that advance planning of this road was not done and the time taken in these studies was over 2 years; the work commenced in December 1973 was completed in 3½ years in March 1977.

10.2. (a) Avoidable expenditure.—In anticipation of technical sanction, tenders for the earthwork in respect of the first four kilometres of the right bank road divided into six groups were invited by the Executive Engineer, Quality Control Division in October 1973. The quantities advertised in the notice inviting tenders were based on a proposal (September 1973) to construct the road 7.5 metres wide for one-way traffic. There was also a proposal to construct another road 7.5 metres wide along the left bank of the river as well from Baradari bridge to Debri Nallah.

Tenders were opened in November 1973. While these were being processed, the Technical Advisory Committee, in its meeting held at Reasi on 31st December 1973, decided that the width of the road be increased to 11 metres enabling it to take two-way traffic and the proposed road along the left bank be taken up to Numbal Shoal (a point ahead of the original terminal). On 1st January, 1974, the Executive Engineer issued letters of intent to successful tenderers informing them that their tenders had been approved by the Chief Engineer for the construction of 11 metres wide road and asking them to start the work for 11 metres final formation instead of 7.5 metres as verbally agreed to by them during negotiations with the Executive Engineer.

The revised quantities were computed by 29th January, 1974 when the revised estimate for Rs. 59.07 lakhs was sent by the Executive Engineer to the Chief Engineer for sanction. The Chief Engineer, however, sanctioned (18th February 1974) the original estimate (for Rs. 36.41 lakhs submitted by the Executive Engineer in December 1973) which had, by then, become obsolete and approved the allotment of works on road 7.5 metres wide to the lowest tenders in each group. Agreements were also executed with the contractors on 21st February, 1974 on the basis of the

original quantities in spite of the fact that in terms of the letters of intent, the contractors had been offered the road works for 11 metres width. These agreements contained two provisions regarding deviations; according to one, the contractors were bound to execute additional quantities upto 50 per cent of the original quantities at the agreed rates and according to the other, the permissible deviation in individual items to be executed at the original rates was not to exceed 25 per cent of the value of the contract as a whole. Apparently, the latter provision was meaningful only in a contract comprising numerous items and not in a contract substantially consisting of only one item, viz. earthwork (the value of earthwork, according to the estimate sanctioned in February 1974 was Rs. 34.22 lakhs out of Rs. 34.25 lakhs being the total value of the only two items, viz. excavation and 'jungle' clearance in the work as a whole).

On 4th March, 1974, the Executive Engineer sought the Chief Engineer's approval to get the revised quantities executed through the original contractors at the original rates on the consideration that these rates were quite moderate and financially sound and that in case the contractors were not assured of the continuity of the work, they might disengage their labour and their procurement later on would become difficult. The Chief Engineer, however, approved (6th June, 1974) the execution of additional quantities through the original contractors at the rates and on the conditions already approved 'to the extent of percentage provided in the agreement'. In terms of the contract, in the event of deviation in quantities exceeding the permissible limit (i.e. 25 per cent/50 per cent as mentioned above), the Engineer-in-charge was to order the contractor to carry out even such extra quantities and the contractor could, within 7 days of the receipt of order, claim revision of the rates supported by proper analysis in respect of the additional quantities beyond the permissible limit. The Engineer-in-charge could, then, either revise the rates having regard to prevailing market rates or get the deviations carried out in such manner as he deemed fit. However, no such order was issued and thus the willingness or otherwise of the contractors to carry out the entire additional quantities at the original rates could not be ascertained.

In the meantime, the Chief Engineer ordered (29th March, 1974) the transfer of administrative control of the road work from Quality Control Division to Civil Division. Details of quantities of earthwork stipulated in the agreements, the revised quantities

and the quantities executed at the original rates through the original contractors are given below:

Group Number	Quantity as per agreement	Quantity as revised	Quantity executed at the original rates	Percentage deviation executed at the original rates	Remarks
			(Cubic metres)		
1.	34,000	27,454	22,128	(- )35	Works completed in quality control Division.
2.	34,000	44,511	46,535	(+ )37	
3.	17,000	17,491	18,091	(+ )6	
4.	40,000	1,16,507	54,501	(+ )36	Works in progress transferred to Civil Division.
5.	40,000	1,00,525	53,394	(+ )33	
6.	40,000	1,72,818	42,800	(+ )7	

From the fact that deviations exceeding 25 per cent had been got executed by Quality Control Division through the original contractors, it seemed that the original rates continued to be acceptable to the contractors. In Civil Division, however, fresh tenders were called and the left-over works (quantities of which in groups 4 and 5 were found more than the revised ones) were allotted (September-October 1974) to the lowest tenders. Particulars are given below of the quantities and the rates which these works were allotted as compared to the rates of the original contractors:

Group number	Quantity allotted	Rates at which allotted	Rate of the original contractors	Extra cost involved
	(Cubic)	(Rupees per cubic metre)		(Rupees in lakhs)
4	1,52,075	7.20	6.20	1.52
5	1,69,000	7.49	5.75	2.94
6	1,25,800	7.70	5.25	3.08

From the letter of intent issued on 1st January 1974 to the original contractors, it was clear that they had agreed to execute 11 metres wide road at their tendered rates. Non-incorporation of the revised quantities in the agreement, therefore, resulted in an extra cost of Rs. 7.54 lakhs. As the quantity actually executed was even more than the quantity allotted in each of the three groups 4 to 6, the extra cost with reference to the quantity executed worked out to Rs. 8.02 lakhs.

