OIL INDIA LIMITED

(A Government of India Enterprise)
P.O. Duliajan, Pin – 786602
Dist-Dibrugarh, Assam

CORRIGENDUM

Addendum No. 3 dated 05.03.2015 to IFB No. CDG5783P15

This Addendum No. 3 dated 05.03.2015 to IFB No. CDG5783P15 for Hiring of Consultancy Services for Laboratory and Simulation Study for Feasibility of Application of Alkaline Surfactant Polymer (ASP)/ Surfactant Polymer (SP)/ Alkaline Surfactant (AS) Flooding in OIL's reservoirs of OIL's operational areas of Assam, India, is issued to modify the bid document to include the changes as furnished in Annexure-I given herein below and to extend the bid closing/opening date and sale of the tender document date as follows:

i)	Last date of sale of Tender Document	: 24.03.2015[15.30 Hrs(IST)]
ii)	Bid Closing Date & Time	: 31.03.2015[11.00 Hrs(IST)]
iii)	Bid Opening Date & Time	: 31.03.2015[14.00 Hrs(IST)]

All other Terms and Conditions of the Bid Document remain unchanged.

(A Das)
Head-Contracts
For Resident Chief Executive

IFB No. : IFB No.CDG5783P15 for Hiring of Consultancy Services for Laboratory and Simulation Study for Feasibility of Application of Alkaline Surfactant Polymer (ASP)/ Surfactant Polymer (SP)/ Alkaline Surfactant (AS) Flooding in OIL's reservoirs of OIL's operational areas of Assam, India

Sl. No.	Clause No.	Existing clause Description	Modified clause Description
1	**Clause 2.3 of Section-II (Scope of Work) Pg 46**	The study will include a comprehensive review of existing geophysical, geological, petrophysical, reservoir, pressure-production data of 02 (two) selected candidate reservoir blocks. The Consultant will carry out necessary laboratory studies for chemical EOR (ASP), review/study all available geo-scientific and engineering data/reports, and the history matched geo-cellular model of the candidate reservoir blocks, which will be provided by OIL, and then carry out an integrated reservoir simulation study incorporating inputs from lab study. Based on its results and recommendations, the Consultant will prepare a field redevelopment and implementation plan of these two reservoir blocks incorporating amenable IOR/EOR schemes (including techno-economic evaluation).	The study will include a comprehensive review of existing geophysical, geological, petrophysical, reservoir, pressure-production data of 02 (two) selected candidate reservoir blocks. The Consultant will carry out necessary laboratory studies for chemical EOR (ASP), review/study all available geo-scientific and engineering data/reports, and the history matched geo-cellular model of the candidate reservoir blocks, which will be provided by OIL, and then carry out an integrated reservoir simulation study incorporating inputs from lab study. Based on its results and recommendations, the Consultant will prepare a field redevelopment and implementation plan of these two reservoir blocks incorporating amenable IOR/EOR schemes (including techno-economic evaluation). **Geo-static model will be provided. Seismic data is also partly available for these two reservoirs in SEG-Y format.**
2	**Clause 6.5 of Section-II (Scope of Work) Pg 50 & 51**	The team of experts from the Consulting firm (or consortium) will visit Company offices at Duliajan, Assam to review/collect the following data for laboratory study and geoscientific data / reports of the 2 candidate reservoir blocks.	The team of experts from the Consulting firm (or consortium) will visit Company offices at Duliajan, Assam to review/collect the following data for laboratory study and geoscientific data / reports of the 2 candidate reservoir blocks. • Sample collection of crude oil and water

		• Sample collection of crude oil and water (formation, injection, produced samples of the selected reservoirs). • The consultant will visit Oil Collecting Stations (OCSs), Water Injection stations, check availability of pumps, equipments and mixing facilities, chemical dosing setup, laboratory facilities of the Chemical and R&D departments and gather data as may be required. The consultant will hold discussions with the personnel from Geology & Reservoir Engineering, Production, R & D, Chemical and Field Engineering departments to assess the procedures and practices and evaluate the various aspects of the feasibility of the project. • Side-wall core analysis reports on lithology, porosity, fluid content for most of the wells in the fields. Conventional core data are available in key wells. • Available structural maps. • Available Isopay maps. • Drilling history • Volumetric estimates of Hydrocarbon in-place and reserves. • PVT and crude oil/gas components/analysis data are available in key wells. ➢ NHK 11D+18 Block : 10 wells ➢ Zaloni 41+54 Block : 7 wells Conventional core and Special Core Analysis (SCAL) data of key wells. ➢ NHK 11D+18 Block : 1 well ➢ Zaloni 41+54 Block : 2 wells	(formation, injection, produced samples of the selected reservoirs). • The consultant will visit Oil Collecting Stations (OCSs), Water Injection stations, check availability of pumps, equipments and mixing facilities, chemical dosing setup, laboratory facilities of the Chemical and R&D departments and gather data as may be required. The consultant will hold discussions with the personnel from Geology & Reservoir Engineering, Production, R & D, Chemical and Field Engineering departments to assess the procedures and practices and evaluate the various aspects of the feasibility of the project. • Side-wall core analysis reports on lithology, porosity, fluid content for most of the wells in the fields. Conventional core data are available in key wells. • Available structural maps. • Available Isopay maps. • Drilling history • Volumetric estimates of Hydrocarbon in-place and reserves. • PVT and crude oil/gas components/analysis data are available in key wells. ➢ NHK 11D+18 Block : 10 wells ➢ Zaloni 41+54 Block : 7 wells Conventional core and Special Core Analysis (SCAL) data of key wells. ➢ NHK 11D+18 Block : 1 well ➢ Zaloni 41+54 Block : 2 wells Pressure transient test results are

