

Chapter 6: Maintenance of Owned Rigs

The Company owned 67 onland and eight offshore rigs as on March 2014. For efficient functioning of the rigs, regular repair and maintenance was essential. Timely repairs and refurbishment was particularly important for offshore rigs which operate in marine environment. Delay in proper upkeep of a rig directly impacts its drilling efficiency and consequently the cost of drilling operations.

In the Company, the repair and maintenance of onland rigs were carried out in-house, through the Central Workshop, Vadodara. Refurbishment and up-gradation of onland rigs had been carried out through Bharat Heavy Electricals Limited (BHEL). The repair and refurbishment of offshore rigs and rig equipment was carried out through competitive tendering process after evaluating the effectiveness of such repairs.

6.1 Dry dock/major lay-up repairs of Departmental offshore jack up rigs

6.1.1 Delay in repairs of jack up rigs

Of the eight departmental offshore rigs, six were jack-up rigs and two were drillships. As per the class requirements, a drillship undergoes dry dock survey twice in a period of five years. However, in the absence of mandatory dry dock requirements for jack-up rigs, repair work of such rigs and rig equipment were carried out on a need basis rather than in a planned manner. The need for a dry dock policy in case of owned jack-up rigs had been highlighted in C&AG's Report No. 9 of 2007 (Paragraph 7.7.4.1, Chapter VII; 'Performance of offshore rigs in shallow water areas of ONGC'). Subsequently, the Company formulated (2007), a policy for dry dock management and major lay-up repairs of jack-up rigs. As per this policy, dry dock of jack-up rigs was to be carried out every six to eight years, depending upon physical inspection and verification by the competent authority.

The six jack-up rigs had been purchased between 1982 and 1990. Considering the practical aspects of drilling operations and shipyard considerations, the Company drew up a five year dry dock road-map for these rigs in May 2007. Meanwhile, Sagar Kiran was sent for dry dock during 2005-08. As per this plan, dry dock and major lay-up repairs of four rigs were planned in 2007 (Sagar Kiran, Sagar Ratna, Sagar Uday, Sagar Gaurav); and the balance two were planned for 2008 and 2009 (Sagar Shakti for 2008 and Sagar Jyoti for 2009). Thus, major lay-up repairs for all the rigs were to be completed by 2009.

Audit observed that, major lay-up repairs of only two rigs, Sagar Ratna and Sagar Uday had been carried out (in 2012 and 2013 respectively). The tender for repair of Sagar Jyoti was under process. Review of drilling workload for the years 2014-18 prepared (November 2014) by the Company revealed that major lay-up repair was not planned for rigs Sagar Shakti and Sagar Gaurav.

The Company stated (April 2015) that due to continuous work requirement, the rigs could not be taken out of cycle for major lay-up repairs as scheduled, though all preventive

maintenance practices were followed as per the OEM recommendations and periodical classification surveys were complied with.

The reply needs to be viewed in the context of repair policy itself being delayed by over 25 years and being laid down to streamline management of dry dock of jack-up rigs. Non adherence to the repair schedule led to rigs being operated with outdated/ obsolete equipment which adversely impacted operational efficiency of the rigs as shown in the table below:

Table 6.1: Efficiency in terms of cycle speed of owned jack-up rigs

Name	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Owned Rigs										
Sagar Jyoti	262	88	426	428	601	426	223	563	447	295
Sagar Gaurav	544	418	426	Capital repairs	473	452	427	330	449	487
Sagar Ratna	781	279	492	790	Dry dock			320	402	114
Sagar Kiran	185	Dry dock		705	842	414	239	637	645	347
Sagar Pragati	Dry dock	356	446	540	588	361	614	515	Rig decommissioned	
Sagar Shakti	151	328	171	392	585	347	395	510	930	479
Sagar Uday	272	205	166	459	NA	239	Dry dock		650	789
Charter Hire (CH) Rigs										
Avg. cycle speed of CH rigs	1,347	1,255	1,307	1,325	1,058	1,118	1,025	1,243	1,051	939

MOPNG (August 2015) did not comment on the subject. The Company stated in its supplementary reply (August 2015) that Sagar Uday and Ratna were pilot projects of sorts after formulation of the policy in 2007 and it was considered prudent to await completion of projects to validate the formulated policy. In view of the experience in these two projects, a need is felt to revisit the policy.

