

Stack Emission Test Report No.: **R-343-H-4-9-0120t**

Plant: **Noble Energy Mediterranean Ltd.**

Location: **Aba Even 12 Street, Herzliya-Pituach, 46725. Israel.**
"LEVIATHAN" Sea Platform Site.

Person on Charge: **Gali Miron**

Stack ID: **Heater-4** **Stack (H-4).**

Stack ID No.:

Test No.: **343-H-4-9**

Test Format: **Technology Test**

Test Date: **15/01/2020**

Report Printing Date: **16/01/2020**

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Test Procedure.

Plant: Noble Energy Mediterranean Ltd.

City: "LEVIATHAN" Sea Platform Site.

Sampling Date: 15/01/2020

Stack Location: Heater-4

Hazard Tested:

Hazard	Sampling Method	Analytical Method	Analytical Lab	Remarks
TOC as Carbon	EPA-25a	FID	Ecolab	
Burnt Gases	EPA-3a	Analyser	Ecolab	
Gas Flowrate	EPA-1, 2, 4	-----	Ecolab	

Sampling Site:

- Two Sampling Ports (4", 90 degrees).
- About 2 Dst DownStream up to the Last Turbulence.
- More than 2 Dst UpStream up to the Next Turbulence.

SamplingTrain:

- TOC Analyser (FID, EPA-25a Flexible Configuration).
- Sampling Probe: Teflon, Flexible, Heated.

Test No.: **343-H-4-9** **Technology**

FUEL:

Filter No.: **N.R.**

Stack Diameter: **73** cm Measured

Stack Cross Area: **0.418** m² = **4.50** ft² Calculated

Nipple "A" Length: **17** cm Measured

Nipple "A" Length: **17** cm Measured

STACK GAS VELOCITY PROFILE (according to EPA Methods 1 and 2).

Traverse Point No.	Fraction of Stack ID %/100	Traverse Point Location cm	InStack Temperature oC	Delta Pi (calculated) mm H2O	Delta Pi (measured) in. H2O	Square Root of Delta Pi (in. H2O) ^{1/2}	Instack Static Pressure mm H2O
Sampling Port "A"							
1	0.979 *	87.5	148	13.46	0.53	0.728	
2	0.933	85.1	148	14.73	0.58	0.762	
3	0.882	81.4	148	14.99	0.59	0.768	
4	0.823	77.1	148	14.73	0.58	0.762	
5	0.750	71.8	148	15.24	0.60	0.775	
6	0.644	64.0	148	23.88	0.94	0.970	-70
7	0.356	43.0	148	33.02	1.30	1.140	
8	0.250	35.3	148	27.94	1.10	1.049	
9	0.177	29.9	148	30.48	1.20	1.095	
10	0.118	25.6	148	30.48	1.20	1.095	
11	0.067	21.9	148	33.02	1.30	1.140	
12	0.021 *	19.5	148	33.02	1.30	1.140	
Sampling Port "A"							
13	0.979 *	87.5	148	20.32	0.80	0.894	
14	0.933	85.1	148	23.62	0.93	0.964	
15	0.882	81.4	148	21.59	0.85	0.922	
16	0.823	77.1	148	19.81	0.78	0.883	
17	0.750	71.8	148	19.30	0.76	0.872	
18	0.644	64.0	148	18.80	0.74	0.860	-70
19	0.356	43.0	148	20.83	0.82	0.906	
20	0.250	35.3	148	23.62	0.93	0.964	
21	0.177	29.9	148	27.94	1.10	1.049	
22	0.118	25.6	148	30.48	1.20	1.095	
23	0.067	21.9	148	30.48	1.20	1.095	
24	0.021 *	19.5	148	27.94	1.10	1.049	
Average	-----	-----	148.0	23.74	0.935	0.957	-70.0

Remarks:

1. Traverse Points Locations were Measured from the Nipples Ends.
2. Instack Static Pressure was Measured in 2 Traverse Points.
3. Traverse Points No. 1, 12, 13 and 24 Locations were moved to 1" Distances from the Stack Walls, according to EPA-1 Method Requirements.

