तेल एवं गैस उत्पादन प्रौद्योगिकी संस्थान

Institute of Oil and Gas Production Technology

पनवेल, नवी मुंबई

Panvel, Navi Mumbai

Project Report

on

असम परिसंपत्ति में आर.डी.एस जी.जी.एस-3 के संचालन को आर.डी.एस जी.जी.एस-2 में स्थानांतरण करने के लिए साध्यता अध्ययन

Feasibility Study to Migrate RDS GGS-3 Operations to RDS GGS-2, Assam Asset

नवंबर - 2022

तेल एवं गैस उत्पादन प्रौद्योगिकी संस्थान
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कं. सं. : IO.22I.PT_SB.011S

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विषय: असम परिसंपत्ति में आर.डी.एस जी.जी.एस-3 के संचालन को आर.डी.एस जी.जी.एस-2 में स्थानांतरण करने के लिए साध्यता अध्ययन

Subject: Feasibility Study to Migrate RDS GGS-3 Operations to RDS GGS-2, Assam Asset

" असम परिसंपत्ति में आर.डी.एस जी.जी.एस-3 के संचालन को आर.डी.एस जी.जी.एस-2 में स्थानांतरण करने के लिए साध्यता अध्ययन " रिपोर्ट की प्रति आपके अवलोकनार्थ संलग्न है।

Please find enclosed a copy of the report on "Feasibility Study to Migrate RDS GGS-3 Operations to RDS GGS-2, Assam Asset" for your kind perusal.

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N. B. Joshi
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Panvel, Navi Mumbai

Project No: IO.22I.PT_SB.011S
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Feasibility Study to Migrate RDS GGS-3 Operations to RDS GGS-2, Assam Asset

कार्यकेंद्र : असम परिसंपत्ति

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Institute of Oil and Gas Production Technology

Panvel, Navi Mumbai

Executive Summary

This pertains to the project titled "**Feasibility Study to Migrate RDS GGS-3 Operations to RDS GGS-2**" taken up by IOGPT as a scheduled project under AWP 2022-23.

The existing facilities at GGS-2 are revamped in the year 2010. However, the existing GGS-3 commissioned in the year 1976 is very old and its facilities are deteriorating day-by-day. Asset wants to explore the feasibility of migrating the GGS-3 operations to GGS-2, which is expected to result in less OPEX, less manpower requirement and lower statutory compliance liability.

Simulation studies have been carried out using Aspen HYSYS process simulator and Pipesim software to review adequacy of the existing facilities to process the combined load of the two GGSs and to conceptualize additional facilities required, if any, at GGS-2. The study reveals that the existing 2-phase HP separator of GGS-2 is inadequate, to overcome which a new HP separator has been conceptualized at GGS-2. Further, as per IOGPT study for RDS redevelopment; ETP, GCP and flare system were found inadequate and have already been recommended for up-gradation. However, same recommendations were revisited considering additional flow from GGS-3, and as per study, flare system will need further up-gradation.

Additionally, two separate well-fluid lines, one for HP well-fluid and one for LP-well fluid, have been envisaged to route the well fluid from GGS-3 headers to GGS-2 headers. Also, a test line from GGS-3 test header to GGS-2 test header is envisaged to facilitate well testing. In order to supply gas from GGS-2 to the existing GGS-3 gas consumers, a pipe line is conceptualized from MP KOD of GGS-2 to GGS-3.

Details of the study have been elaborated in the report.

Rajiv Nischal.

Rajiv Nischal
GGM-HOI IOGPT

Contents

1. Background

Rudrasagar Field of Assam Asset consists of Rudrasagar GGS-1, Rudrasagar GGS-2, GCP & ETP, Rudrasagar GGS-3, Rudrasagar GGS-4 and Charali GGS. The existing facilities at GGS-1 and GGS-2 are revamped in the year 2010. Existing GGS-3 commissioned in the year 1976 is very old and has operational problems. Asset wants to explore feasibility of migrating the GGS-3 operations to GGS-2, which will result in less OPEX, less manpower requirement and lower statutory compliance liability. Hence, Asset wants to check the feasibility study to mitigate RDS GGS-3 operations to RDS GGS-2.

2. Scope of Work

- Study of the existing facilities and operations at RDS GGS-2 and RDS GGS-3
- Simulation study for diverting well-fluid and export products
- Pros and cons of unmanning RDS GGS-3

3. Basis of Study

The input data for this study like long-term production profile, gas composition, crude oil analysis etc. are provided by the Asset. The design basis considered for the surface facilities is briefed below:

3.1. Long term production profile of GGS-2 is given below in Table 3.1

Table 3.1: Production profile of Rudrasagar GGS-2

Year	Drilling Input OP	Liquid m^3/d	Oil m^3/d	Gas SCMD	Water m^3/d	Injection Gas SCMD	Total Gas (AG+IG) SCMD	Annual Oil, MMt	Annual Gas, MMm^3
2021-22		827	117	61080	710	165400	226480	0.037	22.29
2022-23	1	861	118	60585	743	172249	232834	0.038	22.11
2023-24	2	938	135	65650	803	187578	253228	0.043	23.96
2024-25	1	1170	156	72356	1014	234058	306414	0.050	26.41
2025-26		1170	158	72359	1012	234058	306416	0.051	26.41
2026-27	1	1198	153	55067	1045	239537	294604	0.049	20.10
2027-28		1198	148	53292	1050	239537	292829	0.047	19.45
2028-29	1	1232	145	52271	1087	246386	298657	0.046	19.08
2029-30		1232	143	51328	1089	246386	297714	0.046	18.73
2030-31	1	1259	138	49842	1121	251866	301707	0.044	18.19
2031-32		1259	135	48470	1125	251866	300335	0.043	17.69
2032-33	1	1287	131	47203	1156	257345	304548	0.042	17.23
2033-34		1287	128	46034	1159	257345	303380	0.041	16.80
2034-35	1	1314	125	44955	1189	262825	307780	0.040	16.41
2035-36		1314	122	43960	1192	262825	306784	0.039	16.05
2036-37		1314	113	40575	1201	262825	303399	0.036	14.81