(b) There were substantial variations between the quantities estimated and those executed as given below:

Group number			
Quantity as per revised sanctioned estimate (cubic metres)	1,16,507	1,92,525	1,72,818
Quantity executed by Quality Control Division (cubic metres)	54,501	53,394	42,800
Balance to be executed (cubic metres)	62,006	1,37,131	1,30,018
Quantity allotted by Civil Division (cubic metres)	1,52,075	1,69,000	1,25,800
Quantity actually executed in Civil Division (cubic metres)	1,67,488	1,82,261	1,29,425
Total quantity executed by both the divisions (cubic metres)	2,21,989	2,35,655	1,72,225
Excess over sanctioned estimate (cubic metres) and percentage	1,05,482 (90 per cent)	45,130 (24 per cent)	

The Chief Engineer attributed the difference in quantities to the original estimated quantities being based on the end cross-sections only and the increased quantities necessitated by shear zones and the increased length of the road due to its curvilinear alignment.

10.3. Payment of unpaid wages of contractor's labour under an award.—Particulars of certain road works (earthwork only) awarded to two contractors are given below:

Name of the contractor			
Particulars of works	Road from bridge site at Dhyangarh to exit portal of tail race tunnel (RD O to 1,500) divided into three sections hereafter referred to as work A)	Road from Dhyangarh bridge to the site of the dam (RD 1,250 to 1,920 hereafter referred to as work B)	Road from Baradari bridge to tail race tunnel (RD 3,500 to 3,700) (hereafter referred to as work C)
When awarded	December 1973	June 1974	October 1974
Contract quantity (cubic metres)	1,68,704	1,00,060	71,600
Rates per cubic metre (Rupees)	Between 6.31 and 7.13	8.00	7.70
Contract amount (Rupees in lakhs)	11.26	8.00	5.51
Stipulated date of completion	June 1974	June 1975	April 1975

The progress of the works was not in accordance with the stipulated construction schedule. The contracts were, therefore, rescinded by the Executive Engineer in November 1974 (Work A) and May 1975 (Works B and C) after issuing show cause notices to the contractors and the quantities left over were as under:

	Work A	Work B (cubic metres)	Work C
Quantity completed	1,09,821	39,959	14,899
Quantity left over	53,883	60,101	56,701

After inviting fresh tenders, the left-over works were awarded (at the risk and cost of the original contractors) at higher rates involving extra cost of Rs. 3.66 lakhs as per details given below:

	Work A	Work B	Work C
When awarded	January 1975	August 1975	July 1975
Rate per cubic metre (rupees)			
Original	6.31 to 7.13	8.00	7.70
Revised	6.69 to 8.31	10.23	11.00
Extra cost involved (rupees in lakhs)	0.45	1.34	1.87

On a complaint filed by the contractor's labour, the Assistant Labour Commissioner, Udhampur (Court of Authority under the Payment of Wages Act, 1936), passed an award in January 1975 (in respect of contractor AK) for Rs. 1.04 lakhs and requested Sub-Judge, Reasi to recover the amount from the principal employer, viz., the Executive Engineer. The amount of award re-presented unpaid wages of the contractor's labour from June 1974 to October 1974, i.e., during the currency of the contract. The project authorities did not seek competent legal advice immediately after receipt of the award in January 1975. It was only in May 1975—after the labourers resorted to agitation and after another award for Rs. 0.91 lakh was issued in respect of contractor BS—that the Chief Engineer referred the matter to the Control Board to obtain approval of Government for payment of the amount of the two awards. The amount was paid in June 1975 after obtaining the advice of the Standing Government Counsel and clearance from the Control Board but before receiving the advice of the Ministry of Law to which the matter had been referred on 4th June, 1975.

According to the Ministry of Law (November 1975) ".....the contractor failed and/or neglected to comply with his obligation cast by Sub-Section (1) of Section 21 of the Contract Labour (Regulation and Abolition) Act, 1970. In the premises, Central Government as principal employer became liable to make payment of the wages in full or the unpaid balance due thereof. It was open to the contract labour, therefore, to compel the Central Government under Sub-Section (4) of Section 21, to make payment of the unpaid balance of the wages due to the contract labour which the contractor failed and/or neglected to pay. The contract labour, however, did not compel the Central Government by taking action under Sub-Section (4) of Section 21 of the Act, but went to the Labour Court and obtained an award. The award is against the contractor and not against the Central Government....."

.....In the premises, Central Government is not responsible to make payment of the amount mentioned in the award."

Meanwhile, the Chief Engineer appointed (July 1975) a Superintending Engineer of the Project as the sole arbitrator to settle disputes between the department and the contractors. The arbitration award in respect of the dispute with contractor AK issued in September 1976 stipulated that the contractor was to pay Rs. 1.24 lakhs to the department in settlement of all claims and counter-claims and the department was to release the dues of the contractor amounting to Rs. 1.11 lakhs. In respect of the contractor BS, the award issued in January 1978 required the contractor to pay Rs. 3.75 lakhs to the department and receive his dues, deposits, etc. amounting to Rs. 0.25 lakh from the department. The arbitrator accepted the contractor's liability to reimburse to the department the unpaid wages earlier paid by the department on behalf of the contractor as well as their liability to compensate the department for the actual loss arising from the retendering of the works.

Against net sum of Rs. 3.62 lakhs awarded by the arbitrator in both the cases, no recovery had been made so far (December 1978) as the award had not been made a rule of law by the High Court, one of the contractors having filed objections.

According to the provisions contained in Contract Labour (Regulation and Abolition) Act, 1970, the principal employer should nominate a representative to be present at the time of disbursement of wages by the contractor and the representative should certify the amount paid. Further, in terms of the contracts executed with the contractors, they were required to furnish fortnightly labour

returns and to keep a register of unpaid wages. Had the fulfilment of these provisions been ensured by the project authorities, the question of non-payment of wages to the labourers by the contractor would not have arisen.