The supplementary reply of the Company is not acceptable as the proposal for major lay-up repair of third jack-up rig, Sagar Jyoti was mooted in 2009 much before completion of repair work of jack-up rigs, Sagar Ratna and Uday. While the Company's reply regarding need for revisiting the policy is appreciated, further delays in repairs would lead to further deterioration in condition of rigs and impact their efficiency.

6.1.2 Analysis to justify repair deficient

Following the policy (2007) for dry dock and major lay-up repair of departmental offshore jack-up rigs, the Company initiated individual proposals for repair of three rigs (Sagar Ratna, Sagar Uday and Sagar Jyoti). In each case, the Company carried out an analysis to justify the expensive repairs by comparing the cost of repair to the cost of hire and purchase. The net present value (NPV) of the three options (repair, hire, purchase) were worked out and evaluated.

Audit observed that inappropriate assumptions were made while comparing the three options:

- (i) The Company assumed that the departmental offshore jack-up rigs would have a life of ten years following the repair. The assumption was not backed by residual economic life analysis. The Company (December 2004) had formed an in-house Committee to

carry out age and efficiency analysis of rigs. The Committee had estimated that the economic life of jack-up rigs was 30 years and had recommended that a residual economic life estimate be done by a third party on completion of 25 years to assess the feasibility of obtaining extended life of the vessel.

Audit noticed that the rig Sagar Jyoti had completed 26 years when the proposal for repair was taken up. However, the cost benefit analysis of the repair option considered a ten year operation of the rig, post repair even though the economic life of such rigs had been considered as 30 years. The rigs, Sagar Ratna (procured in 1985) and Sagar Uday (procured in 1990), were also considerably aged by 2007 and their economic life ought to have been assessed before assuming a ten year operation post-repair.

- (ii) The Company assumed that the efficiency of the repaired rigs would match the efficiencies of new as well as hired rigs. Audit observed that the efficiency of owned rigs had always been much lower than that of CH rigs. Over the ten year period 2003-13, efficiency (in terms of cycle speed) of comparable type and vintage CH rigs had been more than 2.52 times that of owned rigs. The external consultant (M/s Deloitte) hired to appraise the feasibility report for major lay-up repairs of rig Sagar Uday had also pointed out that the repaired rig may not operate at the same levels of efficiency as that of a new or CH rig.

Audit noticed that the proposal for repair of old rigs would not be considered economically viable vis-à-vis hire / purchase of rigs if realistic efficiency of the alternate options are considered as seen in the case of rig Sagar Uday given below:

Table 6.2: Cost benefit analysis of major lay-up repairs

Scenarios	Alternatives	NPV worked out by the Company considering equal efficiencies of owned and hired rigs in April 2009	NPV considering efficiency of hired rigs as 1.5 times that of owned rigs, as worked out by Audit
	Major cost Assumptions	Rig CH rate USD 154,375 per day	Rig CH rate USD 154,375 per day. Effective rig rate of USD 102,917 per day considering efficiency of hired rigs: owned rigs as 1.5:1
		Repair cost ₹ 365.09 crore with capex escalation of 6 per cent per annum.	Estimated repair cost ₹ 365.09 crore with capex escalation of 6 per cent per annum
		New rig cost USD 205 million	New rig cost USD 205 million (₹ 821.84 crore).
Scenario -1	Hiring of a substitute rig of similar capacity	₹ 820.93 crore	₹ 548.51 crore
Scenario-2	Major Lay-up Repairs cost of owned rig	₹ 564.42 crore	₹ 564.42 crore

(iii) Besides, Audit noticed that the Company was inconsistent in its assumptions as detailed below:

- The salvage cost of rigs was not considered in the cost benefit analysis of repair of rigs Sagar Uday and Sagar Ratna while it was considered at 50 *per cent* for new rig in the case of rig Sagar Jyoti.
- The dry dock expenditure was considered as capital expenditure with 30 *per cent* depreciation in the case of rig Sagar Uday. The same expenditure was considered as partly revenue expenditure in case of rigs Sagar Jyoti and Sagar Ratna and the capital component was depreciated at 15 *per cent*.