		Pressure transient test results are available in key wells. ➢ NHK 11D+18 Block : 3 wells ➢ Zaloni 41+54 Block : 4 wells Well test, perforations, and completion data available in digital format. BHP and BHT, Pressure–Production and Produced water salinity data available in digital format. Economic/financial parameters/data Any other relevant data that may be required **Deliverables:** • Review of available laboratory testing facilities in Chemical and R&D department. • Reports of site visits with observations, wherever necessary. • Consultant should submit a brief report on the data collected indicating the data gaps, if any.	available in key wells. ➢ NHK 11D+18 Block : 3 wells ➢ Zaloni 41+54 Block : 4 wells Well test, perforations, and completion data available in digital format. BHP and BHT, Pressure–Production and Produced water salinity data available in digital format. Economic/financial parameters/data Any other relevant data that may be required **PVT data will be provided during the data collection phase. No SEM-XRD data available for these two blocks, but analog data can be provided.** **Deliverables:** • Review of available laboratory testing facilities in Chemical and R&D department. • Reports of site visits with observations, wherever necessary. • Consultant should submit a brief report on the data collected indicating the data gaps, if any.
3	**Clause 6.10 of Section-II (Scope of Work) Pg 53**	This phase will involve review of the history matched geological models of selected reservoir blocks, which will be provided by OIL in PETREL/PETREL RE/ECLIPSE format, and then incorporate inputs from the findings of the lab study. The history matched models may be suitably modified, if required,	This phase will involve review of the history matched geological models of selected reservoir blocks, which will be provided by OIL in PETREL/PETREL RE/ECLIPSE format, and then incorporate inputs from the findings of the lab study. The history matched models may be suitably modified, if required, after

		after combining all the geophysical, geological, petrophysical, laboratory analysis and engineering data for the selected 2 (two) reservoir blocks under study. The block wise break-up of wells are as follows: ➢ NHK 11D+18 Block : 39 wells ➢ Zaloni 41+54 Block : 22 wells	combining all the geophysical, geological, petrophysical, laboratory analysis and engineering data for the selected 2 (two) reservoir blocks under study. The block wise break-up of wells are as follows: ➢ NHK 11D+18 Block : 39 wells ➢ Zaloni 41+54 Block : 22 wells **History matched dynamic models will be provided. The consultant will have to incorporate the lab data with the dynamic model and review it for any other relevant data requirement to generate various realizations as explained in the SOW.**
4	**Clause 6.0 C Fourth Deliverable of Section II (Scope of Work) Pg 54**	**6.0.C: Phase – III: Dynamic Modeling of candidate blocks** Simulation results of various cases and their comparison with the best case (for pilot area/areas as well as for the reservoir as a whole)	**6.0.C: Phase – III: Dynamic Modeling of candidate blocks** Simulation results of various cases and their comparison with the best case (for pilot area/areas as well as for the reservoir as a whole) **Numerical simulation to be done for the whole reservoir including the identification of the pilot area.**
5	**Clause 6.0 C Fifth Deliverable of Section II (Scope of Work) Pg 55**	**6.0.C: Phase – III: Dynamic Modeling of candidate blocks** If the Reservoir Simulation studies are carried out using softwares other than PETREL and PETREL RE/ ECLIPSE respectively, then the bidder must ensure that these models are handed over to OIL in a format compatible to load and run in PETREL and ECLIPSE/ PETREL RE available with OIL and the Consultant will have to load and run the model in Eclipse/ Petrel RE software available with OIL at no additional cost.	**6.0.C: Phase – III: Dynamic Modeling of candidate blocks** If the Reservoir Simulation studies are carried out using softwares other than PETREL and PETREL RE/ ECLIPSE respectively, then the bidder must ensure that these models are handed over to OIL in a format compatible to load and run in PETREL and ECLIPSE/ PETREL RE available with OIL and the Consultant will have to load and run the model in Eclipse/ Petrel RE software available with OIL at no additional cost. **The model prepared**