2037-38		1314	104	37450	1210	262825	300275	0.033	13.67
2038-39		1314	96	34567	1218	262825	297391	0.031	12.62
2039-40		1314	89	31905	1225	262825	294730	0.028	11.65
Total	9							0.785	353.67

3.2. Long term production profile of GGS-3 is given below in Table 3.2

Table 3.2: Production profile of Rudrasagar GGS-3

Year	Drilling Input OP	Liquid m^3/d	Oil m^3/d	Gas SCMD	Water m^3/d	Injection Gas SCMD	Total Gas (AG+IG) SCMD	Annual Oil, MMt	Annual Gas, MMm^3
2021-22		208	116	16629	92	41600	58229	0.037	6.07
2022-23		208	107	15349	101	41600	56949	0.034	5.60
2023-24		208	99	14167	109	41600	55767	0.032	5.17
2024-25	1	242	100	14360	143	48449	62810	0.032	5.24
2025-26		242	101	14539	142	48449	62988	0.032	5.31
2026-27	1	276	101	14704	175	55299	70002	0.032	5.37
2027-28		276	102	14856	174	55299	70154	0.033	5.42
2028-29		276	94	13712	182	55299	69010	0.030	5.00
2029-30		276	87	12656	189	55299	67955	0.028	4.62
2030-31		276	80	11681	196	55299	66980	0.026	4.26
2031-32		276	74	10782	202	55299	66081	0.024	3.94
2032-33		276	68	9952	208	55299	65250	0.022	3.63
2033-34		276	63	9186	213	55299	64484	0.020	3.35
2034-35		276	58	8478	218	55299	63777	0.019	3.09
2035-36		276	54	7825	223	55299	63124	0.017	2.86
2036-37		276	50	7223	227	55299	62521	0.016	2.64
2037-38		276	46	6667	231	55299	61965	0.015	2.43
2038-39		276	42	6153	234	55299	61452	0.014	2.25
2039-40		276	39	5680	237	55299	60978	0.012	2.07
Total	2							0.474	78.33

3.3. Gas composition (Attached at **Annexure-II**)

Table 3.3: Gas composition

Components (Mole %)	Rudrasagar GGS-1	Rudrasagar GGS-2	Rudrasagar GGS-3	Rudrasagar GGS-4	GCP
Methane	89.13	92.08	82.73	94.09	92.08
Ethane	3.88	3.29	6.42	2.39	3.29
Propane	2.26	1.63	5.33	1.10	1.63
i-Butane	0.67	0.51	1.30	0.30	0.51
n-Butane	0.95	0.58	1.64	0.41	0.58
i-Pentane	0.36	0.10	0.51	0.10	0.10
n-Pentane	0.12	0.04	0.27	0.08	0.04
n-Hexane+	1.09	0.61	0.45	0.28	0.61

CO2	1.42	1.04	1.25	1.15	1.04
Nitrogen	0.12	0.12	0.10	0.10	0.12
Mol. Wt.	19.35	18.23	20.79	17.62	18.23

3.4. Crude oil analysis are attached at **Annexure-II**.

3.5. Existing surface facilities of RDS GGS-2

Asset informed that GGS-2 is revamped in the year 2010 and desires for adequacy check of the installation considering peak quantities as per the profile.

i. Existing Process:

Well fluid from wells are received at the GGS-2 installation in four separate headers namely HP, MP, LP and test headers. Presently, there are two trains. Each train comprises of facilities, i.e., MP well fluid-produced water exchanger, LP well fluid-treated crude exchanger, bath heater having three coils (MP, LP and test), MP and LP separators, MP and LP KOD, heater treater.

Well-fluid from MP header is diverted to well fluid/ produced water heat exchanger, where it is preheated with hot produced water from the heater treater. After preheating, well-fluid is sent to MP coil in water bath heater for heating to ~50-60 ^{0}C. Well-fluid from bath heater flows into MP separator for processing. Gas separated in MP separator is sent to GCP located near GGS-2 for further compression and also to CPP. Liquid from MP separator joins LP liquid at the inlet of the LP separator.

From LP header, well-fluid is preheated in well fluid/crude oil heat exchanger, where it exchanges heat with hot crude oil from heater treater. Pre-heated well-fluid from heat exchanger is fed into LP coil of water bath heater. After heating to ~ 50-60 ^{0}C in bath heater, it is sent for processing in LP separator along with liquid received from MP separator. Gas from LP separator is fed to fuel gas header. Liquid from LP separator is sent to heater treater for heating up to ~ 70 ^{0}C. The treated crude oil from heater treaters is sent via LP well fluid/crude oil heat exchanger to storage tank and pumped to DJP via existing pipeline. The produced water from heater treaters is sent to ETP.

Well fluid from HP header is routed to HP separator for separation of gas and liquid. The separated gas from HP separator is routed to HP KOD for separation of carried over liquid, if any. The gas from HP KOD is routed to common gas header which feeds to CPP, town gas and grid gas (GCP-Lakwa via DJP). The liquid from HP separator and HP KOD is routed to MP separator. The schematic of oil and gas processing facilities at GGS-2 is shown in Figure 3.1.