10.4. *Delay in construction of bridge.*—(a) In order to provide access to the labour colony located on the right bank of the river (construction of the main bridge connecting left and right bank having not been started), a suspension bridge was constructed in June—September 1972 at a cost of Rs. 2.43 lakhs (including cost of material). The deck of the bridge was, however, washed away in August 1973 due to floods. An estimate for Rs. 1.96 lakhs was sanctioned by the Chief Engineer in April 1974 for the restoration of the bridge. The bridge was reconstructed by July 1974 at a cost of Rs. 1.94 lakhs. On 5th August, 1976, the right abutment of the bridge collapsed rendering it unusable again. The bridge was not re-constructed thereafter. The transportation of labour across the river was done by trolley ropes and boats during the period.

(b) The work of construction of a bridge across the river near the work site to link major construction works on both banks of the river was awarded by the Chief Engineer to firm 'N', a Government undertaking, in December 1973 for a lump sum amount of Rs. 40 lakhs. The work to be started on 15th January 1974, was to be completed by March 1975; the work was completed in November 1977 (cost: Rs. 40 lakhs). The delay in completion was attributed to the following:—

- (i) The location of the right side pier was not suitable owing to adverse geological conditions. In March 1974, after the site was inspected by the Chairman, CWC, it was decided to shift the right pier towards the hill side and increase the central span to 95 metres.
- (ii) The geologists suggested in March 1974 to undertake consolidation grouting and anchoring of pier-foundations. This work was done from October 1974 to December 1974.
- (iii) After piers and abutments had been completed by March 1975, the work remained suspended as the designs for the superstructure and bearings had not been finalised. The design were finalised in September 1975 but bearings were procured later in January 1976.
- (iv) The steel gantry and shutterings manufactured by the firm had been assembled at site in August 1976 when

construction from the left side was taken up; in October 1976 because the road on the right side had not been completed and the material being heavy (about 45 tonnes) could be transported across the river by trolley ropes only after the monsoon.

Construction of the main bridge, which was an essential infrastructure, provided in the original estimate was thus commenced two years after the decision to locate certain major works like power house at the right bank and completed about six years thereafter.

11.0. *Machinery and Equipment.*—Against a gross estimate of Rs. 941.32 lakhs (1968) on the purchase of machinery and equipment, the second revised project estimate (1976) provided for a gross estimate of Rs. 3,370.31 lakhs. The increase in cost by Rs. 2,428.99 lakhs was attributed to the following:—

- (i) change in the agency for the construction of the rock-fill dam from contractors to departmental execution; and
- (ii) steep rise in the cost of machinery.

11.1. *Machinery purchased and their performance.*—An expenditure of Rs. 2,259.47 lakhs was booked on machinery and equipment up to December 1978. Particulars of major items of equipment procured till June 1978 were as under:

Particulars of the machinery	Number of machines as per revised project estimate	Number procured upto June 1978	Cost (Rupees in lakhs)
Taxcavators	6	4	19.20
Excavators/shovels	14	4	59.73
Dozers/dozer shovels	40	24	265.82
Dumpers	84	50	212.50
Motor graders	6	3	3.67
Vibratory rollers	19	8	12.29

As the progress of work had remained slow as compared to the construction schedule anticipated in the original and revised project estimates, the machinery was largely unutilised.



11.2. Machinery procured from Beas Project.—In November 1974, the Standing Committee authorised the Chief Engineer to procure surplus machinery from Beas Project in anticipation of Government sanction. Pending final settlement of the purchase price, etc. the project authorities advanced Rs. 242.50 lakhs (Rs. 240 lakhs in February 1975 and balance up to January 1976) to Beas Project; against these advances, the value of the machinery and spares received so far (December 1978), according to the project authorities, was Rs. 183.02 lakhs whereas according to Beas Project, it was Rs. 205.75 lakhs. The difference of Rs. 22.73 lakhs had not yet (December 1978) been sorted out and the balance out of the advance of Rs. 242.50 lakhs had also not been received back so far (December 1978).

Major items of machinery procured from Beas Project were 32 dumpers, 5 dozens, 2 motor graders, 2 vibratory rollers and 2 electric shovels. All these machines, except 1 dozer, 1 motor grader and 8 dumpers had remained unutilised; these were under break-down since their procurement (from June 1975 to June 1976).

11.3. Purchase of 'Hino' dumpers.—In response to tenders for the supply of 15 to 20 ton capacity rear dumpers invited by the Chief Engineer in October 1973, offers from 10 parties were received. The tenders were opened on 3rd December 1973 and the Chief Engineer's recommendations were sent to the CWC and Control Board on 18th December 1973. The validity of the offer of one of the tenderers, firm 'M', was to expire on 22nd December 1973 in Japan; the validity was got extended up to 30th January 1974. The Purchase Committee could not, however, decide on the tenders within the extended validity period and it was only on 11th February 1974 that the Committee approved the purchase of 12 dumpers from firm 'M' subject, *inter alia*, to rebate of Rs. 5,000 per dumper earlier offered by the firm on the supply of 20 dumpers. Firm 'M' did not, however, agree to allow the rebate and demanded a price increase of 12 lakh yen (about Rs. 28,436) on each dumper owing to the 'drastic changes in the international trade following the energy crisis'. In June 1974, the Purchase Committee finally approved the purchase of 12 dumpers at the rate of Rs. 2.72 lakhs each.

Had the offer of the firm been accepted within the extended period of validity, the project would have saved Rs. 3.41 lakhs. Further, at the time payment was made (October 1974) to firm 'M', the parity value of rupee had decreased from 42.2 yen to 36.6 yen per rupee which involved another extra expenditure of Rs. 4.27 lakhs.