			by the consultant should be compatible with ECLIPSE/PETREL RE.
6	**Clause 6.0 C and D of Section II (Scope of Work) Pg 53,54,55 & 56**	Entire Clause as mentioned in the Tender	Entire Clause as mentioned in the Tender. + **Average run time required is 3 - 5 hrs.**
7	**Clause 6.0 A of Section II (Scope of Work)**	Existing Clause as mentioned in the Tender	Existing Clause as mentioned in the Tender + **The temperature at which the separator will run in the relevant field is 45 ° - 50 ° C.**
8	**Clause 6.2 of Section II (Scope of Work)**	OIL has already conducted a pre-tender conference on 29 and 30 November, 2012 in OIL's corporate head office at NOIDA, where few of the interested bidders made detailed presentation on their proposal and interacted with OIL's personnel to assess the work involvement before submitting their bid. **On the basis of the assessment of the work involvement, bidders will quote as per the format given in Annexure-II**. The proposed consultancy study needs to be completed within a time frame not exceeding **14 months** from the date of commencement of the Contract.	OIL has already conducted a pre-tender conference on 29 and 30 November, 2012 in OIL's corporate head office at NOIDA, where few of the interested bidders made detailed presentation on their proposal and interacted with OIL's personnel to assess the work involvement before submitting their bid. **On the basis of the assessment of the work involvement, bidders will quote as per the format given in Price Bid Proforma**. The proposed consultancy study needs to be completed within a time frame not exceeding **14 months** from the date of commencement of the Contract.
9	**Attachment to Section II (Scope of**	NIL	**Appendix –I to the Tender is attached.**

	Work)		
10	**A.Technical of BRC/BEC Pg 22**	NIL	1.4 **<u>Bids from Consortium:</u>** 1.4.1 Any one of the consortium partner should satisfy the minimum experience requirement as per Para 1.1, 1.2 and 1.3 above. Further, any one of the consortium members individually shall have to meet the financial turnover criteria mentioned in Para 2.0. 1.4.2 Consortium bids shall be submitted with a Memorandum of Understanding between the consortium members duly signed by the authorized Executives of the consortium members clearly defining the role/scope of work of each partner/member, binding the members jointly and severally to the responsibility for discharging all obligations under the contract and identifying the Leader of Consortium. Unconditional acceptance of full responsibility for executing the 'Scope of Work' of this bid document by the Leader of the Consortium shall be submitted along with the technical bid. 1.4.3 Only the Leader of the consortium shall buy the bid document, submit bid and sign the contract agreement (in the event of award of contract) on behalf of the consortium. 1.4.4 The Bid Security shall be in the name of the Leader of the consortium on behalf of consortium with specific reference to consortium bid and name & address of consortium members. Similarly the Performance Security shall be in the name of

			the Leader on behalf of the consortium.
11	**To add Note at the end of Section-II (Scope of Work)**	NIL	**Note :** **(i)** The reservoirs appear to be water wet. **(ii)** Salinity: 20-50 ppm ; Magnesium : around 20 mg/l; Calcium : around 15 mg/l. **(iii)** As of now, we plan to conduct full laboratory analysis and Reservoir Simulation studies for both the reservoirs. **(iv)** Both reservoirs are far below the bubble point pressure and hence appear to be intriphasic conditions. **(v)** The two reservoirs have been shortlisted envisaging improved Recovery Factor from them. **(vi) Type of model : Black oil** PLT and RFT data may be available for some wells. If recommended, we can also log PLT and RFT data in some key wells during the course of the study. **(vii) Emulsion Studies:** •OIL is referring to the possibility of a strong/ stable emulsion formation at the topside after the initiation of ASP flooding. This will depend on the chemical characteristics of the surfactant recommended as part of the study. •Typically, the temperature of the separators is usually 50 deg. C, and varies slightly from one installation to another(+/-5 deg. C). •After screening and short listing the most promising surfactant formulations, the

			emulsion stability evaluation will have to be carried out. Hence charges for the same must be quoted separately. •OIL has approved vendor(s) for supply of demulsifiers for its different fields. The formulation being used in the field should be investigated for demulsification. If this fails to provide satisfactory performance (due to the possibility of a strong emulsion resulting due to surfactant action), alternative formulations should be investigated and suggested. **(viii)** Treatment option of produced water with suitable chemicals with scope for re-injection to address HSE concerns training and technology transfer: •The water treatment requirements for disposal and re-injection could involve some common elements (e.g. clarification of water through removal of emulsified oil). However, the EOR additives might render the produced water off-specifications for disposal. This aspect will need to be evaluated once the EOR additives are shortlisted. •In OIL, the produced water treatment has been standardized over the years and involves a combination of gravity settling, deoiler treatment, induced air floatation and filtration. The quality of treated water is usually monitored in terms of its oil content (less than 10 ppm for injection water and 50-100 ppm for disposal could be considered good quality). •Injectivity of the produced water during re-injection is expected to be a concern.