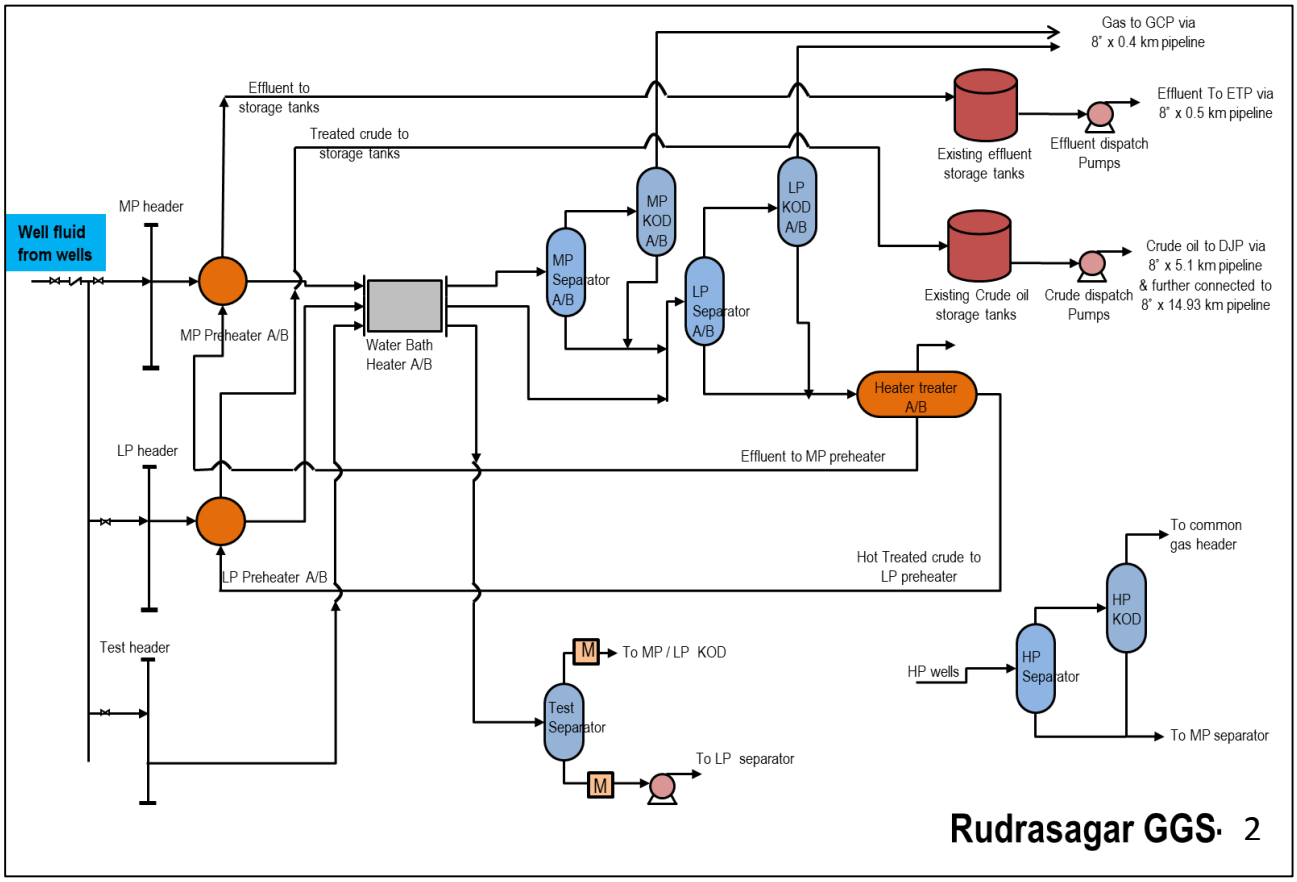


Figure 3.1: Schematic of existing oil and gas processing facilities of Rudrasagar GGS-2

ii. Other design parameters considered in the study

- Operating pressure & temperature of HP separator at GGS-2: 14-15 kg/cm^{2}g & 25-30 ^{0}C
- Operating pressure & temperature of MP separator at GGS-2: 5.0-6.0 kg/cm^{2}g & 25-30 ^{0}C
- Operating pressure & temperature of LP separator: 3.0-4.5 kg/cm^{2}g & 25-30 ^{0}C

3.6. Existing surface facilities of RDS GGS-3

As per Asset all the facilities at GGS-3 are very old and and its facilities are deteriorating day-by-day. Well fluid from wells are received at the GGS-3 installation in three separate headers namely HP, LP and test headers.

A. Other design parameters considered in the study

- Operating pressure & temperature of HP separator: 14.0-15.0 kg/cm2g & 25-30 0C
- Operating pressure & temperature of LP separator: 3.0-4.5 kg/cm2g & 25-30 0C

B. Present sales gas details:

Presently, sales gas is supplied to various consumers at GGS-3. The quantities of sales gas to various local consumers are as follows:

- AGCL consumer: 6,500 SCMD
- SVS colony: 4,500 SCMD
- CISF colony: 5,500 SCMD

- Remaining gas is routed to RDS GCP-Lakwa grid pipeline. Presently 9,000 SCMD gas is being routed to grid pipeline.

3.7. Lift gas requirement: As per profile, the envisaged peak lift gas quantity requirement are 2.63 LSCMD for GGS-2 and 0.55 LSCMD for GGS-3.

3.8. Product specification:

Stabilized oil at the outlet of heater treater: < 0.2% BS & W in treated oil

3.9. A detailed pipeline routing map of RDS field (placed at Annexure –III)

4. Simulation study & Scheme Conceptualization

4.1. Capacity of the installations

Capacities of various facilities at the installations are firmed up on the basis of envisaged maximum quantity of liquid, oil, gas and water as per the production profile and the details are shown in Table 4.1.

Table 4.1: Peak quantity of oil, gas & produced water envisaged at each installation

Installations	Liquid, m^3/day	Oil, m^3/d	Water, m^3/d	Gas, LSCMD	Inj. Gas, LSCMD	Total Gas (Gas+ Inj Gas), LSCMD
GGS-2	1314	158	1225	0.72	2.63	3.08
GGS-3	276	107	237	0.15	0.55	0.71

Note:
- GCP & ETP are located near GGS-2.
- Gas from GGS-1, 2, 3 and 4 is routed to GCP located near GGS-2 for lift gas compression.
- Effluent water from GGS-1, 2, 3 & 4 and Charali GGS is routed to ETP located near GGS-2 for further treatment and injection/disposal.

