



## Study on impact of oil and gas exploration activities on water quality in Konaseema Region of Andhra Pradesh

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**Abstract:** *The study area Konaseema, also called Central Delta, with huge off shore and on shore reserves of oil and natural gas. During the past 15 years, The Central Delta has home of oil companies like ONGC,GSPC,OIL,RIL are generate around 30 lakhs cubic meter of gas every day. Author Studied on Impact of oil and gas exploration Activities on water quality in konaseema using standard methods. The study clearly shows that the ONGC and other oil companies' developmental activity, exploring Oil and Natural Gas which successfully contaminated the ground water aquifer in the entire coastal belt of Konaseema area.*

**Key words:** *ONGC, Central Delta, exploration activities*

### Introduction

Konaseema, also called Central Delta, is an island which is cut off on three sides by the river Godavari and on the fourth side by the Bay of Bengal with huge off shore and on shore reserves of oil and natural gas. During the past 15 years, The Central Delta has home of oil companies like the Oil and Natural Gas Corporation(ONGC), Gujarat State Petroleum Corporation(GSPC), Cairn energy, Oil India Limited (OIL) and Reliance Industries Limited (RIL) for taking up exploration activities. Oil companies generate around 30 lakhs cubic meter of gas every day[1],

which have taken up the drilling and exploration activities are unmindful full of the negative effect of their activities on the environment particularly the water resources in this area. Hence this study involves analysis of water sample in areas where the explorations activities are proposed for the exploration, exploration is in progress and also surroundings of the exploration was completed.

### Experimental Methods

The sample collection procedures and the methods adopted by author for the determination of different chemical parameters of the water samples collected from different



sources. The procedures adopted for the sampling and determination of various chemical parameters are as per the standard methods [2-6].

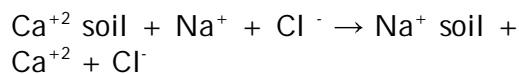
### Results and Discussion

The Discussion is presented in the following manner

- a. Quality of Surface water samples at surroundings of the exploration is proposed
- b. Quality of Ground water samples at surroundings of the exploration is proposed
- c. Quality of Surface water samples at surroundings of the exploration is in progress
- d. Quality of Ground water samples at surroundings of the exploration is in progress
- e. Quality of Surface water samples at surroundings of the exploration was completed
- f. Quality of Ground water samples at surroundings of the exploration was completed

Oil and gas exploration companies started exploration activity for oil and natural gas in the coastal areas and offshore of konaseema area in Bay of Bengal. The many places of coastal belt of konaseema from south to north had been explored for the last 15 Years. Some of the places exploration is in progress and some of the places exploration is proposed. During the

exploration they went to the depth of 1500-4000 meters in the earth some amount of ground water coming along with oil from those depths was brought to earth and was kept in waste water ponds. These are not cemented. This waste water is called produce water. This is mostly brine water with huge salt content i.e high concentrations of TDS,  $\text{Na}^+$ ,  $\text{Ca}^{+2}$ ,  $\text{Mg}^{+2}$ ,  $\text{Cl}^-$  etc., When the quantity of produce water is high from the drilling wells, the water collected in the waste ponds might over flow from the ponds especially during rainy season, and seep through the soil resulting in increased salt content of the ground water aquifer.



Similarly all other cations that are present in liquid waste (brine water) from oil companies drilling activity might exchange with  $\text{Ca}^{+2}$  of soil and reach the ground resulting in increases of total hardness of the ground water aquifer.

At present, most of the onshore (on land) drilling operation of ONGC like companies were completed and most of the wells are in production and even in the few drilling sites, the author tried to get liquid waste effluents for analysis, he did not succeed as he was not allowed to collect the samples. He collected from, the literature, the composition of the produce water from drilling



operations and the results are presented in Table1

**Table 1 :ONGC Produce water [7]**

S.No	Parameters	Produce water
1	pH	7.30
2	TDS	658
3	Chlorides	2033
4	Sulphates	32
5	Total hardness	150
6	Calcium, as Ca++	24
7	Salinity, as NaCl	3354
8	Magnesium, Mg++	17
9	Total alkalinity as CaCO <sub>3</sub>	1862
10	Bicarbonates as CaCO <sub>3</sub>	2272

companies' developmental activity, exploring Oil and Natural Gas which successfully contaminated the ground water aquifer in the entire coastal belt of Konaseema area.

**REFERENCES**  
1) *Executive summary of the proposed oil & gas development in offshore ravva field, pkm-1 block, Cairn india limited off surasani yanam village, east godavari district, andhra pradesh* october **2013**.