			•OIL does not want to carry out degradation studies for the EOR additives. QC lab studies refers to the routine parameters of the produced water for monitoring during disposal/ re-injection. **(ix)** <u>Training and Technology transfer</u> Points A, B : The technology transfer is meant in relation to job work association only whereby 2-3 OIL personnel's at one point of time could be involved for maximum of 5-10 working days during laboratory and simulation studies including history matching and prediction. Point C: 2-3 OIL personnel at one point of time. **(x) Sample Collection:** The Consultant is to collect samples from the field. **(xi)** Food, Lodging and Transportation will be provided by OIL to the Consultants during their stay in Duliajan. **(xii)** Government/Pollution Control guidelines enclosed as **Annexure-B** to the tender.
12	**Clause 5.2 of Section I (GCC) Pg 29**	The Contractor shall be solely responsible throughout the period of this contract for providing all requirements of their personnel including but not limited to their transportation to & fro Duliajan/field site, enroute/local boarding, lodging, medical attention etc. Company shall have no liability or responsibility in this regard.	The Contractor shall be solely responsible throughout the period of this contract for providing all requirements of their personnel including but not limited to their transportation to & fro Duliajan, enroute boarding, lodging, medical attention etc. Company shall have no liability or responsibility in this regard.

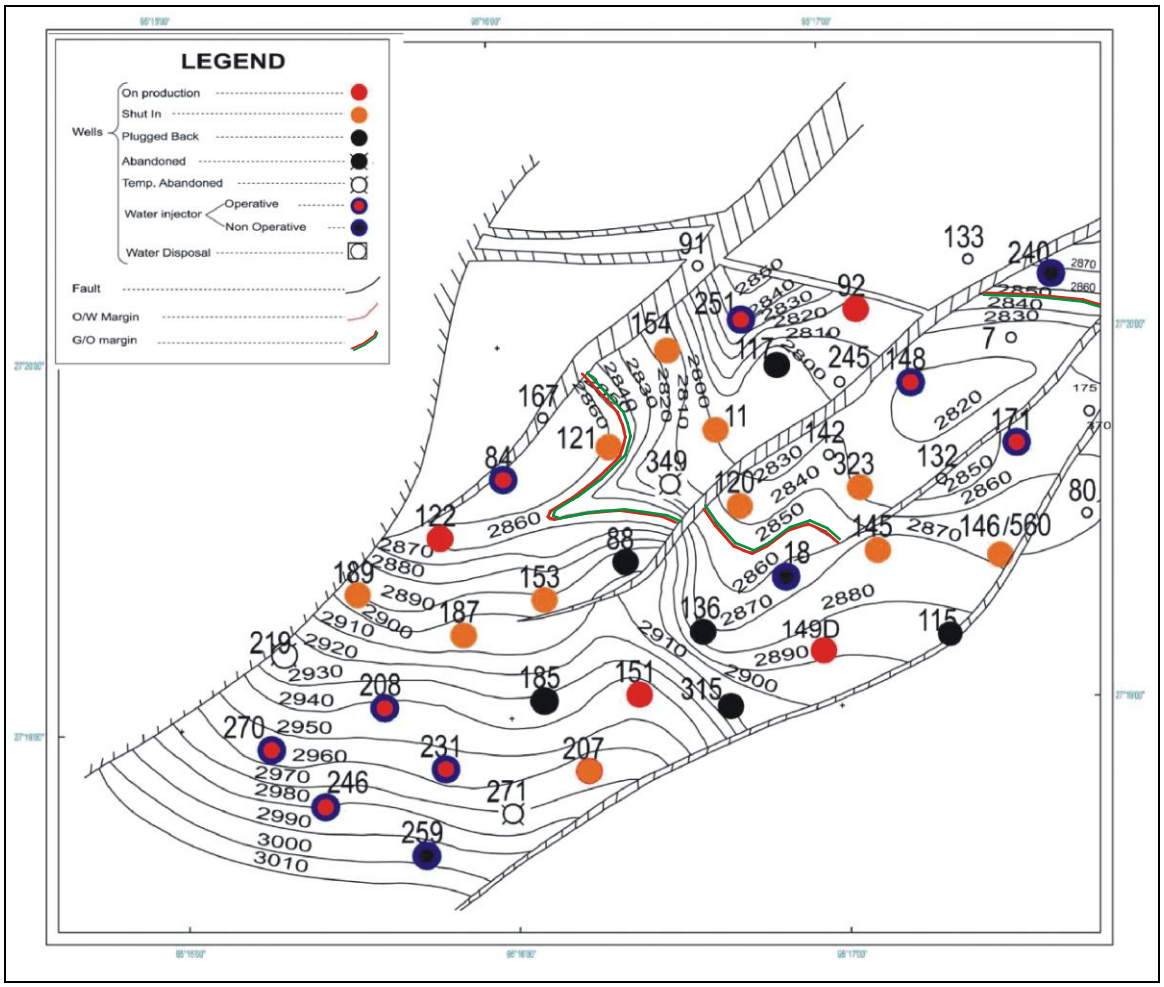
Annexure-B

Government/Pollution Control guidlines

Sl .No.	Parameter	On-shore discharge standards (Not to exceed)
1	pH	5.5—9.0
2	Temperature	40oC
3	Suspended Solids	100 mg/l
4	Zinc	2 mg/l
5	BOD	30 mg/l
6	COD	100mg/l
7	Chlorides	600 mg/l
8	Sulphates	1000 mg/l
9	TDS	2100 mg/l
10	%Sodium	60 mg/l
11	Oil and Grease	10 mg/l
12	Phenolics	1.2 mg/l
13	Cyanides	0.2 mg/l
14	Fluorides	1.5 mg/l
15	Sulphides	2.0 mg/l
16	Chromium(Cr+ 6)	0.1 mg/l
17	Chromium (Total)	1.0 mg/l
18	Copper	0.2 mg/l
19	Lead	0.1 mg/l
20	Mercury	0.01 mg/l
21	Nickel	3.0 mg/l

A. NHK Main Barail 3rd Sand (011D+018 Block)

1. NHK 011D+018 block occupies an area of about 8.15 km^2. The pool is in south western portion of the Nahorkatiya Main anticline and is bound by faults on the western and eastern parts. The productive limit on the southwestern side is limited by oil-water margin. This block is a faulted anticlinal structure with the major axis trending in NE-SW direction. Within this block, there are two major NE-SW trending non sealing faults which are depicted in the structure contour map of Barail Third sand (Figure – 1). The oil water margin in the southern part forms the remaining boundary of the pool. There is a gas cap present in the reservoir with volume equal to 19% of reservoir oil volume. The gas-oil margin is at about 2859 mbd in the central part of the reservoir.

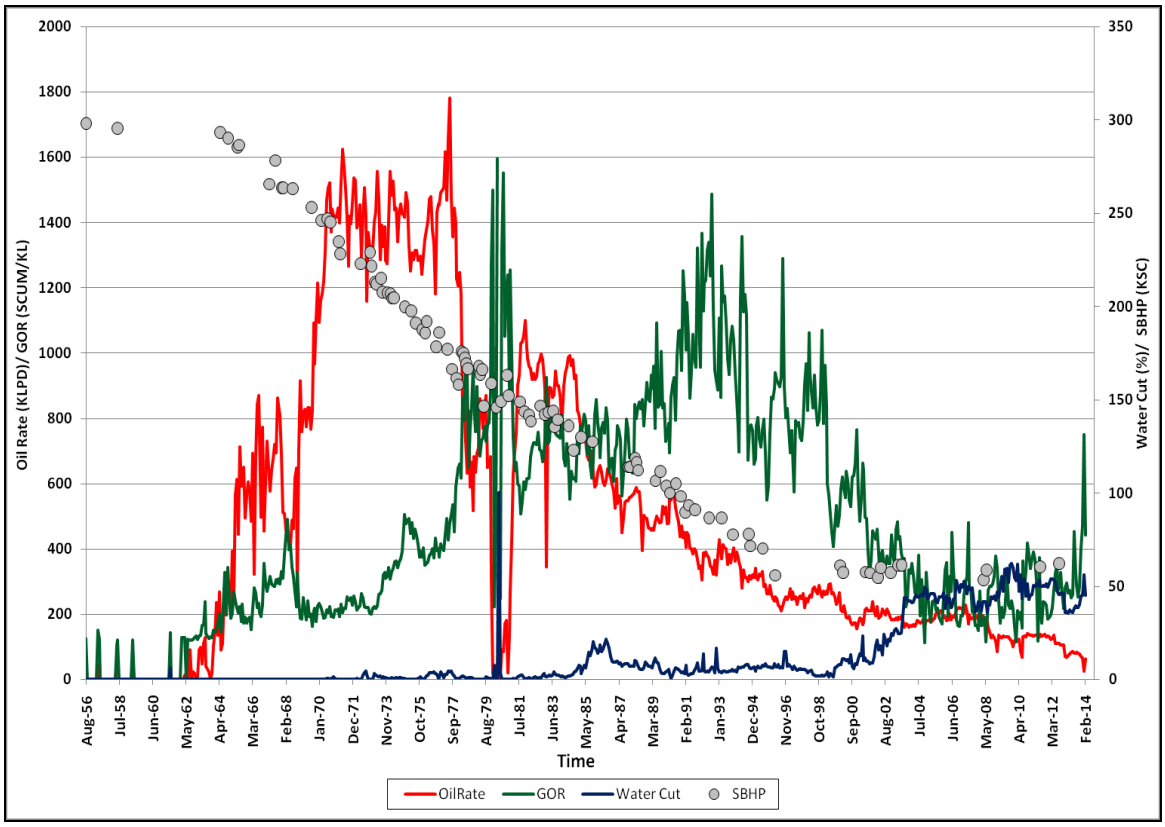


Text Figure – 1: Depth Contour Map on Top of Barail 3rd Sand NHK Main (11D + 18 Block)