A uniform set of assumptions would improve the quality and transparency of the analysis.

The Company stated (April 2015) that the major lay-up repairs/ up-gradation of rigs were done after carrying out cost benefit analysis of repair works *vis-a-vis* hiring of rigs/ purchase of new rig. A holistic view would prove that the cost of repair in case of all the rigs in the past was in favour of the Company considering the foreign exchange components and benefits in owning rigs which ensure better bargains in the day rates of charter hire.

Reply of the Company needs to be viewed in the context that the Company was itself aware of the shortcomings of the economic analysis justifying repair. This was seen in the internal comments of the Finance wing which had pointed out that the efficiency of the Company's owned rigs was considerably lower than that of the CH rigs and if this disparity in efficiency was considered, the proposal of repair of old rigs may not be a financially acceptable option.

MOPNG (August 2015) did not have further comments to add on this issue. During the Exit Conference (August 2015) with MOPNG, the Company assured that efficiency factor would be factored in the future cost benefit analysis of major lay-up repairs.

The Company in its supplementary reply (August 2015) added that dry docks of Sagar Uday and Ratna had time and cost over-runs and considering their first dry dock since inception it was observed that dry docking cost was in the range of 55-60 *per cent* of new rig. In view of this experience, it is being considered to review dry docking and major lay-up repair of the existing rigs so that minimal work is done to run these rigs for a short term of about 4-5 years and in the meantime to prepare a strategy for replacement of the old rigs.

Audit acknowledges the assurance given by the Company during Exit Conference and the acceptance of the fact of abnormal cost over runs during the repairs. Action of the Company will be watched in future audit.

6.1.3 Delay in finalisation of scope of work and tender leading to cost escalations

The scope of work for major lay-up repairs of rigs Sagar Ratna and Sagar Uday was prepared on the basis of defect analysis by a third party, M/s MODU spec, Singapore. The scope of work so prepared for rigs Sagar Ratna and Sagar Uday was also vetted by M/s NSRDC and M/s MODU spec respectively. Based on the scope finalised, tenders were invited and contract awarded to M/s Hindustan Shipyard Limited and M/s Larsen & Toubro Limited in August 2008 and July 2010, respectively.

Audit noticed that there were inordinate delays in finalising the scope of work and tender finalisation. The freezing of scope of work and tender finalisation took 36 months (rig Sagar Ratna) and 48 months (rig Sagar Uday). The scope of work for rig Sagar Jyoti was yet (May 2015) to be finalised even after six years (since 2009).

The rig, Sagar Jyoti had been commissioned during 1983. Following the major lay-up repair policy (2007), the rig was to be repaired in 2009. Audit noticed that the initial scope of work for major lay-up repairs could be prepared by the Company only in 2009.

Subsequently, the scope of work was changed in 2012, with a plan to use the salvage equipment of rig Sagar Ratna in order to optimize the cost of repair.

Audit noticed that the plan to use the salvage equipment of rig Sagar Ratna while changing the scope in 2012 was not in line with the equipment replacement policy which prescribes 20 years as age for such critical equipment. The proposal to use salvage equipment of rig Sagar Ratna which were more than 27 years old was also not justified since the cost of overhauling of these salvage equipment was 75-87 per cent of new equipment which was economically not a prudent option.

The deficient scope prepared in 2009 had contributed to delay in repair. The scope of major lay-up work of rig Sagar Jyoti was yet to be finalised (May 2015) (even after six years).

The delay in finalisation of scope was compounded by delay in handing over the rigs to the contractor for repair. The resultant delay led to further deterioration of the rig condition, increased the scope of repair work and consequent cost escalations.

The cost estimates for the repair were prepared in-house and were vetted by a third party, M/s IMU, Vizag. Audit noticed that the cost also escalated significantly from the time the Company decided to undertake repairs to the award and execution of the contract as detailed below:

Table 6.3: Cost escalation in execution of major lay-up repairs of own jack up rigs

(₹ in crore)

Sl. No.	Name of the rig	Cost estimated at the time of decision	Contract cost awarded	Cost of actual execution	Percentage increase	
					Contract with reference to estimate	Actual cost with reference to estimate
1	S/Ratna	228.82	361.07	586.78	58	156
2	S/Uday	365.09	376.91	572.48	3	57

The increase in cost and the altered rig market changed the relative economics of the repair and hire options. For example in April 2009, NPV (considering operation over a ten year period) of cost for repair of rig Sagar Uday had been worked out as ₹ 564.42 crore as against the NPV of hiring cost as ₹ 820.93 crore. By the time the contract was awarded in May 2010, the NPV for repair had risen to ₹ 664.95 crore as against the NPV for hire of ₹ 585.85 crore (the rig hire rates having declined substantially).