Combustion Gases Measurements Data Analyser (EPA-3 Method).

Test Time: **09:15**

Time	O2 Conc-n	CO2 Conc-n
HH:mm	% v	% v
09:15	4.51	10.59
Average	4.51	10.59
0 oC -		
NORM. TO 3 % Oxygen		
EMISSION RATE, g/Hour		

Real Stack Gas Dry Molecular Weight, Calculated, According to EPA Method 3a:

Md real	=	29.87 g/Mole
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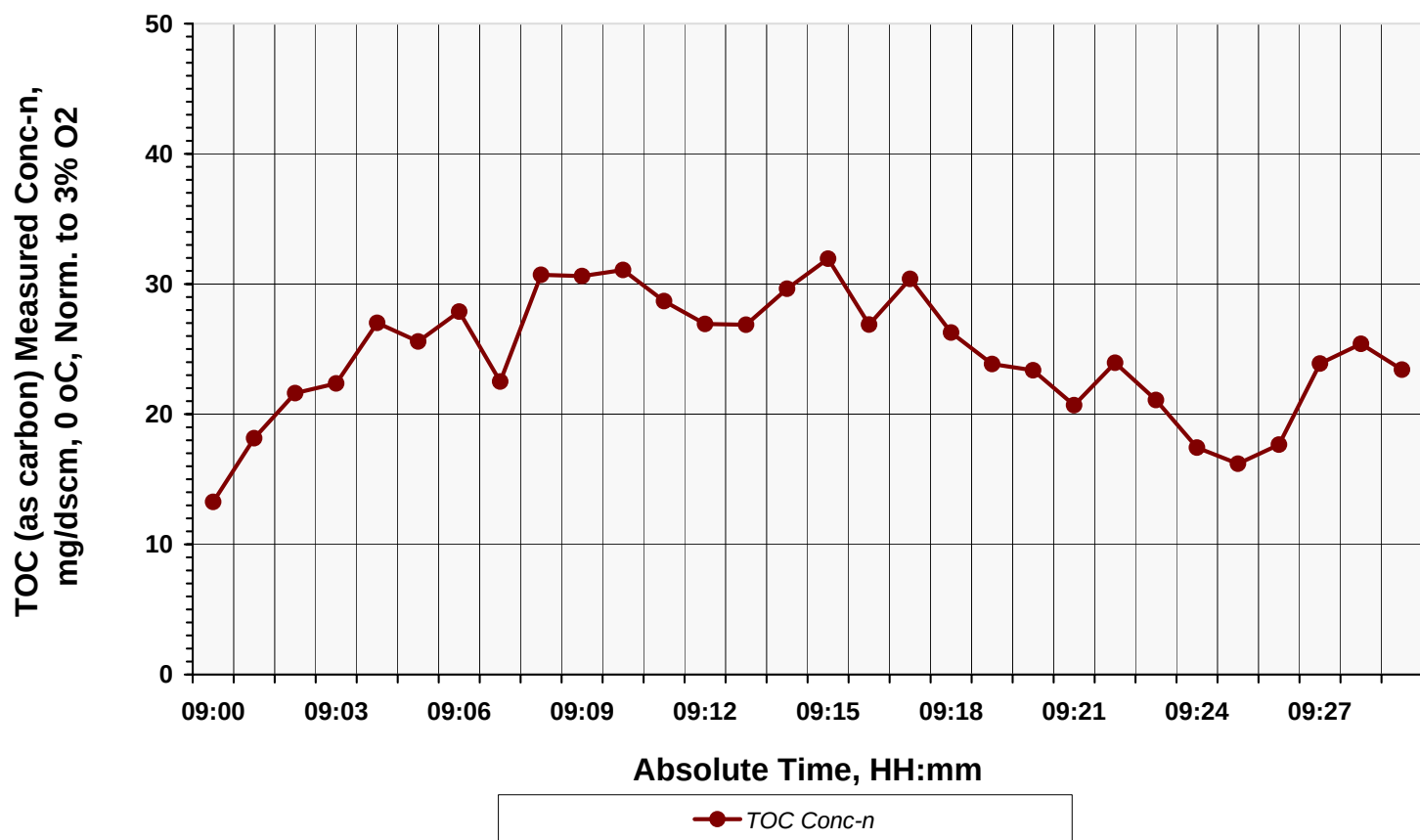
TOC (Total Organic Carbon) Determination.