2. So far, 39 wells have been drilled in this reservoir out of which only 4 wells are on production, 13 wells are shut-in and 8 well are injecting water. Out of 13 shut in wells, four wells are shut in due to poor inflow. Four wells are kept shut in due to very high gas oil ratio. Two wells are kept shut in due to complicated tubing fish in the hole. The remaining three wells are shut in due to 100% water cut.

3. Two wells were isolated due to high producing GOR and both the wells were recompleted in Barail 4th+5th sand. Five wells are non-operative water injectors and rest seven wells are plugged back.

4. The pressure production plot of the NHK Barail 3rd Sand 11D+18 is presented in Text Fig – 2. NHK018 was the first well to be completed in the reservoir in Aug'1956. But regular production from the reservoir could be established only in Dec'63. The oil production rate from the reservoir gradually built up with completion of new wells in the reservoir, to a plateau production level between 1400 - 1500 m^3/day in 1970 and remained more or less at that level till the onset of decline by end of 1977. During 1979-80, oil production from the reservoir was completely stopped due to state wise agitation in Assam. After that, the oil production from the reservoir continued to decline. As 31.01.2014, the oil production rate of the block is 64 m^3/day.



Text Fig - 2: Pressure production performance of 11D+18 block

5. This block produced clean oil with negligible water up to Apr'70. Water cut of the reservoir remains below 5% up to Oct'84 and between 10 – 15 % up to 1999. After that, water cut started to increase as water injection was continued (Water injection started during Jul'78) in the reservoir. The present water cut of the block is 45%.

6. Initial produced GOR of the block had remained between 150 – 220 SCM/KL up to 1973, when the reservoir pressure was around 230 Ksc. After that as the pressure decreased with continuous oil production, the produced GOR started increasing and reached to the level of 1480 SCM/KL in Aug'92. The increase in produced GOR indicates liberation of solution gas in the reservoir due to drop in reservoir pressure below bubble point. Since 1992, the produced GOR started decreasing indicating that maximum of solution gas has evolved from the oil and same is being produced from the wells. The current GOR of the block is 442 SCM/KL.

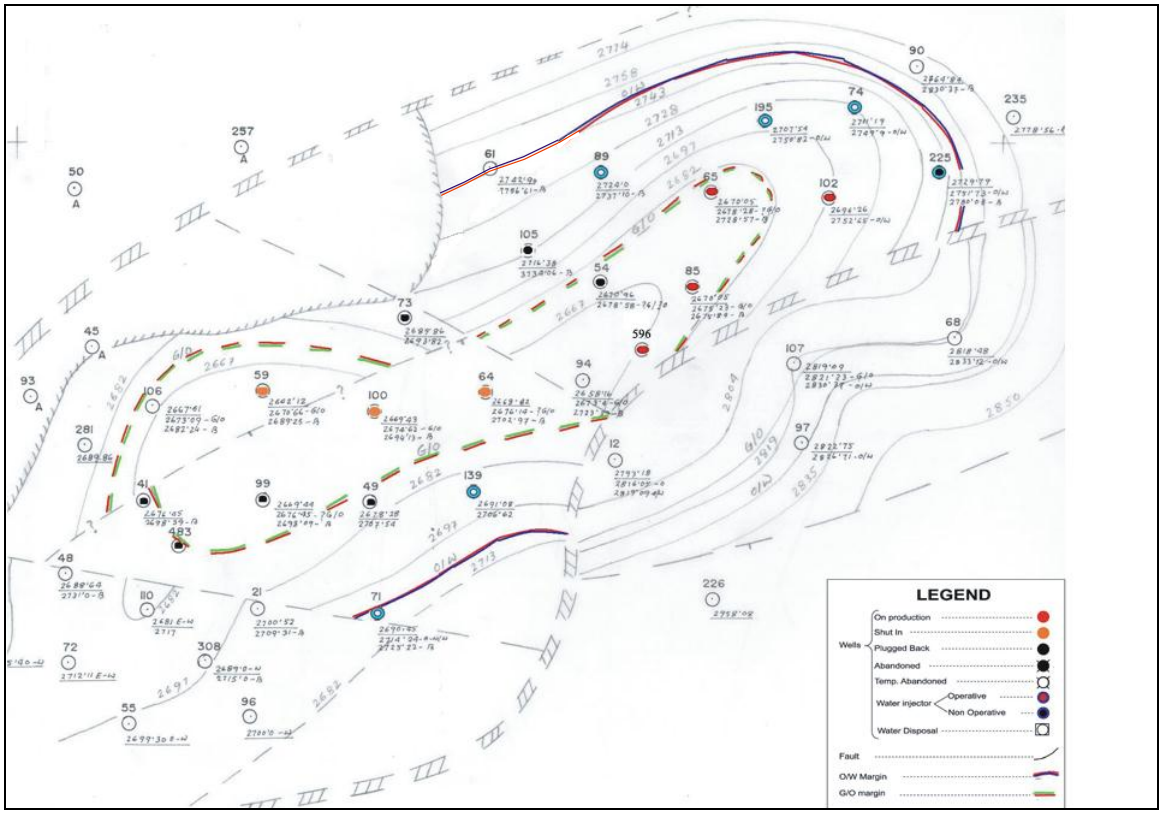
7. Water injection was started in this reservoir during July'1978 with one well after the reservoir pressure had declined to 165 ksc with oil recovery equivalent to 20% of STOIIP. Since then number of wells were converted as water injector. Presently, 8 injection wells are in operation injecting around 2635 klpd water.