## 12. Stores and stock

### 12.0. Idle weigh-bridges

- (i) In April 1974, the project purchased a weigh-bridge from Jammu and Kashmir Government for Rs. 0.70 lakh. The Chief Engineer sanctioned (September 1975) an expenditure of Rs. 8,000 for its installation. Construction of foundations, etc. was completed in November 1977 at a cost of Rs. 0.06 lakh but the weigh-bridge had not been installed (December 1978).
- (ii) Another weigh-bridge was purchased from a firm in May 1975 for which Rs. 0.80 lakh (95 per cent of price) were paid to the firm. Foundation works were executed for this weigh-bridge in June 1977 at a cost of Rs. 0.13 lakh. Meanwhile, it was noticed (November 1977) that certain parts (costing Rs. 1,620) were missing from the weigh-bridge. After procuring these parts, the weigh-bridge was commissioned in June 1978. The delay in commissioning of the weigh-bridge from April 1974 to June 1978 was attributed (December 1978) by the Chief Engineer to delay in its transportation from Jammu to project area due to paucity of trailers and to delay in procurement of the missing parts.

12.1. Shortages of stores.—During the course of handing over charge of stores by storekeeper 'A' to the relieving 3 storekeepers, shortages of steel and explosives (value assessed subsequently by the Executive Engineer at Rs. 0.30 lakh) came to notice. To Audit enquiries on the shortages, the project authorities stated (August 1978) that a departmental committee had been constituted to look into the matter and its report was awaited and that no cash security seemed to have been obtained from the storekeeper.

No recovery of the shortages (value Rs. 0.30 lakh) had been made so far (December 1978).

13. Summing up.—The following are the main points that emerge:—

- (1) The Project was started without adequate investigations resulting in changes in designs of the diversion tunnel and other major structure of concrete dam and rockfill dam.

- (ii) The first unit of the project originally scheduled for commissioning in June 1975 was expected. (December 1978) to be completed and commissioned by 1985-86. The delay is mainly attributable to change in designs, non-finalisation of designs of major structures, etc.
- (iii) The work on the diversion tunnel, a critical item in the construction schedule of the project, was (December 1978) in progress, though it was awarded to a contractor for execution in March 1972 for completion by August 1973. The delay is attributable to extensive changes in design during construction.
- (iv) Construction of essential infra-structure facilities like the road on the right bank of the river and bridge at work site were taken up only in December 1973 although construction of the project started in August 1970 and the decision to locate the power house on the right bank had been taken in June 1971.
- (v) A saving of Rs. 2.96 crores in the original project estimate (1968), increased to Rs. 4.24 crores in first revised estimate (1974—not sanctioned), was anticipated on account of re-use of the material excavated from the concrete dam site in the rockfill dam. This saving was not provided in the second revised estimate (1976) as it was stated to be impracticable, because of lack of storage space for the excavated material and impossibility of synchronising the rockfill dam work with that of the concrete dam.
- (vi) Machinery worth Rs. 1.83 crores purchased between June 1975 and June 1976 from the Beas Project were lying (December 1978) un-utilised.
- (vii) The project estimate increased four fold from Rs. 55.15 crores (1969) to Rs. 222.15 crores (1976). Of the increase, Rs. 33.63 crores were accounted for by changes in design and increase in quantities, Rs. 25.93 crores by change in location of the power house from left to right bank of the river Chenab and provision of tailrace tunnel, etc., Rs. 76.07 crores by escalation in the cost of material and labour due to delay in the execution of the project, Rs. 12.50 crores by departmental execution of the rock-fill dam and the rest of the increase by other extra items of work.

## APPENDIX II

### Statement of Conclusions/Recommendations

S. No.	Para No.	Ministry / Deptt. Concerned.	Recommendations
1	2	3	4
1.	1' 22 & 1' 23	Ministry of Energy	<p>Salal Hydro-electric Project was originally approved as a State project on the basis of a project report prepared in 1968 which indicated the estimated cost as around Rs. 55 crores. In August, 1970, the Project was taken over by the Government of India for execution as a Central Project. The project estimate was revised to Rs. 113 crores in March 1974 and further revised to Rs. 222 crores in September 1976. The cost of the project as per latest estimates (November 1980), is likely to go further to Rs. 350 crores at current prices.</p> <p>The Committee note that the Salal Project has been beset with problems of heavy over-runs of both time and cost. As the later sections of this Report would show, inadequate investigations at the pre-construction stage and frequent changes in designs were in a very large measure responsible for this continuing delay of a vital project. The Committee would have expected that with experience of the execution of the gigantic Bhakra-Nangal project and the Sutlej-Beas Link Project (both in the Himalayan region) and with</p>

the expertise of available in the country in the field of geological sciences and techniques, it should have been possible to use the latest available technology to facilitate proper planning and timely execution of this vital project. According to the Ministry of Energy, the scheme was full of "geological surprises" and consequently the project got delayed. The Committee note that this approach and process of trial and error would ultimately cost the Exchequer more than six times the original estimates.

2. 1.24 Ministry of Energy.

The Committee find that there has been a steep escalation due to labour and material costs since the project was taken over by the Government of India. The 1976 estimate had projected an increase of Rs. 76 crores over the original estimate of 1968 under this head. The latest estimate of November 1980 shows a further increase of Rs. 89 crores. Thus, out of a total increase of Rs. 295 crores (Rs. 350 crores—Rs. 55 crores), the escalation in labour and material cost alone amounts to Rs. 165 crores i.e. nearly 56 per cent of the total cost escalation. The Committee have learnt that this project which was initially estimated to cost Rs. 55 crores would ultimately involve an extra expenditure of Rs. 165 crores towards labour and material costs alone, not to mention other costs. The Committee would like to be apprised of the detailed reasons for such abnormal rise in cost. They would in particular like to be assured that all

necessary steps have been taken for proper materials management at all stages of execution of the project.