4.2. Simulation study overview

Simulation has been done in the study for the peak combined load of GGS-2 and GGS-3 well-fluids. Simulation has been done for following points:

a. Sizing of pipeline from GGS-3 header to GGS-2 header
b. Adequacy check of surface facilities at GGS-2 for combined well-fluid load
c. Sales gas supply scheme to GGS-3 consumers

4.3. Sizing of pipelines from GGS-3 to GGS-2

Presently there are 5 wells at GGS-3 and additional 2 new wells are expected in future. Out of the existing 5 wells, 2 high pressure wells are in self flow mode and 3 low pressure wells are in SRP mode. It has been also indicated in the profile that the 2 new wells will come in HP mode. A distance of 10.015 km between GGS-2 and GGS-3 is considered in the study for the back-pressure calculation.

Simulation study has been done in Pipesim software for calculating the maximum back pressures at the well head after routing the well- fluid from GGS-3 header to GGS-2 header. The results of the study are shown in Table 4.2.

Table 4.2 Well-wise back pressure at GGS-3 wells in various scenarios

SN	Well No.	Lift Mode	Current Q, oil (m^3/d)	Current Q, water (m^3/d)	Current Q, gas (m^3/d)	Current well head pressure corresponding to separator pressure of GGS-3 (HP-14 ksc, LP-5 ksc), kg/cm2	Back pressure at the well head after diverting wells to GGS-2 (HP separator pr: 10 ksc, LP sep. Pr.: 4.5 ksc)	Pressure drop in pipeline (HP line: 6" x 10 km & LP line: 8" x 10 km), kg/cm^2	Lift gas quantity (*), m3/d (Q liquid after gas lift)	Future well head pressure after diverting wells with lift gas, kg/cm2,	Pressure drop in pipeline (HP line: 6" x 10 km & LP line: 8" x 10 km), kg/cm^2
1	R-191-HP (THP: 70 ksc)	Self	62.0	15.8	8612	15 - ABP	13.2	3.2	2244 (63)	14.0	4.0
2	R-192-HP (THP: 50 ksc)	Self	60.0	21.8	8545	15 - ABP	13.2	3.2	2244 (63)	14.1	4.1
3	R-194-LP	SRP	29.5	27.7	500	-	5.8	1.3	8000 (29.5)	5.9	1.4
4	R-84A-LP	SRP	7.2	2.4	700	-	5.7	1.2	30123 (18)	6.5	2.0
5	R-075-LP	SRP	29.5	27.4	500	-	5.8	1.3	8000 (29.5)	5.9	1.4
6	New Well-1-HP	Self	34 (Future)	-	-	-	12.7	2.7	2244 (34)	13.7	3.7
7	New Well-2-HP	Self	34 (Future)	-	-	-	12.7	2.7	2244 (34)	13.7	3.7

Note:

1. (*) Lift gas rates are taken from the report, "*Selection Of Suitable Artificial Lift Mode For The Wells Of GGS-3 RDS",* issued in July 2022 from IOGPT.
2. Flow rates for new wells is calculated from the long term profile

From Table 4.2, following can be summarized:

1. For HP well-fluid, one 6" line will be required from GGS-3 to GGS-2, which will result in maximum back-pressure of 14.1 ksc at the well head.
2. For LP wells, one 8" line will be required from GGS-3 to GGS-2, which will result in maximum back-pressure of 6.5 ksc at the well head.
3. For the testing of wells, one 4" line is needed from GGS-3 test header to GGS-2 test header.

4.4. Adequacy Check of Surface facilities for Rudrasagar GGS-2

A simulation model for existing surface facilities of GGS-2 was developed in Aspen HYSYS process simulator. In the study, combined well fluid load of GGS-2 and GGS-3 are considered.

A. Peak well fluid considered for adequacy check of Rudrasagar GGS-2 is shown in Table 4.3 below:

Table 4.3 : Peak quantities of Rudrasagar GGS-2

As per profile	Well fluid from wells of GGS-2			
	Total	HP header	MP header	LP header
Peak Liquid, m^3/d	1314	--	946	369
Peak Oil, m^3/d	158	--	120	51
Peak Water, m^3/d	1225	--	894	331
Asso. Gas, LSCMD	0.72	0.19	0.43	0.18
Lift gas, LSCMD	2.63	--	--	--
Total Gas, LSCMD	3.08			

B. Peak well fluid considered for adequacy check of Rudrasagar GGS-3 is shown in Table 4.4 below:

Table 4.4 : Peak quantities of Rudrasagar GGS-3

As per profile	Well fluid from wells of GGS-3		
	Total	HP header	LP header
Peak Liquid, m^3/d	276	200	76
Peak Oil, m^3/d	107	165	72
Peak Water, m^3/d	237	93	14
Asso. Gas, LSCMD	0.15	0.14	0.014
Lift gas, LSCMD	0.55	--	--
Total Gas, LSCMD	0.71		

C. Peak well fluid considered for adequacy check of Rudrasagar GGS-2 is shown in Table 4.5 below:

Table 4.5 : Combined peak production of RDS GGS-2 and RDS GGS-3

As per profile	Well fluid from wells of GGS-2 and GGS-3			
	Total	HP header	MP header	LP header
Peak Liquid, m^3/d	1590	200	946	445
Peak Oil, m^3/d	265	165	120	123
Peak Water, m^3/d	1462	93	894	345
Asso. Gas, LSCMD	0.87	0.33	0.43	0.194

Lift gas, LSCMD	3.18	--	--	--
Total Gas, LSCMD	3.79			

D. Adequacy check of surface facilities at RDS GGS-2:

Considering combined well-fluid production of RDS GGS-2 and GGS-3, adequacy check of GGS-2 was carried out, result of which is shown in Table 4.6.