The rig, Sagar Ratna, had been released for major lay-up repairs in August 2009. The work was expected to be completed by May 2010. The completion of dry dock took over a years' additional time (excess time taken being 27 months) and cost increased by ₹ 225.71 crore (63 per cent increase over contract cost).

Audit noticed: that:

- Rig was in continuous operation for 25 years since commissioning without major lay-up repairs. As such procurement of critical spares became a major reason for delay.
- Indecision on the part of the Company regarding design of the Raw Water System contributed to further delay. The design was changed repeatedly accounting for a delay of 9 months.
- The scope of work had to be changed from overhauling of draw works, mud pump and crane equipment to replacement based on advice of OEM considering the cost of overhaul and technical obsolescence. As this decision regarding replacement was taken without stripping down the equipment, the same could have been done through the OEM at the time of preparing scope of work, thereby saving lead time in procurement of equipment.

Thus, even at the stage of award of the contract, repair of rig Sagar Uday was not the most economic option, rendering the exercise of cost benefit analysis before repair redundant. Even after award of the contract and handing over the rigs, the costs increased significantly as can be seen from the table 6.3. Audit noticed that the cost increases during execution of the contract was on account of expanded scope of work added during contract operation which also led to considerable delay in execution. As per the major lay-up repair policy of the Company, such changes in scope of work should be vetted by an independent, internationally accredited third party. Audit noticed that this was not done. Besides, the change in scope of work could have been anticipated by the Company as seen in the specific case of Sagar Ratna elaborated above.

The Company replied (April 2015) that orders had been taken with due approvals by the competent authority. The Company stressed that there were several activities, as per the laid down procedures, to reach the final stage of award. Compliance with these procedures along with their due interpretations resulted in actual time taken being larger than the norm. The Company also stated that due to continuous work requirement the rigs could not be taken out of cycle for major lay-up repairs as scheduled. Accepting the delays in finalisation of contract and resultant cost escalation, the Company stated that the present procedural framework requires a complete review. It was also stated that a stage gate process would be introduced for speeding up the project implementation. The Company assured that efforts have been made to review the existing framework to ensure that future projects were completed within scheduled time and cost.

The Company stated in its supplementary reply (August 2015) that the scope of work for the lay-up repair projects of rigs, Sagar Ratna and Sagar Uday were prepared based on the condition of the equipment and was duly vetted by a third party. However, as the scope of work is framed while the rigs are in operation, it is not possible to finalise the complete scope

work. Only after dismantling of the equipment and systems, it is possible to know the exact nature of repair and the additional requirement of spares which result in change orders. Many change orders are due to additional spares / jobs that are required to bring the equipment/system in functional order as per recommendations of OEM or classification agencies.

The assurance of the Company (April 2015) is noted. It may, however, be relevant to point out that delay in finalising scope of repair work had been noticed even earlier in the Company. The Internal Audit group of the Company had done a theme audit on dry docking of offshore rigs in 2009-10. This report had also highlighted the excessive time in finalisation of scope and repair of rig. It had been highlighted that incomplete assessment of scope of work led to delay in repair of rigs and increase in repair cost. The delay and the cost escalations pointed out in this internal audit report are tabulated below:

Table 6.4: Delay in major lay-up repairs and resultant cost escalation

Name of rig	Period of dry dock	Actual dry dock days	Excess days	No. of change orders	Additional cost (₹ in crore)	Contract cost (₹ in crore)
S/Pragati	3/04 to 7/06	852	590	NA	NA	NA
S/Kiran	3/06 to 10/08	945	620	282	55.51	217.69
S/Bhushan	10/06 to 9/08	696	580	650	57.24	91.77

Source: Theme Audit of dry docking of offshore rigs carried out by IA of the Company

There was, thus, a strong case for corrective action by the Company to avoid such delays and cost escalations.