The author collected few bore water, open well, tap water and canal water samples at surroundings of various drilling sites are proposed for the exploration, exploration is in progress and also surroundings of the exploration was completed and analyzed. The results of analysis of the canal and well water samples of various cases are presented in Tables 2 to 7.

The salt content In these well waters is so high .The hardness, Ca<sup>+2</sup>, Mg<sup>+2</sup>, Cl<sup>-</sup> are high most probably due to seepage of brine water and D.O is low due to seepage of organic wastes which in turn results in high values NO<sub>2</sub><sup>-</sup> .

The above study clearly shows that the ONGC and other oil

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Table-2

**Analysis data of chemical parameters of surface water samples at surroundings of the exploration is proposed in Konaseema area**

*All values expressed in ppm except pH and E. C*

Sample No	pH	E.C (m mhos)	Turbid	Alkalinity	OD	TDS	Cl <sup>-</sup>	Total Hardness	Ca <sup>+2</sup>	Mg <sup>+2</sup>	Na <sup>+</sup>	K <sup>+</sup>	NO <sub>2</sub> <sup>-</sup>	NO <sub>3</sub> <sup>-</sup>	PO <sub>4</sub> <sup>-3</sup>	SO <sub>4</sub> <sup>-2</sup>	F <sup>-</sup>
1	7.9	0.24	20	125	6.1	147	28	93	22	12	12	3.9	0.02	2.4	3.6	4.2	0.3
2	8	0.26	25	135	6.5	150	38	99	20	12	14	5.4	0.03	2.6	2.3	3.2	0.2
3	7.7	0.22	18	149	6.3	143	29	98	21	12	11	3.7	0.02	3	2.2	2.8	0.3
4	7.9	0.27	22	145	6.6	158	25	94	20	11	16	1.4	0.04	2.6	3.8	4.8	0.2
5	7.9	0.31	30	142	6.3	183	28	138	35	12	10	3.5	0.02	2.8	2.9	6.4	0.2
6	7.9	0.28	26	103	6.4	170	20	123	26	15	11	3	0.03	2.2	3.7	5.2	0.2
7	7.9	0.27	32	154	6.5	159	24	113	26	11	14	3	0.06	2.6	3.2	4	0.3
8	8	0.27	34	150	6.7	162	26	123	24	16	11	4	0.03	2.1	6.6	5.8	0.1
9	8	0.28	22	154	6.5	162	36	118	24	14	10	3.4	0.03	2.8	5.8	3.6	0.2
10	7.9	0.28	24	128	6.6	168	44	113	28	11	12	2.4	0.05	3.5	3.6	3.2	0.3
11	7.9	0.24	32	138	5.9	146	35	98	22	11	14	3	0.05	3.9	3.9	2.8	0.3
12	8	0.27	22	140	6.4	164	45	103	22	12	10	3.2	0.06	3.6	4.9	3	0.2
13	7.8	0.28	20	144	6.7	172	44	125	30	12	11	4	0.04	3.5	5.5	4.8	0.2
14	7.6	0.29	34	128	6.2	168	35	133	32	13	10	1.6	0.05	2.8	4.9	5.6	0.2
15	8	0.24	28	138	6	146	45	98	22	12	12	3	0.03	2.9	4.2	2.9	0.2
Mean	7.89	0.27	25.93	138.20	6.38	159.87	33.47	95.87	24.93	12.40	11.87	3.23	0.04	2.75	4.07	7.03	0.23



Table-3

Analysis data of chemical parameters of Ground water samples at surroundings of the exploration is proposed in Konaseema area