Table 4.6: Adequacy check of Rudrasagar GGS-2

Equipment	Existing Size / Capacity / Duty	Required Size / Capacity / Duty	Remarks
MP well fluid-produced water heat exchanger	0.76 MMkcal/hr	0.25 MMkcal/hr (each)	Adequate
LP well fluid-treated crude heat exchanger	0.133 MMkcal/hr	0.08 MMkcal/hr (each)	Adequate
Bath heater (MP, LP and test coils) 02-FF-101A/B	1.63 MMkcal/hr (each bath heater	MP /LP Well fluid inlet/outlet op. temperature: 40 / 60 ^{0}C Test well fluid Inlet/Outlet op. temperature: 30 / 60 ^{0}C 1.07 MMkcal/hr (each)	Adequate
HP separator	Dia: 1.0 m Height:2.5 m Feed Nozzle: 6", Gas Outlet Nozzle: 4", Liquid outlet Nozzle: 2"	Dia: 1.0 m Height:3.0 m Feed Nozzle: 4", Gas Outlet Nozzle: 4", Liquid outlet Nozzle: 2"	Indequate
HP KOD	Dia: 0.9 m Height:2.25 m Feed Nozzle: 4", Gas Outlet Nozzle: 4", Liquid outlet Nozzle: 1.5"	Dia: 0.9 m Height:1.8 m Feed Nozzle: 4", Gas Outlet Nozzle: 3", Liquid outlet Nozzle: 1"	Adequate
MP Separator A/B	Dia:1.6 m Height:4.8 m, Feed Nozzle: 8", Gas Outlet Nozzle: 6", Liquid outlet Nozzle: 3"	Dia:1.6 m Height:3.2 m, Feed Nozzle: 4", Gas Outlet Nozzle: 2", Liquid outlet Nozzle: 3"	Adequate
MP KOD A/B	Dia:1.0 m Height:2.5 m, Feed Nozzle: 6", Gas Outlet Nozzle: 6", Liquid outlet Nozzle: 1.5"	Dia:1.0 m Height:1.8 m, Feed Nozzle: 3", Gas Outlet Nozzle: 2", Liquid outlet Nozzle: 1"	Adequate
LP Separator A/B	Dia:1.6 m Height:4.8 m, Feed Nozzle: 6", Gas Outlet Nozzle: 6", Liquid outlet Nozzle: 4"	Dia:1.6 m Height:3.8 m, Feed Nozzle: 4", Gas Outlet Nozzle: 2", Liquid outlet Nozzle: 3"	Adequate
LP KOD A/B	Dia:1.0 m Height:2.5 m, Feed Nozzle: 6", Gas Outlet Nozzle: 6", Liquid outlet Nozzle: 1.5"	Dia:1.0 m Height:1.8 m, Feed Nozzle: 3", Gas Outlet Nozzle: 2", Liquid outlet Nozzle: 1"	Adequate
Heater Treater (2 no.)	2 x 1080 m^3/day (45 m^3/hr); total: 2160 m^3/day heat duty (each): 2.6 MMkcal/hr	Op. pressure: 2.5 kg/cm^2g Inlet/Outlet temp:60-70 ^{0}C heat duty (each): 0.46 MMkcal/hr	Adequate

Crude Storage Tanks	4200 m^3 (1 x 2000 m^3, 5 x 400 m^3, 1 x 200 m^3)	993 m^3 (Considering 3 days storage; 80% filling capacity)	Adequate
Crude transfer pumps	100 m^3/hr (1 operating+1 standby	66 m^3/hr (Considering 4-5 hrs pumping)	Adequate
Line from GGS-2 to GCP	6" line of 500 m	10" line of 500 m	Inadequate, a 10" line is required
Enclosed Ground Flare system	11,200 kg/hr (~3.27 LSCMD)	7.58 LSCMD (peak load) (Gas to GCP-GG S-2: 6.71 LSCMD lift gas+GGS-2 associated gas + GGS-3 associated gas)	Inadequate, Asset may contact vendor for scale up of existing ground flare system.

Remarks:

1. Fire water requirement is calculated based on crude storage tank area of GGS and single compressor shed area of GCP. Considering single major fire scenario, fire water requirement is found adequate based on guidelines in OISD-189. As per OISD-189, for calculating fire water flow rate for compressor shed of GCS/GCP, the shed area should be divided into suitable number of segments so that maximum water requirement can be optimized. However, the fire water requirement needs to be reviewed and worked out considering the new compressor facilities and GDU envisaged in GCP during detailed engineering.
2. As per IOGPT study for RDS redevelopment; ETP, GCP and flare system were found inadequate and are being recommended for up-gradation. **Same recommendations were revisited considering additional flow from GGS-3, and it has been found that flare system will need further up-gradation**.

4.5. Sales gas supply scheme to GGS-3 consumers:

Two options have been explored for sales gas supply to consumers of GGS-3 gas:

Option-1: Route the gas from GGS-2 (MP KOD) to GGS-3 for sales using the existing gas metering system and existing pipeline network

Basis:

- MP KOD at GGS-2 will operate at 5 – 6 kg/cm2g
- Distance between GGS-2 and GGS-3 is 3 km
- Pressure required at GGS-3 for sales gas supply is 4 kg/cm2g

A single 6" pipeline can be used to route the sales gas from the MP KOD of GGS-2 to the sales gas header at GGS-3 end, which will result in maximum backpressure of 4.8 kg/cm^2 at the GGS-3 end. Exiting metering facility can be used at GGS-3 for metering the sales gas to the consumers.

Option-2: Use the DJP (junction point) to tap gas for consumers at GGS-3

For using the DJP junction point to supply the gas to consumers, additional facilities, viz., a KOD and Flare unit will be required. However, since the purpose of the study is to unman the RDS GGS-3, this option will defeat this objective.

Hence, option-1 is a better option in the context of unmanning the GGS. However, in Option-1, liquid-free gas from GGS-2 is to be ensured to meet sales gas quality, if required as per the sales agreement.