Considering the experience of the Company, mandatory survey schedules, equipment replacement policy and the downtime of the equipment, much of the changes could have been avoided.

6.1.4 Performance of rigs after dry dock

During the dry dock and major lay-up repairs of rigs Sagar Uday and Sagar Ratna, obsolete equipment were replaced and systems were upgraded to the latest technology at par with industry standards. It was expected that repairs would lead to higher efficiency of the rigs in terms of cycle speed and commercial speed. Further, it was expected that the rigs would be deployed for exploration and development drilling rather than work-over jobs. Audit observed that performance of rigs post dry dock had not improved as envisaged. The performances of the two rigs, Sagar Uday and Sagar Ratna, before and after dry dock are tabulated below:

Table 6.5: Performance of rigs before and after dry dock

Cycle speed	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Sagar Uday	Rig was used for work-over operations				Dry dock	Dry dock	650	789
Sagar Ratna	492	790	Dry dock	Dry dock	Dry Dock	320	402	114
Avg. for offshore rigs			815	884	978	1116	863	994*

Source: Director T&FS Annual report

** Source: SAP Report*

As can be seen from the table above, the efficiency (expressed in terms of cycle speed) did not improve significantly after repair and consistently remained below the average for the Company. Deployment of the two rigs, post repair was also below expectations:

- Rig Sagar Uday had been used for work-over jobs before major lay-up repairs. As per the proposal for repair, the rig would be utilised for drilling exploratory and development wells including high tech/ horizontal and Extended Reach Drilling (ERD) wells, post repair. Audit noticed that after repair, the rig was mainly used for work-over operations. Only two exploratory wells had been drilled with the rig since 2013.
- The rig Sagar Ratna was to demonstrate an improvement in cycle speed post repair as per the repair proposal. Audit, however, noticed that the cycle speed dropped below even the pre-dry dock levels after carrying out major repairs at a cost of ₹ 586.78 crore.

The Company replied (April 2015), that rig Sagar Uday was capable of drilling exploratory wells, post dry dock. The rig had been deployed to work-over wells on account of priority given by the Assets. The Company explained the low cycle speed of rig Sagar Ratna as being due to loss of 65 days in 2012-13 on account of non-controllable activities. Besides, the Company pointed out that the rig Sagar Ratna was deployed in the east coast for exploration drilling where it faced difficult formations.

The reply of the Company was not acceptable in view of the following:

- (i) Deployment of rig, post major repairs to work-over operations was not desirable, given that it goes against the objective for which costly repair of the rigs had been carried out. It was noticed that even during 2014-15, the rig Sagar Uday was used for work-over operations. Even during 2015-16, the rig had been mainly planned for work-over operations.
- (ii) The cycle speed of Sagar Ratna did not improve even during 2013-14 and 2014-15. The speed of the rig was low even when compared to the average speed achieved by rigs in the east coast (as against the average cycle speed of 504 in the east coast, Sagar Ratna achieved a speed of 402 in 2013-14 and 114 in 2014-15).

MOPNG did not offer any further comments (August 2015). The Company in its supplementary reply (August 2015) stated that during 2013-14, Sagar Uday was deployed for drilling cycle for only 5.90 rig months. Out of these operational rig months, rig remained under repair for 1.33 Rig Months due to follow-up repairs immediately after dry-dock, which constituted 23 *per cent*. During 2012-13, the rig Sagar Ratna was deployed for drilling cycle for only 6.38 rig months of which the rig remained under repair for 1.31 rig months due to follow up repairs immediately after dry dock. The rig also encountered unexpected well activity while drilling leading to downhole complications. The well later had to be side tracked, resulting in lesser cycle speed. In 2013-14, the cycle speed suffered due to casing retrieval job under rig building phase (1.94 rig months) as well as longer production testing time (3.09 rig months). The repair time for rigs Sagar Uday and Sagar Ratna in 2014-15 was only 11.8 days and 9.9 days, respectively.

The reply of the Company needs to be viewed in the context of justification provided in the major repairs proposal of rigs Sagar Uday/ Ratna wherein it was stated that post repairs, the

rigs would be on par with latest offshore drilling technology and international standards. However, the performance of the rig was much lower than average of charter hired rigs. Besides, the cycle speed of rigs is not affected by out of cycle days during the post dry dock repairs and, hence, cannot be said to affect the performance of the rig.