3. 1.25 Ministry of Energy. The other areas where the original estimates of costs have registered a steep escalation due to increase in scope of power generation and increases due to change in designs and quantities of work. The revised estimate of 1976 visualised increases of the order of Rs. 25.93 crores and Rs. 33.63 crores on these counts respectively over the original estimates. A further increase of Rs. 31 crores is anticipated under these two heads in the latest exercise carried out in November 1980. The Committee have commented on these increases in later sections of this Report.
4. 1.26 Ministry of Energy/  
Ministry of Finance. The Committee are disturbed to find that yet another area where costs have gone up manifold is "Direction and Administration". The estimated expenditure under this head has jumped from Rs. 375.70 lakhs in 1968 to Rs. 1904.35 lakhs in 1976 and Rs. 2550.00 lakhs in 1980, showing an increase of 580 per cent within a span of 12 years. The Committee would like the Ministry of Energy to analyse in depth with the help of the Chief Cost Accounts Officer of the Ministry of Finance the reasons for the abnormal increase in expenditure under this head with a view to exploring areas where economies could be effected.
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1.28 Ministry of Energy. An increase of Rs. 14.06 crores in the revised estimates of 1976 over the original estimates, is attributed to non-provision and inadequate provisions in the original project report.

The Committee desire that more care should be taken in the preparation of detailed project estimates so that a clear picture is available to the Parliament of the cost-benefit ratio of a project before the same is sanctioned and pitfalls in planning are avoided. The Committee have discussed this aspect at greater length in a subsequent section of this Report.

The Committee are surprised to learn that the basic fact that the river bed had a "major shear zone" which subsequently necessitated a change of site could not be discovered during investigations conducted by the J&K Government over a period of four years (1961-64) but came to light only after the Project Report had been finalised. Normally, decisions in regard to the location of projects are taken only after evaluating the results of various investigations conducted on alternative sites. In the case of Salal Project, however, a decision was taken in June 1964 to locate the project at the present site (Dhyangarh) "on the consideration of the topograph and layout alone" and detailed investigations only followed this decision. The Committee feel that the project planning in the case of Salal Project left much to be desired right from the very beginning based as it was on inadequate data. Secretary, Department of Power conceded during evidence that "there were elements in the feasibility report which one might say, were a little unrealistic." No wonder, during the course of execution, the Project authorities

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had to face various "geological surprises" which led to prolonged investigations and experimentation in treatment of foundations with consequent escalation in cost.

The Committee cannot too strongly emphasise the need for undertaking detailed geological surveys and investigations and collating/collating all relevant data before such projects are sanctioned. That this is not a solitary instance of this nature is clear from the observations made by the Y. K. Murthy Committee appointed to examine the procedure for investigation and implementing the multi-purpose and hydro-electric projects. In its report submitted in June 1978, the Murthy Committee had observed that a number of projects had taken longer to complete, benefits had come later than expected, the capital costs had been larger than originally planned and consequently the returns on capital had been smaller than expected. The Murthy Committee had also observed that these difficulties could be traced largely to inadequate investigations, incomplete understanding of the geological problems and defective project planning. The above observations are equally valid the case of Salal Project as well.

The Committee trust that the Ministry of Energy would draw suitable lessons from their experience of execution of the Salal Project while planning for such projects in the Himalayan region.

The Committee note that the Project Report drawn up in 1968 envisaged the commissioning of 3 units of 90 MW each in June 1975,



June 1976 and June 1979 respectively. The dates of commissioning were, however, revised from time to time and according to the latest indications the first unit of the Project is now likely to be commissioned not earlier than 1987. This inordinate delay has been largely responsible for the enormous increase in cost estimate of the Project. As any further delay in the completion of the project would cause further escalation in the cost of the project, the Committee would like the Ministry of Energy to take all possible steps to complete the project at the earliest.

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The Committee note that a Central Hydro-Electric Projects Control Board was set up in July 1970 with a view to ensure efficient, economic and early implementation of hydro-electric projects taken up by the Central Government at Sahal, Baira Siul and Loktak in the States of J&K, Himachal Pradesh and Manipur respectively. The Control Board constituted a Standing Committee and authorised it to take decisions on behalf of the Board on such technical, financial and other matters as were delegated to it from time to time. A high powered "Committee of Direction" was also constituted to give directions on policy matters and to oversee the execution of the project in accordance with the sanctioned estimates.

The Committee deeply regret to note that during the period of 8 years of its existence, the Control Board met only once during each of the years 1973, 1975 and 1976 and 1978, twice during

1971 and 1972 and thrice during 1974. The Committee find that it did not meet at all in 1977. Thus, the total number of meetings of the Control Board which was put in charge of supervising this project, was 11 during a period of 8 years. The Standing Committee which was supposed to take decisions from time to time, also met only 11 times in 8 years. The Committee are deeply distressed to note that the Committee of Direction which was a high powered body entrusted with the task of overseeing the execution of the project within the sanctioned estimates, did not meet at all. No wonder, this elaborate machinery devised to control and monitor the execution of the project failed to deliver the goods and the project is now faced with problems of heavy over-runs both of cost and time. The Committee consider it to be a serious lapse on the part of the Ministry that no meeting of the high powered Committee of Direction of which the Minister of Irrigation and Power/Energy was the Chairman, was convened during the period of as many as 8 years. The Committee expect that such lapses will not recur.

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The Committee find that it was only in May 1978 that the project was handed over to NHPC for execution for the reason that "Government was feeling greatly handicapped as in the existing framework, enough flexibility for more expeditious decisions was not possible. The company form of management was considered to be more conducive to quick decision making and effective implementation of the programme".