5. Summary and Conclusion:

The main objective of study is to migrate the operations of RDS GGS-3 to RDS GGS-2. Simulation studies have been carried out using Aspen HYSYS process simulator and Pipesim software to review adequacy of the existing facilities to process the combined load of the two GGSs and to conceptualize additional facilities required, if any, at GGS-2. The study reveals that the existing 2-phase HP separator of GGS-2 is inadequate, to overcome which a new HP separator has been conceptualized at GGS-2.

Further, as per IOGPT study for RDS redevelopment; ETP, GCP and flare system were found inadequate and are being recommended for up-gradation. However, same recommendations were revisited considering additional flow from GGS-3, and as per study, flare system will need further up-gradation.

Based on the simulation results, following pipelines have been conceptualized in the study:

1. 6” x 10 km pipeline for HP well fluid from GGS-3 HP header to GGS-2 HP header
2. 8” x 10 km pipeline for LP well fluid from GGS-3 LP header to GGS-2 LP header
3. 4”x 10 km test pipeline from GGS-3 test header to GGS-2 test header for testing of GGS-3 wells.
4. 6” x 10 km pipeline for sales gas from GGS-2 MP KOD to GGS-3 sales gas header
5. 10” x 0.5 km pipeline from GGS-2 to GCP.

6. Annexures

Annexure-I

Long term oil & gas profile provided by the Asset

Rudrasagar Production profile — GGS-1

Year	Drilling Input OP	Ql (m3/d)	Qo (m3/d)	Qg (scmd)	Qw (m3/d)	Annual Oil (MMt)	Annual Gas (MMm3)	Inj Gas Requirement M3/day
2021-22		471	54	18629	417	0.017	6.87	94200
2022-23	1	520	62	21574	458	0.020	7.87	104000
2023-24		535	69	24108	466	0.022	8.80	107000
2024-25	2	816	86	30243	730	0.028	11.04	163200
2025-26		816	101	35306	715	0.032	12.89	163200
2026-27		816	93	32587	723	0.030	11.89	163200
2027-28		816	86	30078	730	0.027	10.98	163200
2028-29	1	843	86	30159	757	0.028	11.01	168600
2029-30	1	877	95	33231	782	0.030	12.13	175400
2030-31	1	904	103	36066	801	0.033	13.16	180800
2031-32		904	102	35686	802	0.033	13.03	180800
2032-33	1	931	101	35335	830	0.032	12.90	186200
2033-34		931	100	35012	831	0.032	12.78	186200
2034-35	1	958	99	34713	859	0.032	12.67	191600
2035-36		958	98	34438	860	0.031	12.57	191600
2036-37		958	91	31786	867	0.029	11.60	191600
2037-38		958	84	29338	874	0.027	10.71	191600
2038-39		958	77	27079	881	0.025	9.88	191600
2039-40		958	71	24994	887	0.023	9.12	191600
Total	8					0.530	211.91	

Rudrasagar Production profile — GGS-2

Year	Drilling Input OP	Ql (m3/d)	Qo (m3/d)	Qg (scmd)	Qw (m3/d)	Annual Oil (MMt)	Annual Gas (MMm3)	Inj Gas Requirement M3/day
2021-22		827	117	61080	710	0.037	22.29	165400
2022-23	1	861	118	60585	743	0.038	22.11	172249
2023-24	2	938	135	65650	803	0.043	23.96	187578
2024-25	1	1170	156	72356	1014	0.050	26.41	234058
2025-26		1170	158	72359	1012	0.051	26.41	234058
2026-27	1	1198	153	55067	1045	0.049	20.10	239537
2027-28		1198	148	53292	1050	0.047	19.45	239537
2028-29	1	1232	145	52271	1087	0.046	19.08	246386
2029-30		1232	143	51328	1089	0.046	18.73	246386
2030-31	1	1259	138	49842	1121	0.044	18.19	251866
2031-32		1259	135	46470	1125	0.043	17.69	251866
2032-33	1	1287	131	47203	1156	0.042	17.23	257345
2033-34		1287	128	46034	1159	0.041	16.80	257345
2034-35	1	1314	125	44955	1189	0.040	16.41	262825
2035-36		1314	122	43960	1192	0.039	16.05	262825
2036-37		1314	113	40575	1201	0.036	14.81	262825
2037-38		1314	104	37450	1210	0.033	13.67	262825
2038-39		1314	96	34567	1218	0.031	12.62	262825
2039-40		1314	89	31905	1225	0.028	11.65	262825
Total	9					0.785	353.67	

G. Satheesh 19/07/2021
(G. SATHEESH)
Manager (Reservoir)

G. Venkateshwarlu
C.M(R).

G. Venkateshwarlu
Chief Manager (Res.)
ONGC, Assam Asset, Nazira

Rudrasagar Production profile — GGS-3

Year	Drilling Input OP	Ql (m3/d)	Qo (m3/d)	Qg (scmd)	Qw (m3/d)	Annual Oil (MMt)	Annual Gas (MMm3)	Inj Gas Requirement M3/day
2021-22		208	116	16629	92	0.037	6.07	41600
2022-23		208	107	15349	101	0.034	5.60	41600
2023-24		208	99	14167	109	0.032	5.17	41600
2024-25	1	242	100	14360	143	0.032	5.24	48449
2025-26		242	101	14539	142	0.032	5.31	48449
2026-27	1	276	101	14704	175	0.032	5.37	55299
2027-28		276	102	14856	174	0.033	5.42	55299
2028-29		276	94	13712	182	0.030	5.00	55299
2029-30		276	87	12656	189	0.028	4.62	55299
2030-31		276	80	11681	196	0.026	4.26	55299
2031-32		276	74	10782	202	0.024	3.94	55299
2032-33		276	68	9952	208	0.022	3.63	55299
2033-34		276	63	9186	213	0.020	3.35	55299
2034-35		276	58	8478	218	0.019	3.09	55299
2035-36		276	54	7825	223	0.017	2.86	55299
2036-37		276	50	7223	227	0.016	2.64	55299
2037-38		276	46	6667	231	0.015	2.43	55299
2038-39		276	42	6153	234	0.014	2.25	55299
2039-40		276	39	5680	237	0.012	2.07	55299
Total	2					0.474	78.33	