6.2 Dry docking and maintenance of Departmental drillships

6.2.1 Delays in dry dock of drillships

As per International Rule Requirement of the Classification Surveys, the Company had to carry out dry dock survey of its drillships (Sagar Bhushan and Sagar Vijay) twice in a period of five years. This was not strictly adhered to. Dry dock of drillships were delayed vis-à-vis plan. Delays were also noticed in actual execution of repairs which led to excess costs as can be seen in the case of rig Sagar Bhushan detailed below:

Rig Name	Delay	Reasons
Sagar Bhushan	As against scheduled date, the dry dock took 332 more days (2012-13).	<ul style="list-style-type: none"> During the repair period, the surveyors activated SPS-5 survey¹⁹ which was due by October 2012, without which the ship could not have sailed out. The proposal (June 2012) of dry dock cell for SPS-5 survey was approved by the competent authority <i>i.e.</i> Executive Purchase Committee and LOA was issued only on 29 Oct 2012 after expiry of scheduled completion date of repair. Audit noticed that the SPS-5 survey was part of the initial package but was left out while awarding the contract. This led to avoidable delay in repairs. The delay in repairs led to non-availability of the rig for drilling activities. This resulted in loss of six planned rig months. In the absence of S/Bhushan, the planned location assigned to it was drilled by deploying more expensive, higher capacity, deep water rigs in two different spells at an additional cost of ₹ 167.11 crore approx.²⁰.

While accepting the audit observation, the Company stated (April 2015) that its Board intended to implement the Stage Gate Process²¹ for speeding up implementation for the forthcoming projects which was expected to address problems of delay. MOPNG in its reply (August 2015) stated that the assurance of the Company would be noted for compliance.

The action taken by the Company would be watched in future audit.

¹⁹ SPS – Special purpose ship survey. The drillships are subjected to periodical surveys for the purpose of maintenance of class.

²⁰ Actinia cost-US\$ 209570*156 days *55= ₹179.81 crore.

Noble Duchess cost- US\$ 198452*31 days *55=₹33.84 crore.

Sagar Bhushan cost- ₹24.89 lakh per day * 187 days =₹46.54 crore.

Pending information, average cost per day of Sagar Bhushan was considered at 2008-09 level.

Exchange rate assumed as US\$=₹55.

²¹ Stage Gate Process is used to describe a point in a projector plan at which development can be examined and any important changes or decisions relating to costs, resources, profits, etc. can be made.

6.2.2 Performance of drillships after up-gradation

The Company upgraded Sagar Vijay to water depth capability of 900 metres (1997-98) and Sagar Bhushan to 400 metres capability (2003). Audit noticed that these rigs were utilised only in shallow water (less than 400 metres water depth) during 2010-14 except a lone well in 2013-14. Further, despite regular dry docking, no marked improvement in their performance was noticed:

Table 6.6: Performance of drillships after upgradation

Cycle speed	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Sgar Bhushan	Dry dock		273	175	PT [@] for 320 days	Dry dock	290	105
Sagar Vijay	196	227	Dry dock	422	226	Rig was under rig building (90 days), PT (167 days) & Capital Repairs (103 days)	309	Not indicated by the Company

@ PT-Production testing

The Company stated (April 2015) that after up-gradation to water depth capacity of 900 metres, Sagar Vijay had drilled 18 wells of which nine were in water depth of 500 to 900 metres. Likewise, after up-gradation in 1996-98, the rig Sagar Bhushan was capable of operating upto 400 metres. However, as no well between 300 to 400 metres water depth was required for drilling, Sagar Bhushan had not drilled any such well. The Company also stated that the rigs had undergone only dry docking and other mandatory surveys as per International Maritime Organization (IMO) regulations and no major capital repair of equipment was undertaken except some minor repairs. The Company had pointed out that the rig Sagar Vijay and Sagar Bhushan had been commissioned in 1985 and 1987 respectively and most of the equipment on the rigs were more than 27 to 29 years old and had outlived their useful lives. The Company asserted that considering the life of rig and present condition of equipment, the rigs were utilised to their optimum level. Besides, up-gradation and replacement of major systems and equipment of these two rigs had been initiated to improve their future performance.