All values expressed in ppm except pH and E. C

Sample No	pH	E.C (m mhos)	Turbid	Alkalinity	D.O	TDSS	Cl <sup>-</sup>	Total Hardness	Ca <sup>+2</sup>	Mg <sup>+2</sup>	Na <sup>+</sup>	K <sup>+</sup>	NO <sub>2</sub> <sup>-</sup>	NO <sub>3</sub> <sup>-</sup>	PO <sub>4</sub> <sup>-3</sup>	SO <sub>4</sub> <sup>-2</sup>	F <sup>-</sup>
)BW1	8	0.9	8	393	2.2	525	64	420	84	50	23	7.5	0.06	29	16	118	0.3
)BW2	8.2	0.8	6	370	3.3	463	34	420	96	43	22	4	0.06	24	18	98	0.3
)BW3	8	1.16	5	385	2.1	675	74	570	116	67	35	8.6	0.06	52	20	123	0.2
)BW4	8	1.25	4	385	3.4	725	94	610	148	58	44	8.6	0.09	53	18	164	0.2
)BW5	8	1.02	8	393	3.1	589	54	420	96	43	25	9	0.07	23	21	130	0.3
)BW6	8.6	0.97	6	346	2.6	563	27	400	84	46	30	5	0.03	19	19	128	0.3
)OW7	8.3	1.03	4	393	4.3	599	34	420	96	43	30	5.6	0.04	33	18	134	0.2
)BW8	8.2	0.73	8	277	2.4	422	60	250	60	24	24	6	0.09	20	16	102	0.4
)BW9	8.4	0.93	8	238	3	542	123	414	72	58	24	4	0.08	57	14	82	0.2
)OW10	8.6	0.97	4	323	3.9	562	60	350	68	43	23	8	0.07	23	18	130	0.4
)BW11	8.4	1.01	5	323	2.5	587	44	360	88	34	25	5.2	0.06	32	18	135	0.3
)TW12	8.7	0.94	6	393	6	548	47	370	72	46	28	4.2	0.07	40	19	126	0.3
)BW13	8.2	1.04	5	370	2.3	603	71	430	152	12	38	4.6	0.1	32	12	116	0.2
)OW14	8.3	1.14	7	308	4.4	661	84	520	104	63	59	4.1	0.09	31	15	120	0.2
)BW15	8.2	0.95	6	277	3	550	45	350	68	44	45	4.5	0.04	25	20	122	0.4
)OW16	8.4	0.99	8	323	4.4	573	64	400	84	45	28	5.7	0.05	26	16	126	0.3
)BW17	8.5	0.8	6	254	2.5	465	37	260	60	26	27	8	0.02	23	14	106	0.4
18(BW)	8.4	1.1	4	370	2.8	641	101	440	88	53	45	9.8	0.01	44	18	128	0.3
19(BW)	8.5	0.9	5	323	2.1	521	54	310	80	26	27	16	0.07	24	16	116	0.3
20(OW)	8.7	1.06	8	346	3.5	614	91	480	100	55	36	12	0.08	35	17	114	0.2
21(OW)	8.6	1.47	10	462	4.3	853	168	440	100	45	86	31	0.08	54	21	146	0.2
22(BW)	8.6	0.81	4	254	2.8	470	44	280	52	31	37	22	0.09	32	15	108	0.5
23(OW)	8.2	1.35	8	346	4.1	786	81	450	120	36	60	4.5	0.02	55	19	140	0.2
24(BW)	8.5	1.13	5	277	2.7	657	263	320	72	34	53	29	0.15	50	18	130	0.3
25(BW)	8.4	1.09	6	370	2.3	634	54	410	96	40	34	7.8	0.21	35	19	124	0.3
26(BW)	8.6	0.8	6	323	2.9	459	64	320	76	31	44	14	0.2	32	19	110	0.4
27(BW)	8.6	0.77	5	231	2.3	449	34	210	40	26	20	7	0.12	20	15	106	0.4
28(OW)	8.5	0.77	8	277	4.5	450	34	270	60	29	31	10	0.02	32	15	104	0.3
29(OW)	8.5	1.01	6	300	3.6	589	57	320	76	31	30	11	0.07	28	15	126	0.4
30(BW)	8.3	0.79	4	300	2	461	91	280	60	27	33	9.3	0.01	24	16	112	0.4
Mean	8	1	6	331	3.18	559	71	381	85	40	35	9	0.1	33	16	120	0.3



Table-4

**Analysis data of chemical parameters of surface water samples at surroundings of the exploration is in progress in Konaseema area**