8. The initial reservoir pressure was 300 Ksc. There has been a continuous decline in reservoir pressure of the block with continuous oil production. The minimum reservoir pressure of the block was measured as 54 Ksc in Dec'02. The current reservoir pressure of the block is 62 Ksc (measured in May'11), showing minor increase in reservoir pressure due to water injection.

9. The cumulative oil production from the reservoir is 9.9799 MMSKL (around 36.9% of STOIIP - 27.0396 MMSKL) as on 31.03.2013, and corresponding gas production is 5194.7233 MMSCM with GIIP - 6094.8826 MMSCM.

B. Zaloni Barail 4th Sand (41+ 54 Block)

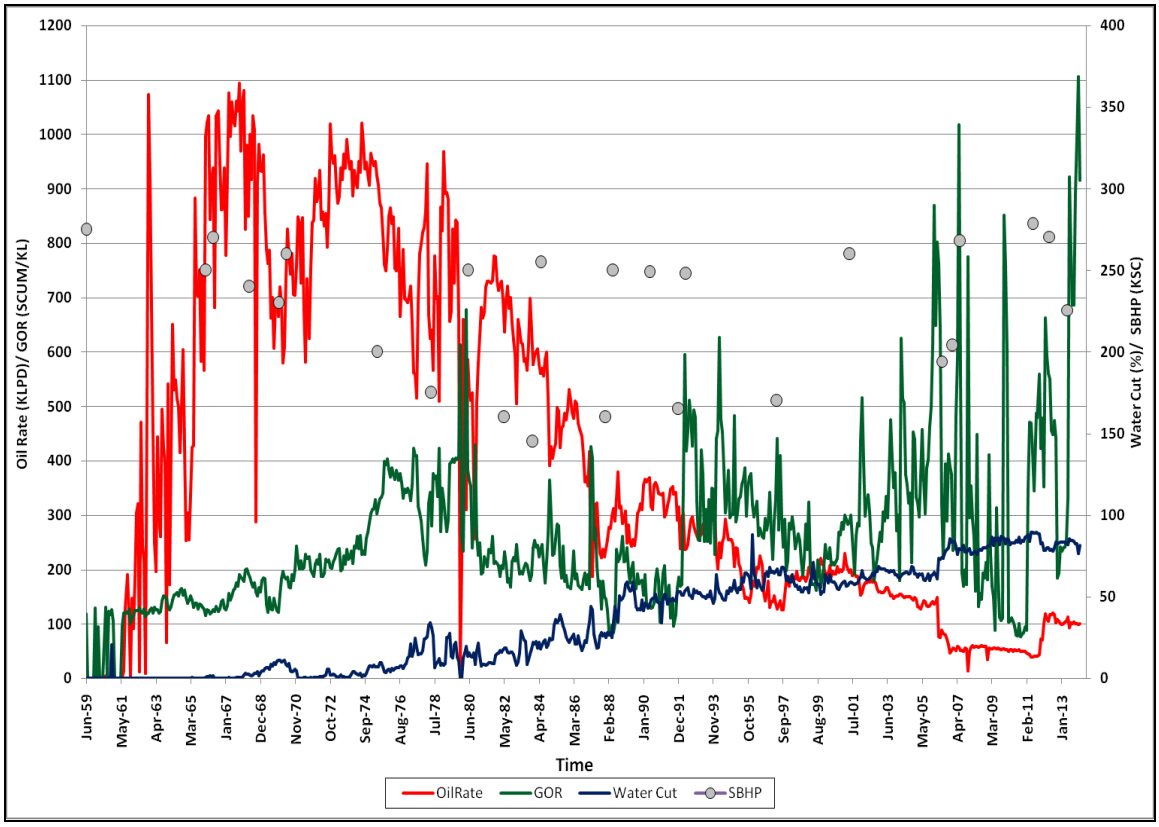
10. The Zaloni field is an elongated dome like structure at Barail top level with the major axis trending in the NE-SW direction. Three major faults trending NE-SW direction divide the structure into three fault block. The Zaloni main block which is at the central part of the structure have multi-stacked hydrocarbon potential reservoirs namely Barail 3rd Sand, Barail 4th Sand and Barail 5th Sand respectively. The structure contour map on top of Barail 4th sand 41+54 Block is presented in Text Figure – 3.