The Company had accepted that the rigs were old and the equipment on board had outlived their useful lives. Audit, however, noticed that the proposal for replacement of major equipment on the rigs was yet (May 2015) to be approved and, hence, it was unlikely that the same would be replaced during the ensuing dry dock (Sagar Vijay in 2015 and Sagar Bhushan in 2016). Thus, both the rigs would continue to operate with lower efficiency. It was noticed that the rig Sagar Vijay had not drilled a single well with depth more than 400 metres during the seven year period (2006-13) and had taken up drilling of a single deep water location in 2013-14 which emphasises the inefficient deployment and operation of these rigs.

The Company in its supplementary reply (August 2015) stated that due to availability of Dynamic Positioning (DP) rigs since 2003, the DP rigs were deployed for deeper water

operations considering their suitability of east coast environment. The Company's reply needs to be viewed in the context of high operating cost of these drillships as against their deployment. MOPNG in its reply (August 2015) did not offer any comments on this issue.

6.3 Delay in replacement of equipment on rigs

A. Delay in replacement of main engine of rigs

The rig equipment replacement policy of the Company (November 2008) laid down the schedule for replacement of equipment on rigs. The policy, *inter-alia*, provided that main engine, alternator, DC motor of the rigs need to be replaced after twenty years.

The rigs Sagar Vijay and Sagar Bhushan had been commissioned in 1985 and 1987, respectively and the main engine, alternators and DC motors on these rigs were well over twenty five years old when a decision (2014) was taken for their replacement. This was in contradiction to the rig equipment replacement policy of replacing the equipment after 20 years.

Audit noticed that overhauling of the main engines were delayed due to non-availability of spares. Besides, the spares were being made available by the OEM at a very high cost as they were custom made, the main engine having already become obsolete. Subsequently, in May 2014, it was proposed to replace the main engines which was yet to be approved. In the proposal, the Company had worked out the savings on replacing the main engine as being ₹ 11.06 crore per annum (due to reduced cost of operation and lower fuel consumption). Considering the lead time for procurement of the engines, it was unlikely that the engines would be replaced during the next dry dock (2015 for rig Sagar Vijay and 2016 for rig Sagar Bhushan).

The Company, while acknowledging (April 2015) that there had been delay in procurement of spares, stated that impetus rate contracts had also been put in place to expedite the spares procurement process. A number of capital equipment were under procurement and would be replaced during rig operation itself. The replacement of main engines and water makers were presently under procurement and would be replaced at the earliest available opportunity.

The reply needs to be viewed against the non-compliance with the Company's own rig equipment replacement policy of 2008 and continuance with obsolete equipment which had a higher cost of operation. MOPNG had no further comments to offer (August 2015).

B. Delay in replacement of water makers

All offshore rigs have water makers installed on them to cater the requirement of potable water as supply of potable water from base was costlier. Each departmental offshore rig had two water makers (one working and one standby). The life of the water maker was ten years as per the equipment replacement policy (November 2008).

Audit noticed that replacement of water makers was overdue in five out of eight offshore rigs. In four rigs (Sagar Shakti, Sagar Bhushan, Sagar Jyoti and Sagar Gaurav), the water makers were not functional at all and the entire potable water requirement was being met by supply from base through OSVs. In other two rigs also, the requirement of potable water exceeded the actual production and the shortfall was being met through supply from base. Supply from

base was more expensive than production through water makers. Considering the rate of supply of potable water from base at ₹ 6 per litre (conservative estimates taken from the Company) and adjusting for the cost of production of potable water through water makers at ₹ 0.50 per litre (estimates of Company), the extra expenditure on supply of potable water from base during 2010-14 worked out to ₹ 70.89 crore. Besides, need to supply potable water to rigs added to the burden on marine logistics, especially OSVs which were not adequate for logistics supplies to the rigs for ensuring unhindered drilling operations.