according to EPA Method No. 25a.

Meaure- ment	Time	FID Reading as Propane	TOC Conc-n (calculated, as Carbon)	TOC Conc-n (calculated, as Carbon, St-d Cond-s, 0 oC)	TOC Conc-n (calculated, as Carbon, St-d Cond-s, 0 oC, Norm. to 3 % O2)	TOC Emission Rate (as Carbon)	Remarks
No.	HH:mm	ppm	ppm	mg/dscm	mg/dscm	g/Hour	
1	09:00	6.42	19.26	12.1	13.3	199.2	
2	09:01	8.79	26.37	16.6	18.2	272.8	
3	09:02	10.47	31.41	19.8	21.6	324.9	
4	09:03	10.83	32.49	20.5	22.4	336.1	
5	09:04	13.08	39.24	24.7	27.0	405.9	
6	09:05	12.39	37.17	23.4	25.6	384.5	
7	09:06	13.50	40.50	25.5	27.9	419.0	
8	09:07	10.90	32.70	20.6	22.5	338.3	
9	09:08	14.87	44.61	28.1	30.7	461.5	
10	09:09	14.82	44.46	28.0	30.6	459.9	
11	09:10	15.05	45.15	28.5	31.1	467.1	
12	09:11	13.89	41.67	26.3	28.7	431.1	
13	09:12	13.04	39.12	24.7	26.9	404.7	
14	09:13	13.01	39.03	24.6	26.9	403.8	
15	09:14	14.35	43.05	27.1	29.6	445.4	
16	09:15	15.47	46.41	29.3	31.9	480.1	
17	09:16	13.02	39.06	24.6	26.9	404.1	
18	09:17	14.72	44.16	27.8	30.4	456.8	
19	09:18	12.72	38.16	24.1	26.3	394.8	
20	09:19	11.55	34.65	21.8	23.9	358.5	
21	09:20	11.32	33.96	21.4	23.4	351.3	
22	09:21	10.02	30.06	18.9	20.7	311.0	
23	09:22	11.60	34.80	21.9	24.0	360.0	
24	09:23	10.21	30.63	19.3	21.1	316.9	
25	09:24	8.44	25.32	16.0	17.4	261.9	
26	09:25	7.84	23.52	14.8	16.2	243.3	
27	09:26	8.55	25.65	16.2	17.7	265.4	
28	09:27	11.57	34.71	21.9	23.9	359.1	
29	09:28	12.30	36.90	23.3	25.4	381.7	
30	09:29	11.34	34.02	21.4	23.4	351.9	
Average	-----	11.87	35.61	22.44	24.51	368.37	

- Remarks:**
1. The Concentrations were Calculated at Standard Conditions (Dry Gas, 0 oC, Atmospheric Pressure) and Normalized to 3% O2.
 2. Analytical Method: TOC FID Analyser.
Flame Ionization Detector (FID) was Calibrated before the Test with 3 Propane Calibration Gases (EPA Protocol Quality)
 3. Measuring Time: **09:00-09:29**

**Noble Energy - Leviathan Sea Platform. Heater-4 Stack.
Technology Test .15/01/2019. TOC as Carbon.**



CALCULATIONS.