Rudrasagar Production profile — GGS-4

Year	Drilling Input OP	Ql (m3/d)	Qo (m3/d)	Qg (scmd)	Qw (m3/d)	Annual Oil (MMt)	Annual Gas (MMm3)	Inj Gas Requirement M3/day
2021-22		425	59	16395	366	0.019	6.71	85000
2022-23		440	56	17509	384	0.018	6.39	88000
2023-24		440	54	16692	386	0.017	6.09	88000
2024-25	1	689	71	22131	618	0.023	8.08	137849
2025-26	1	717	94	25274	622	0.030	10.68	143329
2026-27		717	94	25143	623	0.030	10.64	143329
2027-28	1	744	94	25022	650	0.030	10.59	148808
2028-29		744	93	24911	651	0.030	10.55	148808
2029-30		744	86	24685	658	0.028	9.74	148808
2030-31		744	79	24630	665	0.025	8.99	148808
2031-32	1	778	82	25387	696	0.026	9.27	155658
2032-33		778	84	26087	694	0.027	9.52	155658
2033-34	1	806	85	26201	721	0.027	9.56	161137
2034-35		806	85	26307	721	0.027	9.60	161137
2035-36		806	78	24281	727	0.025	8.86	161137
2036-37		806	72	22412	733	0.023	8.18	161137
2037-38		806	67	20686	739	0.021	7.55	161137
2038-39		806	62	19093	744	0.020	6.97	161137
2039-40		806	57	17623	749	0.018	6.43	161137
Total	5					0.465	164.42	

Total Inj Gas Requirement = 6.709 LSCMD (maximum)

Annexure-II

Gas composition of Rudrasagar GGS-1, 2, 3, 4

REGIONAL GEOSCIENCE LABORATORIES
OIL AND NATURAL GAS CORPORATION LIMITED
A&AA BASIN, SIVASAGR – 785697, ASSAM, INDIA

GAS ANALYSIS REPORT

1. Test Report No.	SVS / RGL / CL / GS / 05 /19-20/204				Dated: 03.12.2019
2. Sample ID No.	378-(19-20)	379-(19-20)	381-(19-20)	382-(19-20)	374-(19-20)
3. Type of Sample	Consumer Gas samples collected from supply headers of:				
4.Consumer	Mkypur T.E GLK GGS I	Sibbari T.E.,Geleky T.E.; ONGC Colony, Nazira. GLK GGS II	Borsila T.E. GLK GGS III	Maduri T.E., Charali GGS	Nahrobi T.E. Lakwa GGS-VI
5. Pressure (Kg/cm^2)	4.7	2.8	4.2	2.5	
6. Date/ Time of collection (hr.)	25.11.2019/ NA	25.11.2019/ NA	25.11.2019/ NA	26.11.2019/ NA	21.11.2019/ NA
7.Collected / provided by	ST-SVS				
8.Date of receipt in Lab	26.11.2019	26.11.2019	25.11.2019	27.11.2019	22.11.2019
9. Analysis data					
Component	%mol	%mol	%mol	%mol	%mol
Methane	77.27	82.91	81.21	78.68	82.40
Ethane	8.60	7.95	8.41	6.06	7.77
Propane	6.15	4.61	5.25	6.48	4.58
Iso-Butane	1.55	1.29	1.35	1.98	1.35
n-Butane	2.30	1.39	1.78	2.80	1.66
iso-Pentane	0.86	0.53	0.55	0.91	0.60
n-Pentane	0.52	0.25	0.32	0.63	0.31
Hexane +	1.10	0.56	0.51	1.03	0.59
Carbon-di-oxide	1.57	0.45	0.55	1.30	0.62
Nitrogen	0.08	0.06	0.07	0.13	0.12
SUM :	100.00	100.00	100.00	100.00	100.00
Properties (calculated)#					
Sp.Gr. (Real)	0.7830	0.7115	0.7282	0.7865	0.7204
Density, Kg/SM^3	0.9595	0.8719	0.8923	0.9637	0.8827
Mol. Wt.	22.59	20.54	21.02	22.69	20.80
Nett C.V., Kcal / SM^3	10741.646	10052.595	10246.640	10833.107	10123.417
Gross C.V., Kcal / SM^3	11824.214	11089.017	11296.679	11923.104	11164.247

Calculations are as per ISO: 6976 (1995)
Last Calibration done on: 22.11.2019
H2S content: Nil

Sign. 03.12.19
Name: (Madhurjya Gogoi)
Desig: JTA (Chemist)
Distribution:
1. I/C Chemistry,Surface Team
2. I/C Technical cell,Room no 23,RDB 1,Ground floor, Nazira
3. I/C GAIL Terminal, GAIL LKW
4. Office Copy

31/11/19
(Pratika Basumatary)
Chemist

RGL/SVS/REC/GSF3

Crude Oil Analysis

RGL, A&AA Basin Sivasagar	Test Report of Routine Sample	Issue No.: 04 Date of Issue: 30.10.2015 Rev. No.: 00 Date of Rev.: Nil Page 1 of 1
	NO. RGL/SVS/REC/DLFS	

Date: 24.01.2018

TEST REPORT NO.: 100/2017-18

TEST REPORT OF CRUDE OIL SAMPLES OF CHARALI GGS, RDS GGS-I & II

A. Sample Details:

1	Sample Lab ID	**205/2017-18**	**206/2017-18**	**207/2017-18**
2	Type of Sample	Crude Oil	Crude Oil	Crude Oil
3	Source of Collection / Well No.	Charali GGS	RDS GGS-II	RDS GGS-I
4	Area/Field	RDS	RDS	RDS
5	Date & Time of Collection	08.01.2018 @ 11:30 hrs	10.01.2018 @ 16:50 hrs	12.01.2018 @ 14.30 hrs
6	Collected by	Mr. Tilak Singh, Chief Chemist		
7	Date of Receipt in Lab	09.01.2018	11.01.2018	17.01.2018
8	Sample Received from	Mr. Tilak Singh, Chief Chemist		