*All values expressed in ppm except pH and E. C*

Sample No	pH	E.C (m mhos)	Turbid	Alkalinity	D.O	TDS	Cl <sup>-</sup>	Total Hardness	Ca <sup>+2</sup>	Mg <sup>+2</sup>	Na <sup>+</sup>	K <sup>+</sup>	NO <sub>2</sub> <sup>-</sup>	NO <sub>3</sub> <sup>-</sup>	PO <sub>4</sub> <sup>-3</sup>	SO <sub>4</sub> <sup>-2</sup>	F <sup>-</sup>
III-1	7.8	0.32	28	160	6.6	197	17	112	26	11	20	2.8	0.01	3.3	4.5	3.8	0.2
III-2	7.6	0.28	32	138	6.7	168	44	122	27	11	13	4.5	0.03	2.8	3.4	3.5	0.2
III-3	7.9	0.26	36	146	6.4	153	38	108	26	11	12	3.7	0.04	2.6	3.9	2.2	0.2
III-4	7.4	0.25	42	120	6.2	154	37	111	30	6.5	18	3.9	0.02	2.4	4	3.2	0.3
III-5	7.8	0.32	28	127	6.4	188	39	135	31	14	12	2.8	0.03	2.8	5.2	2.8	0.2
III-6	7.6	0.29	46	126	6	177	44	127	31	12	11	3.5	0.05	3.6	3.4	3	0.3
III-7	7.2	0.32	30	142	6.6	186	45	130	32	12	10	3.3	0.04	3.2	3.2	2.6	0.2
III-8	7.4	0.28	24	141	6.5	168	41	107	29	8.4	12	5.3	0.03	3.6	4.3	2.2	0.2
III-9	7.2	0.27	20	144	6.2	162	46	108	27	10	11	4.1	0.05	3.9	3.6	2	0.3
III-10	7.1	0.31	36	137	6.8	188	38	118	28	12	16	3.2	0.04	3.6	3.4	2.4	0.3
III-11	7.2	0.33	40	132	6.8	198	36	132	30	14	18	3.9	0.05	3.2	3.6	3.2	0.2
III-12	7.2	0.3	23	120	6.2	174	35	104	26	9.4	13	3.1	0.02	3.1	4.5	3.2	0.2
III-13	7.4	0.28	27	1.54	6.8	168	41	110	28	9.6	13	4	0.04	1.5	4.6	3.4	0.2
III-14	7.6	0.33	32	137	6.5	196	45	123	29	12	12	3.3	0.05	3.6	5.9	3.8	0.2
III-15	7.8	0.28	30	133	6.6	163	36	116	27	12	10	2.8	0.04	3.2	5.2	2.8	0.3
Mean	6.96	0.29	31	126	6	176	38	110	28	8	11	3	0.04	2.8	4.1	2.9	0.2



Table-5

**Analysis data of chemical parameters of Ground water samples at surroundings of the exploration is in progress in Konaseema area**

*All values expressed in ppm except pH and E. C*

Sample No	pH	E.C (in mhos)	Turbid	Alkalinity	D. O	TDS	Cl <sup>-</sup>	Total Hardness	Ca <sup>+2</sup>	Mg <sup>+2</sup>	Na <sup>+</sup>	K <sup>+</sup>	NO <sub>2</sub> <sup>-</sup>	NO <sub>3</sub> <sup>-</sup>	PO <sub>4</sub> <sup>-3</sup>	SO <sub>4</sub> <sup>-2</sup>	F <sup>-</sup>
1	7.9	0.9	8	493	2.1	925	264	430	94	54	223	12.1	0.09	30	17	117	0.3
2	8.2	0.8	6	470	3.5	963	334	420	96	43	222	11	0.16	25	19	98	0.3
3	8	1.16	5	385	2.1	975	374	570	116	67	235	8.6	0.16	52	20	125	0.2
4	7.5	1.25	4	485	3.4	1025	294	600	148	58	244	10.2	0.09	33	18	161	0.2
5	8	1.02	8	393	3.1	1012	354	420	76	43	225	9	0.07	23	21	130	0.3
6	8.1	0.97	6	346	2.2	999	327	400	84	46	230	11.2	0.13	19	19	128	0.3
7	7.4	1.03	4	393	4.3	1023	234	420	76	43	230	10.2	0.14	33	18	134	0.2
8	7.5	0.73	8	577	2.4	1045	260	250	60	24	190	11.2	0.09	20	16	102	0.4
9	8.4	0.93	8	638	3	1056	323	414	72	58	192	12.3	0.08	57	14	82	0.2
10	7.9	0.97	4	323	3.9	1045	260	350	68	43	195	14	0.07	23	18	130	0.4
11	7.5	1.01	5	323	2.5	1042	244	360	78	34	221	12.2	0.06	32	18	135	0.3
12	8.1	0.94	6	393	4	952	247	470	72	46	228	11.2	0.07	40	19	126	0.3
13	8.2	1.04	5	370	2.3	905	271	430	92	54	238	12.2	0.1	32	14	116	0.2
14	7.9	1.14	7	408	4.4	952	284	520	104	63	259	12.9	0.09	31	15	120	0.2
15	8.2	0.95	6	477	3	958	245	350	88	44	245	11.3	0.14	25	20	122	0.4
16	8.1	0.99	8	623	4.4	965	264	400	84	45	228	12.3	0.15	26	16	126	0.3
17	7.8	0.8	6	554	2.5	985	237	460	60	26	227	11.3	0.12	23	14	106	0.4
Mean	7.9	0.98	6.12	450.06	3.1	991.8	283.2	427.29	86.3	46.5	225.4	11.3	0.1	32	17.4	121.0	0.2
	2		9		2	8	9		5	3	1	6	1	1	1	6	9