The Committee cannot but express their deep distress over the failure of the Government to provide the basic organisational framework necessary for the speedy execution of the Salal Project. No review of the functioning of the Control Board was undertaken at the highest level and the project languished for want of direction and coordination among the various agencies involved in its execution.

Now that the NHPC have been entrusted with the task of execution of the Salal Project, the Committee trust that no further slippages in the completion of the Project will be allowed to occur.

It is established that when the contract for Diversion Tunnel was awarded to M/s NPCC in March 1972, the additional conditions stipulated by the firm demanding price escalation in the cost of labour and material and extra payment for dewatering were not settled beforehand and the firm was allowed to proceed with the work "on the consideration that they modify some of their special conditions." The reason indicated by the Ministry to the Committee for taking this course of action was the consideration that "valuable time would be lost in the process of fresh bids and tenderer was a public undertaking." The additional conditions preferred by the firm had considerable financial implications for the

project. Moreover, without assessing the financial implications of these additional conditions, it could not have been possible for the project authorities to make any worthwhile comparison with the rates quoted by other contractors. The Committee, therefore, consider that notwithstanding the contracting firm being a public undertaking, the Project authorities should have done the exercise of computing the value of the additional conditions in terms of money while deciding to award the contract to the firm and at the time of awarding the contract to the firm these conditions should have been duly incorporated in the contract so as to avoid any ambiguity and scope for controversy on this score.

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The contract for diversion tunnel was awarded to M/s. National Projects Construction Corporation in March 1972 for Rs. 170.23 lakhs. Subsequently, due to increase in the scope of work involving construction of adit, dome and shaft, the value of the contract was increased to Rs. 220.85 lakhs. Infact, the expenditure on these works completed by National Projects Construction Corporation amounted to Rs. 400 lakhs upto October, 1980. The total expenditure on the diversion tunnel is now estimated to be as high as Rs. 692.10 lakhs as against only Rs. 47.14 lakhs provided for in the original estimate and Rs. 595.46 lakhs in the revised estimate of 1976.

The Committee regret to observe that before giving the go-ahead to the contractor on the basis of the original design of installing the gate structure at the entry portal of the diversion tunnel, the Tech-

nical Advisory Committee (TAC) did not fully consider the implications of "slumped rock mass" indicated by the Geological Survey of India. The TAC, instead decided that with a modified design it could be possible to instal the gate structure at the entry portal which ultimately proved to be a total miscalculation. Apart from rendering infructuous the expenditure of Rs. 8.45 lakhs already incurred before shifting the gate structure to the middle of the tunnel, it resulted in a delay of over 64 years in completion of the diversion tunnel thus throwing the entire project schedule out of gear, not to mention the huge escalation in costs all round.

The Committee trust that the unfortunate experience in this case would impel the planners to take geological investigations more seriously in future so that projecis of this nature are not beset with difficulties in crucial areas the way Salal Project has been.

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The Committee observe that the Concrete Dam comprising spillway, power dam and non-overflow blocks, posed "extra-ordinary design problems" due to its unique location on a narrow saddle and the "un-anticipated geological problems." It took several years for the concerned agencies to find out suitable solutions to these problems and in fact it was only in October, 1980 that the final excavation drawings for blocks 16 to 25 of the dam were released by the Central Water Commission.

The Committee find that as a result of design changes, quantities of a number of components of the concrete dam structure viz., excavation, drilling, grouting and concreting have increased substantially thereby pushing up the cost of the dam from nearly Rs. 17 crores (as per 1968 estimates), to Rs. 77.5 crores (November 1980 estimates) i.e. by nearly 356 per cent.

The Committee are not persuaded by the contention of the Ministry that "no amount of pre-construction investigations will precisely indicate the magnitude, disposition and physical nature of all the geological infirmities of the foundation". As the heterogenous formation of the Himalayas is well known, the Committee cannot resist the impression that adequate efforts were not made initially to pool the experiences of execution of other projects in the Himalayas, to sift the available data and to harness the latest techniques of pre-construction investigations. Had enough attention been paid to these aspects, the parameters of the problem could have been more easily delineated, solutions would not have taken so long to come by and considerable amount of time and money could probably have been saved.

The Committee do believe that the benefits of the studies made, the experiences gathered and the processes employed in treating the foundations of the concrete dam would be fully made use of while taking up similar projects elsewhere.

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The 1968 and the 1974 estimates of the Salal Project provided for savings of Rs. 2.96 crores and Rs. 4.24 crores respectively on account of anticipated re-use of the material excavated from the concrete dam site in the rockfill dam. This envisaged either simultaneous construction of the concrete and rockfill dams to enable direct use of the material or in the alternative, safe stock-piling of the excavated material for future use in the rockfill dam. The experience during construction has shown that it was not found possible either to synchronise the construction of concrete and rockfill dams or to safely stockpile or store all the material excavated from the concrete dam site as envisaged in the project estimates.

Out of a total of 21.2 lakh cu.m. of re-usable material anticipated to be recovered, only 6.70 lakh cu.m. are stated to have been used for creating enabling works (for the excavation work) such as approach road and working platform. 5.12 lakh cu.m. of material is stated to have been stock-piled out of which 2 lakh cu.m. is proposed to be used in the main concrete dam and 3.12 lakh cu.m. is meant for reuse in the rockfill dam. Thus, only 11.8 lakh cu.m. of the excavated material out of anticipated total excavated material of 21.2 lakh cu.m. has either been utilised or will be utilised. The remaining 9.4 lakh cu.m. is reported to have been "washed away in silt" and is being treated "as a spoil".