B. Test Results: Distillation Data (As per ASTM D 86)

ID- 205/2017-18: Charali GGS

IBP = 58°C

Sl. No.	Temperature Range (°C)	Percentage of Fractions (% v/v)	Cumulative Percentage of Fractions (% v/v)
1	IBP-75	3.0	3.0
2	75-100	4.5	7.5
3	100-125	6.0	13.5
4	125-150	5.0	18.5
5	150-175	6.0	24.5
6	175-200	6.0	30.5
7	200-225	4.0	34.5
8	225-250	5.5	40.0
9	250-275	7.0	47.0
10	275-300	8.5	55.5

Recovery upto 300°C = 55.5 % (v/v)
Residue upto 300°C = 43.6 % (v/v)
Volume loss upto 300°C = 0.9 % (v/v)

24.01.2018 24.01.2018 24.01.2018

1

ID- 206/2017-18: RDS GGS-II

IBP = 80°C

Sl. No.	Temperature Range (°C)	Percentage of Fractions (% v/v)	Cumulative Percentage of Fractions (% v/v)
1	IBP-100	1.5	1.5
2	100-125	3.5	5.0
3	125-150	4.0	9.0
4	150-175	5.0	14.0
5	175-200	5.0	19.0
6	200-225	5.0	24.0
7	225-250	7.0	31.0
8	250-275	8.0	39.0
9	275-300	10.0	49.0

Recovery upto 300°C = 49.0 % (v/v)
Residue upto 300°C = 50.1 % (v/v)
Volume loss upto 300°C = 0.9 % (v/v)

ID- 207/2017-18: RDS GGS-I

IBP = 70°C

Sl. No.	Temperature Range (°C)	Percentage of Fractions (% v/v)	Cumulative Percentage of Fractions (% v/v)
1	IBP-100	2.0	2.0
2	100-125	2.0	4.0
3	125-150	2.0	6.0
4	150-175	4.0	10.0
5	175-200	4.0	14.0
6	200-225	5.0	19.0
7	225-250	7.0	26.0
8	250-275	9.0	35.0
9	275-300	11.5	46.5

Recovery upto 300°C = 46.5 % (v/v)
Residue upto 300°C = 52.8 % (v/v)
Volume loss upto 300°C = 0.7 % (v/v)

Remarks/Comments :-

Milon Jyoti Koiri
TA-III (Chem)

Sanghamitra Basak
Chemist

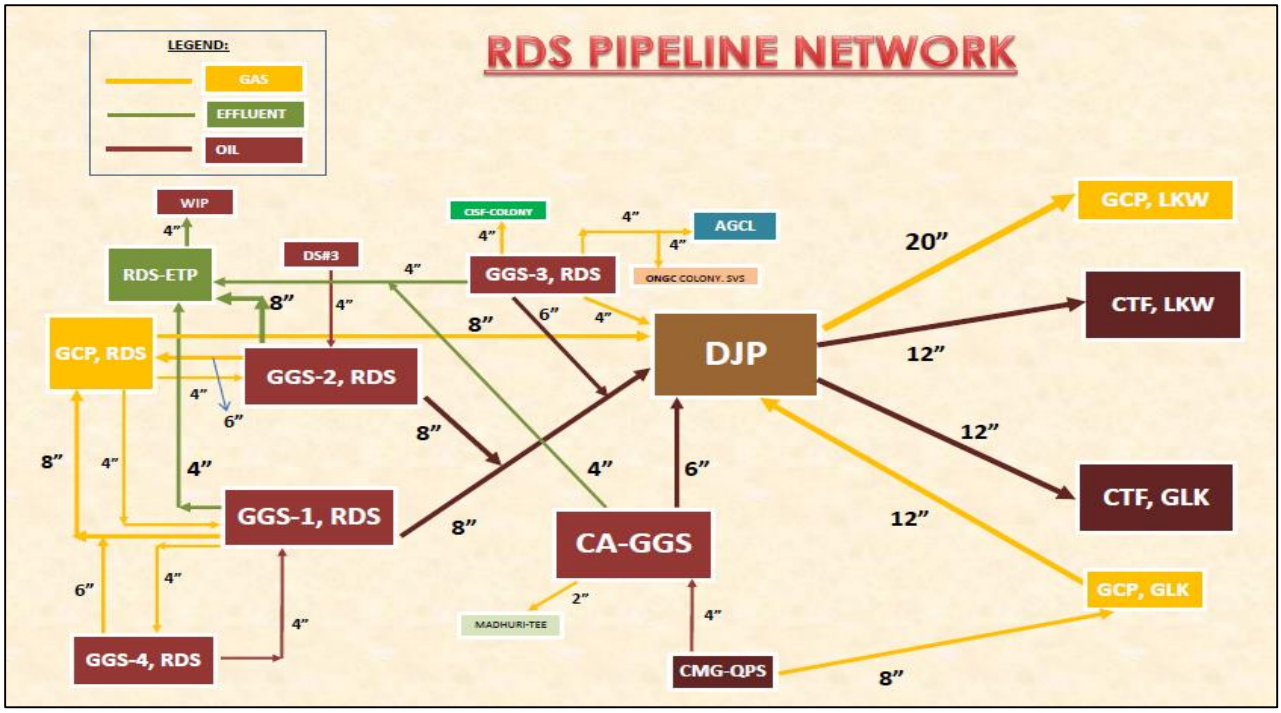
Rakesh Kumar
Chief Chemist

Distribution:
1. DGM (Chem), I/c- Chemistry, Surface Team, Assam Asset
2. Office copy

2

Annexure-III

Routing map of pipelines at RDS



तेल एवं गैस उत्पादन प्रौद्यौगिकी संस्थान

Institute of Oil and Gas Production Technology

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