Table-6

**Analysis data of chemical parameters of surface water samples at surroundings of the exploration was completed in Konaseema area**

*All values expressed in ppm except pH and E.C*

Sample No	pH	E.C (mhos)	Turbidity	Alkalinity	D.O	TDS	Cl <sup>-</sup>	Total Hardness	Ca <sup>+2</sup>	Mg <sup>+2</sup>	Na <sup>+</sup>	K <sup>+</sup>	NO <sub>2</sub> <sup>-</sup>	NO <sub>3</sub> <sup>-</sup>	PO <sub>4</sub> <sup>-3</sup>	SO <sub>4</sub> <sup>-2</sup>	F <sup>-</sup>
1	7.3	1.87	25	165	3.5	399	86	198	32	21	21	5.1	0.05	8.1	8.2	10.2	0.3
2	7.5	2.27	27	220	3.7	400	85	202	65	41	26	4	0.03	5.2	5.2	11.2	0.3
3	7.8	1.43	24	175	3.4	388	73	195	53	32	31	6.2	0.06	9.1	9	8.3	0.3
4	7.5	2	29	162	3.5	349	33	185	41	20	27	5.5	0.08	10.1	8.1	7.8	0.2
5	8.1	2.2	28	189	3.9	385	74	190	35	24	26	5.5	0.13	12.2	7.2	6.9	0.3
6	8	1.89	26	195	4.1	420	19	220	25	15	29	7.3	0.06	11.2	8.2	9.5	0.3
7	7.4	2.05	24	200	4.8	428	35	212	35	22	20	3.9	0.08	12.2	7.2	5.9	0.3
8	7.8	2.12	26	190	4.1	401	44	218	69	35	25	9.1	0.14	14.2	8.3	8.9	0.2
9	7.1	2.42	26	180	3.4	385	65	194	42	41	20	8.2	0.03	10.2	5.6	9.8	0.3
10	7.6	2.4	25	167	3.8	369	52	198	55	24	29	4.8	0.15	7.1	5.6	10.2	0.4
Mean	4.48	1.21	15.29	108.41	2.25	230.82	33.29	118.35	26.59	16.18	14.94	3.51	0.05	5.86	4.27	5.22	0.17



Table-7

### Analysis data of chemical parameters of Ground water samples at surroundings of the exploration was completed in Konaseema area

*All values expressed in ppm except pH and E.C*

Sample No	pH	E.C (m mhos)	Turbid	Alkalinity	D.O	TDS	Cl <sup>-</sup>	Total Hardness	Ca <sup>+2</sup>	Mg <sup>+2</sup>	Na <sup>+</sup>	K <sup>+</sup>	NO <sub>2</sub> <sup>-</sup>	NO <sub>3</sub> <sup>-</sup>	PO <sub>4</sub> <sup>-3</sup>	SO <sub>4</sub> <sup>-2</sup>	F <sup>-</sup>
1	7	1.87	4	525	2.5	1087	242	390	62	52	212	13	0.05	18.6	11.4	240	0.4
2	7.4	3.27	8	600	2.5	1899	220	620	112	82	208	20	0.13	15.2	10.9	320	0.3
3	7.6	3.43	10	625	3.9	1994	733	620	105	72	313	16	0.06	19.7	17.6	350	0.3
4	7.8	2	5	750	2.1	1163	333	400	72	40	272	59	1.3	19.1	16.2	252	0.3
5	8	3.2	10	650	2.3	1860	741	350	78	28	563	52	0.13	27.2	14.9	324	0.3
6	8	1.89	9	775	2	1094	133	300	58	24	495	15	0.26	14	17.1	240	0.4
7	7.5	2.05	6	425	2.2	1190	358	400	68	55	200	3	0.08	23	13.9	230	0.3
8	7.4	3.18	10	600	2.3	1842	449	780	139	81	250	12	0.14	5.6	17.3	340	0.2
9	7.4	3.13	12	625	2.3	1816	658	550	84	82	405	20	0.03	53.7	13	328	0.3
10	7.6	2.79	10	725	2.2	1617	524	350	58	44	395	20	0.35	24	14.1	285	0.4
Mean	7.57	2.68	8.4	630	2.43	1372	439.1	476	83.6	56	337.3	23	0.25	22.01	14.64	290.9	0.32

BW: Bore well water

OW: Open well water

TP : Tap Water