Text Figure – 3: Depth Contour Map on Top of Barail 4th Sand Zaloni (41+54 Block)

11. So far, 22 wells have been completed in this reservoir, out of which only 4 wells are on production, 4 wells are shut-in and 5 well are injecting water. 6 wells are plugged back and completed higher up and rest 3 wells are temporarily abandoned.

12. The pressure production plot of the Zaloni Barail 4th Sand (41+ 54 Block) is presented in Text Fig – 4. The sand was completed as an oil producer in June'59; however the regular production commenced in mid-1961. The production rate of this pool reached to a peak level of 1080 klpd by Feb'68 due to completion of other wells in this reservoir. Later, production rate from this pool fluctuated in the range of 600 – 900 klpd till 1985 after which it started declining. The current oil production from this pool is around 102 klpd.



Text Fig - 4: Pressure production performance of 41+54 block

13. Significant water production from this Pool started from 1975 which gradually increased to a level of around 200 klpd till early part of 1983. Subsequently, water production started increasing and reached to a level of around 361 klpd by Mar'89. The current level of water production from this reservoir is around 454 klpd (82 % water cut).

14. Early trend of the GOR of the reservoir was more or less remained close to solution GOR (130 scum/kl) of the reservoir and showed a steady trend till 1969. After that, as the reservoir pressure started declining, a rising trend in GOR value was observed. The current GOR value is 916 scum/kl.

15. Water injection was initiated in the block in June, 1969 which arrested the decline in oil production and took it back to a level of around 1000 klpd for a few years in the 1970's. Gas injection was also initiated in the reservoir from September, 1965. While gas injection was discontinued in July, 1999, water injection is presently ongoing through five injection wells. The present rate of water injection is around 910 klpd. However, the reservoir is on a constant decline from 1975 with the increase of water cut and was producing at the rate of around 40 klpd with 88 % water cut during November 2011. A new well has come up recently, which was drilled as a replacement of gas injector well, and has shoot up the production to around 120 klpd with 78 % water cut.

16. The initial reservoir pressure was around the bubble point pressure of 275 kg/cm^2. Pressure maintenance operation was started with injection of gas through NHK 94 in Sept '65. The reservoir pressure at the time of initiation of pressure maintenance was around 265 kg/cm^2. Water injection was also initiated in July '69 to add support to the aquifer drive. As can be seen from production plot, two distinct pressure trends were observed in the reservoir. Pressure decline has been more abrupt in wells located away from the periphery of the oil-water contact / water injection wells. The current average reservoir pressure is estimated to be around 119 kg/cm^2. Early initiation of pressure maintenance scheme has resulted in high recovery from this reservoir.

17. The cumulative oil production from the reservoir is 7.7183 MMSKL (around 53.4% of STOIIP - 14.4666 MMSKL) as on 31.03.2013, and corresponding gas production is 1867.4342 MMSCM with GIIP - 2210.2907MMSCM.

18. The summarized reservoir data of the above discussed reservoir is presented in Text Table-1.

Text Table – 1: Summarized Reservoir Data

Reservoir	**NHK Main Barail 3rd Sand (011D+018 Block)**	**Zaloni Barail 4th Sand (41+ 54 Block)**
STOIIP, MMSKL	27.0396	14.4666
Cumulative Production, MMSKL	9.9799	7.7183
No. of Wells	39	22
Wells on Production	4	4
Water Injection wells	8	5
Oil Production rate, m3/day	63.7	101.4
Reservoir Datum Depth, mbd	2896	2713
Initial Reservoir Pressure, kg/cm^2	300	275
Current Reservoir Pressure, kg/cm^2	62	119
Bubble Point Pressure, kg/cm^2	279	269
Formation Volume Factor	1.45	1.45
Oil Viscosity at initial reservoir condition, cp	0.55 - 0.65	0.5 - 0.7
Crude API	30.3	29.5
Pour Point, ^{0}C	33	29.7
Average Porosity	20.9	24
Av Permeability range from Pressure Transient Analysis in selected wells, md	30 - 200	50-500

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