The Committee also note that even for the 5.12 lakh cu.m. of excavated material which was stock-piled for reuse, no credit was shown in the estimate either for concrete dam or for the rockfill dam where it was intended to be used. The lapse is sought to be explained away by maintaining that the entire stock piled material was advertised as a quarry for concrete dam. The Committee consider that this was not a regular procedure to adopt.

The Committee note that the work of consolidation grouting of formation rock below spill-way was awarded to M/s NPCC in December, 1974 without prior thorough investigation and trials. As a result, the execution of the work by the contractors became "experimental" on an almost continuing basis" so much so that in May 1976, the contractor relinquished the work saying: "we only wish that these ideal conditions were well established before the award of work to us." The Committee learn that the trial grouting got done through M/s Cementation Co. was confined to "a conventional size of test plot." No wonder the work parameters evolved did not suit the different rock strata encountered in the area of operations. Considering the varying nature of rock strata in the Himalayan Ranges, the only prudent course was to have trials done more extensively covering different rock formations in the area. Belatedly, the project authorities realised that the nature of the job required to be done needed skilled men and specialised equipment which were already available with the Beas Organisation. In the process valuable time was lost.



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The Committee view with concern the hurry in awarding the work for treatment of shear zones in blocks 9 to 11 before the drawings of the part of work were available even if it was done with a view to save time. They feel that had the work been awarded after the receipt of drawings, the benefit of competitive rates for the work would have been available.

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I. 135.

The Committee note that the estimated cost of Rockfill Dam has increased successively from Rs. 14.52 crores in the original estimate of 1963 to Rs. 22.89 crores in the first revised estimate of 1974 and further to Rs. 40.29 crores in the second revised estimate of 1976. The cost is estimated to go up still further to Rs. 58 crores as per latest available indications. The five fold increase in the cost is attributed to the increase in (i) the cost of replacement of material in the dam, (ii) wages, (iii) cost of indigenous and imported machinery (iv) increase on account of treatment of adverse geological features etc.

In this context, the Committee notice that in February, 1974 it was decided to undertake the work departmentally. The Committee were informed during evidence that "a study of comparative economics based on precise evaluation of tenders was not done and is not available". They further note that one of the considerations for taking a decision to get the work done departmentally was to utilise the surplus men and machines from the Beas Project.

It is surprising that although tenders were invited, they were not evaluated with a view to ascertaining whether it would at all be more economical to get the work done departmentally and that a decision in this regard was taken without evaluating the cost involved. The Committee consider it to be a very casual way of taking decisions in matters where expenditure of crores of rupees is involved. Considering the huge escalation in costs, the Committee would like the Ministry to enquire as to whether it would have been more economical to get the work done through contract labour taking into account the cost of machines, haulage, establishment of workshops, expenditure on overhauling, repair and maintenance, the wear and tear of machines, extra labour force employed thereon etc. The Committee would like to emphasise that decisions in matters like this should be taken after a careful study of the economics of the proposal.

18. 1.143 —do—  
The Committee note that the road for haulage of fill material to the Rockfill Dam was constructed upto a width of 20 feet approximately in October 1974. In March 1975 it was widened to 40—46 feet and in December, 1976 it was further widened to 50—59 feet. This indicates lack of planning on the part of project authorities.

19. 1.144 —do—  
Regardless of the observations of the local project officers regarding the short width of the road actually found by them on the spot, the Ministry has relied upon the cross-section of the road appended to the Project Report and also on the surmise that the filling portion of the road in certain lengths must have been washed away by two

intervening rainy seasons. The Committee consider that the matter calls for a probe by NHPC management with a view to dispelling the impression that the previous widening of the road was actually not carried out, but was shown to have been carried out and paid for accordingly.

20.

1.159

Ministry of Energy

It is admitted that after the Salal Project was approved in 1968 as a State Project, the Planning Commission has had no occasion to review the project until 1976 when a revised estimate indicating a more than fourfold increase in cost of the project was cleared by the Public Investment Board (PIB) and approved by the Cabinet. Between 1968 and 1976 several important decisions were taken which had changed the entire complexion of the project involving manifold cost increase over that envisaged in the original proposal cleared by the Planning Commission in 1968. One such decision was to take over the project as a Central project in 1970. Another major decision taken in 1971 was the change in the location of power house from left bank to the right bank of the river as a corollary to the increase in the proposed capacity of the Power House from 270 MW to 345 MW. The Committee are surprised as to how such decisions involving major financial commitments not originally envisaged, could be taken without consultation with, and approval of, the Planning Commission. The Committee are of the firm opinion that

this was a serious lapse on the part of the administrative Ministry. Since cost escalation had already taken place, the approval of the PIB in 1978 was more or less a formal affair. There was at that stage hardly any choice with the Planning Commission, the PIB and the Cabinet except to approve the on-going project.

The Committee would like to emphasise that proper policies and procedures should be evolved with a view to ensuring that whenever any State project is proposed to be taken over for execution by the Government of India, prior approval of the Planning Commission and PIB is obtained. Further, as soon as it is found that the project cost is likely to exceed more than 20 per cent of the approved estimated cost of the project, the fact should be brought to the notice of the Planning Commission, PIB and the Cabinet for review and approval.

In this connection, the Committee find that at present there is no method by which Parliament is concurrently kept apprised of the progress in the implementation of various Central Sector projects and programmes in which huge amounts have been voted by Parliament. The Committee find that the information made available to Parliament through the budget documents or annual reports of the concerned Ministries is sketchy and quite inadequate for making a proper appraisal of the progress of various on-going projects. The Committee, therefore, strongly recommend that in the cases of all Central sector projects/programmes where the estimated outlay is Rs. 100 crores or more and also in cases where the

21. 1.160 —do—

22. 1.161 —do—

estimated outlay/investment subsequently exceeds the above figure, a separate Project/Programme appraisal report should be placed before Parliament during every budget session. Such report should indicate clearly the physical and financial targets, progress made and reasons for delays, non-fulfilment of targets etc. (year-wise). These Reports, project-wise/programme-wise, should be made available before the debates on the Demands for Grants start, so that Parliament is fully kept apprised of all such projects programmes.