Barometric Pressure (Pbar):.....	754 mm Hg =	29.69 in. Hg	Measured
InStack Static Pressure (Pg):.....	-5.15 mm Hg =	-0.203 in. Hg	Measured
InStack Absolute Pressure (Pso):.....	748.9 mm Hg =	29.48 in. Hg	Calculated
InStack Gas Temperature (Tso):.....	148.0 o C =	758 o R	Calculated
Dry Gas Molecular Weight (Md):.....	29.87 g/Mole		Measured
Water Content in the Gas Stream:.....	0.15 Mole Parts		Assumed
Wet Gas Molecular Weight :.....	28.09 g/Mole		Calculated
Pito't Tube Calibration Factor (Cp):.....	0.84 Calibrated	at 18/11/19	Calibrated

Stack Gas Velocity and Flowrate

Stack Gas Velocity (Vso):.....	20.04 m/sec	Calculated
Stack Gas Flowrate (Stack Cond., Qao):.....	30,187 acm/Hr	Calculated
Stack Gas Flowrate (St-d Cond., Qso):.....	16,414 dscm/Hr	Calculated

TOC Analyser Calibration Data.

TOC Calibration Field Test.

$$\text{Calibration Error (\%)} = ((CR - CTC) / CTC) * 100\%$$

Calibration Gas	Certified TOC Conc-n (CTC) ppm	Analyser Reading (CR) ppm	Adjusted to ppm	Calibration Error %	Max. Allowed Error % of CTC	Status	Average Response Time sec	Remarks
Zero	0.0	0.22	0.00	-----	-----	-----		
Low-Level (~30%)	2.0	2.05	-----	2.50	+ - 5%	V		Diluted
Mid-Level (~50%)	3.0	3.04	-----	1.33	+ - 5%	V		Diluted
High Level (~85%)	5.0	5.15	5.00	-----	-----	-----	34	Diluted
Span Value (~2*ELV)	6.0							

TOC Calibration POST-RUN Test.

$$\text{Calibration Error (\%)} = ((CR - CTC) / SPAN) * 100\%$$

Time HH:mm	Calibration Gas	Certified TOC Conc-n (CTC) ppm	Analyser Reading (CR) ppm	Calibration Drift %	Max. Allowed Error % of SPAN	Status	Remarks
9:35	Zero	0.0	0.09	1.50	+ - 3%	V	
9:44	Mid-Level	3.0	3.11	1.83	+ - 3%	V	

Table of Results.

Stack ID	Facilities Connected to the Stack		Test Methods					Test Results								
			Hazard	Test	Sampling	Analytical	Hazard	Stack	Stack	Stack	Oxygen	Oxygen	Hazard	Hazard	Remarks	Hazard
	Facility	Worked in the Same Time	Tested	Uncertainty	Method	Method	TA-LUFT Classification	Gas Temperature	Gas Water Content	Gas Flowrate Cond-s (St-d Cond-s)	Measured	for Normalization	Conc-n (St-d Cond-s)	Conc-n (St-d Cond-s, Norm-d to Oxygen)		Emission Rate
				%				o C	% v	Cond-s	% v	% v	mg/dscm	mg/dscm		Kg/Hr
Heater-4 Stack	Heater-4 Test No.: 343-H-4-9	1	TOC as Carbon	12.70	EPA-25a *	FID *	OS-III	148.0	15	16,414	4.51	3.0	22.44	24.51		0.3684
									assumed							

Remarks:

1. The Concentrations were Calculated at Standard Conditions (Dry Gas, 0 oC, Atmospheric Pressure) and Normalized to 3% O2.
2. TOC Concentrations were Calculated as Carbon.
3. "< LOD" = less than the Limit of Determination. "< LOQ" = less than the Limit of Quantification.
4. "*" - the Test was Proceeded under ISO-17025 Accreditation.

***** END OF THE REPORT *****