The Company stated (April 2015) that water makers installed at rigs were designed to utilise heat generated by the power pack engines to produce potable water from sea water. Heat generation depends upon the availability of load on the engines which in turn depends on the operation being carried out at rig. Further, water was transported through supply vessels carrying regular provisions. When the potable water was pumped through bulk hoses, boat delivers the other rig materials like mud chemicals, store/spares *etc.* concurrently. Therefore, there was no time loss of boat/supply vessels in delivering the potable water and, thus, charter hire day rate of OSVs cannot be included in the cost of water supplied to rig. The Company further stated (April 2015) that replacement policy was not mandatory in case of working equipment/ where OEM support and spares were available. However, replacement of equipment as per need was already in process and these would be soon replaced.

The reply of the Company is not convincing. It is pertinent to note that the hired rigs cater to their own water requirement. Out of potable water supplies made by the Company to all the rigs during 2010-14, a meagre 3.1 to 7.8 *per cent* was supplied to CH rigs while the bulk 96.9 to 92.2 *per cent* was supplied to owned rigs. The Company had charged its contractors (May 2014) ₹ 6.48 per litre for supply of potable water through its vessels. Audit noticed that this rate (₹ 6.48 per litre) had been worked out based on costs alone without loading any profit margin. In fact, the Company charged a much higher rate (including a profit margin of 50 *per cent*) to others for supply of potable water. While working out the financial impact of supplying potable water from base, Audit had considered a conservative estimate of ₹ 6 per litre and also adjusted it against the actual cost of production of water by water makers.

MOPNG in its reply (August 2015) did not offer any comments on this issue.

6.4 Refurbishment and up-gradation of onland rigs

The capital repair and up-gradation of onland departmental rigs were done through BHEL and the Company's Central Work Shop (CWS) located at Vadodara. Audit scrutinised the capital repair jobs conducted by CWS during 2010-14. It was noticed that of the 27 repair jobs carried out by the Company during this period, only five were completed within the planned time (CWS plans 180 days for repair of drilling rigs and 150 days for repair of work-over rigs). In the remaining 22 cases, delays upto 181 days were noticed which impacted availability of rigs.

Audit noticed that delay in procurement of spares and delay in release of rigs by the Assets were the major contributing factors as indicated below:

- The capital repair of three rigs (BHEL 120-III, 120-IV and 120-VI) had been planned by CWS for the year 2010-11. CWS, however, placed the order for spares necessary for the repairs only in August 2010 which was received in June 2011. The capital repairs of these rigs had to be postponed for want of spares. Capital repair of BHEL-III and IV was finally delayed by two years while that of BHEL-VI was delayed by three years.
- Repair of the rigs, CW-700-II and BHEL-M-450-1 had been planned in the year 2009-10. Accordingly, CWS procured the spares necessary for repair of CW-700-II and BHEL-M-450-1, worth USD 0.95 million (₹ 4.59 crore, 1 USD = ₹ 48.33) in 2009. However, as the rigs were not released by the Asset, the actual repair of the rigs was carried out much later (in 2011-12 for rig BHEL-M-450-1 and 2012-13 for rig, CW-700-II). Similarly, though the spares for repair of rig M-750-II valuing USD 331,767 had been received in CWS in March 2011, the actual repair could be carried out only in 2012-13. In another case, spares valuing ₹ 3.10 crore for the work-over rig A-50-III had been procured in December 2009 but the actual repair was carried out only in 2011-12. Delay in release of rigs by the concerned Assets led to blocking up of funds with the CWS.

The Company stated (October 2014) that rig refurbishment time was dependent on various factors. One of the main factors was the condition of the rig on receipt. CWS procured overhauling spares and this did not include other type of components called insurance spares. The condition of such type of components were known only at the time of dismantling. CWS had to procure components/services which were not envisaged for replacement in regular refurbishment. Procurement of such components/services took time due to inherent intricacy of such type of components and procurement process. Secondly, the rigs were chassis mounted and needed complete chassis repair along with equipment mounted on chassis. Thirdly, all the rigs were very old, more than 20-25 years in operation and were continuously exposed to open atmosphere which reduced its life cycle. MOPNG in its reply stated (August 2015) that further steps have been taken to get the health check-up of all rigs through a third party agency and rigs have been categorized based on the need to refurbish or to lay off the rigs.

Reply of the Company needs to be viewed in the context that the insurance spares were needed to be kept at CWS as non-availability of these spare at CWS caused delay in majority of the cases. The proposed action as mentioned in MOPNG's reply would be watched in future audit.