23. 1.168 &  
1.169

Ministry of Energy

The Committee observe that between the years 1968—1976, the estimated unit cost of power generation from Salal Project has gone up from 3.37 paise to 11.24 paise at the generation and from 3.73 paise to 12.70 paise at the grid station (based on 8 per cent interest). The latest estimate however, shows a further increase in the anticipated cost of power generation to 20 paise per unit at the generation end.

Considering the steep escalation in the anticipated cost of the project from Rs. 55 crores in 1968 to Rs. 350 crores at present, the Committee desire that a detailed study of the cost effectiveness of the project should be undertaken. The Committee would like to be apprised how the Salal Project compares in this respect with other hydro-electric projects in the country.

24 1. 189 —do—  
 The Committee do not find any merit in inviting tenders for the tail race tunnel and issuing the tender documents without the drawings and designs of the work required to be done and thereafter extending the date of receipt of tenders, as was done in the present case. In future, tenders for works should be invited only after the designs and drawings of the work proposed to be done are complete in all respects and these should be made available to the prospective tenderers along with other Tender Documents.

25 1. 190 —do—  
 The Committee feel that payment of advance of Rs. 50 lakhs without interest to M/s. Gammon Ind'a Ltd. without settling beforehand certain special conditions of the agreement was imprudent as in the event of contractor's refusal to agree to the special conditions the money advanced would itself have become difficult to recover. The Committee consider that in such cases, the conditions of the agreement should invariably be settled prior to payment of advance. The Committee would also like that this matter is examined in depth in consultation with the Ministry of Finance and suitable guidelines issued so that the interests of Government are adequately safeguarded.

26 1. 198 & 1. 199 —do—  
 The Committee find that the work of construction of the tail race tunnel was scheduled to be completed within 56 months of the start of the work i.e. by 24 September, 1932. However, the progress is very slow as only 256 metres of tunnel boring has been completed till October 1989 out of the total length of 4820 metres required to

be excavated. In fact the excavation work of tunnel boring was originally scheduled for completion by January 1981 i.e. within 40 months of the start of excavation work as per the terms of the contract. The firm has submitted revised target date for the completion of Tailrace tunnel by March 1984. The Chairman-cum-Managing Director, Salal Project was candid enough to inform the Committee during evidence that the Chief Executive of the firm had not responded to his invitation for discussion and that he was doubtful if they would adhere even to the revised schedule.

The Committee take a serious view of the whole matter and desire that this should be sorted out at the earliest with the contracting firm. In case the firm expresses its inability to adhere even to the revised schedule, notwithstanding the facility of interest-free advance of Rs. 50 lakhs given to it, the Committee would like the Ministry to invoke the penal provisions in the agreement and take alternate steps to get the work done by the stipulated date.

27 1.205

Ministry of Energy/  
Ministry of Industry/  
Ministry of Steel.

The Committee are disturbed to find that a major Project like the Salal Project has of late been facing acute shortage of critical items like cement and steel. Only 10 per cent of the requirements of cement were met during 1980 (upto October 1980) and what is worse the supplies were not evenly spread over. The Committee were informed that even the sources of supply are the Southern

States like Tamil Nadu which is more than two thousand kms. away from the project site. The Committee do not find any rational justification in allocating cement for Salal Project from such far off places which not only adds to the cost of inputs on account of higher transportation charges but also leads to delays. The Committee recommend that the Ministries of Steel and Industry should make arrangements for supply of steel and cement for the project from the nearest available sources and as per schedule of requirements. The Committee further recommend that for such a critical project, Government must ensure timely supply of essential inputs like steel and cement. This is a serious matter which needs immediate attention of the concerned authorities so that such deficiencies do not hold up the progress of the Project any further.

The Salal Project presents a typical example of vital projects getting bagged down during construction for various reasons, some of which could have been easily foreseen. The Project has shown heavy over-runs of time and cost as can be seen from the fact that whereas it was initially expected to have been commissioned by June 1979 at an estimated cost of Rs. 55 crores, the latest anticipation is that the first unit of the project would not be commissioned before March 1987 and the total expenditure involved would be as high as Rs. 350 crores provided further delays do not occur. What comes out prominently from the Committee's enquiry is the utter inadequacy of pre-construction investigations which resulted in frequent changes in designs and construction drawings. In fact, geological, geo-physical and geo-technical investigations had to be continued



over the years in respect of several major components of the project during execution. This resulted in substantial increases in the quantities of work required to be done with consequent increases in cost and delay in execution. Had adequate investigations for preparation of detailed designs and drawings been conducted before awarding the work for various components of the project, the parameters of the problem could have been more precisely delineated and numerous changes that had to be made therein resulting in higher costs, could have been avoided.

29 I. 207 Ministry of Energy.

Yet another unfortunate aspect of the history of this project is the lack of direction from the top and insufficient coordination among the various agencies involved in its execution. It was only as late as in May 1978 that decision was taken to hand over the Project to the National Hydro-electric Power Corporation—a public sector undertaking, for execution on agency basis since it came to be realised that execution of such projects through departmental efforts was not conducive to expeditious decision making. The tardy implementation of the project is therefore the direct result of the failure of management at the top level to come to grips with the complexity of the job they had undertaken upon themselves. The Committee trust that the lacunae pointed out by them in this report would be gone into in depth so that suitable remedial measures can be taken for the future.

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