








Ambient Air Quality and noise Measurements Report

Gas pipeline network in Luxor City

Luxor governorate

October 2020

Petro Safe

CONTENTS

1. INTRODUCTION

Air quality and noise monitoring has been carried out as part of the baseline description for the Environmental and Social Impact Assessment of the proposed transmission line route gas project located in Luxor City - Luxor governorate, since the rout is passing nearby the Elementary school in the village and it is considered as a sensitive receptor. The location was set as suitable location for ambient air quality and noise level monitoring.

Air quality monitoring has been undertaken for the pollutants of primary concerns (NO_2, SO_2, T.S.P and PM_{10}), in order to better characterize the baseline air quality as part of the environmental impact assessment required where a one-hour average measurements were conducted for carbon monoxide (CO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), Total Suspended Particulates (T.S.P) and particulate matter (PM_{10}) for one specific location in front of Nagaa El- Taweel primary school in the front of the gas route, where the air quality complies with the national guidelines for all the analysed parameters. The site-specific air quality measurements were conducted using Standard ambient air quality monitoring instruments under the supervision of experienced specialists. Noise levels were conducted as per the international standard using type 1 precision noise level meter.

1.1 Objectives

The overall objectives of this monitoring round are to:

- Assess/confirm compliance of the air quality in the baseline environment with relevant national guidelines;
- identify any non-compliance issues, if any; and
- Provide general conclusions based on analysis results.

1.2 Scope of Work

- The scope of work of the present monitoring includes the sampling and analysis of active air and noise in the surrounding area as to distinguish whether air quality is impacted by the project activities or not.
- The measurement will be conducted in the herein location within the boundaries of the sensitive object.

1.2.1 Sampling strategy

The selection of the active air measurement location is based on the prevailing wind direction; site Topography, the future layout of the proposed project components and the location of the nearest sensitive receptors with respect to the project plots. Moreover, the selection is based on the guidelines stated in the American Society for Testing Materials (ASTM) reference method[1].

[1] D1357-95 (Reapproved2000) Standard Practice for Planning the Sampling of the Ambient Air

The following ambient air pollutants where the target parameters to be measured during the monitoring program:

- Total Suspended Particulate (TSP)
- Thoracic particulate (PM_{10})
- Nitrogen dioxide NO_2.
- Sulfur dioxide SO_2.
- Carbon monoxide CO.

Moreover, location of the measurements is shown in the figure below

1.3 Location

The GPS coordinates of the as Ambient Air (**AA**) measurement location

Location	Latitude	Longitude
Nagaa El Taweel school/ Mixed residential commercial area	25°43'6.30"N	32°39'50.00"E

Figure 1-1 location map for Gas pipeline beside Nagaa El Taweel school

2. LEGISLATION AND REGULATORY FRAMEWORK

2.1 National and International Legislation

The results of ambient air quality measurements were compared to the national limits set in Annex 5 of the Executive Regulation (710/2012) and the guideline values of world health organization (WHO) for the ambient air quality.

Table 2-1 and Table 2-3 lists the corresponding applicable national and international ambient air quality permissible limits.

Table 2-1 Applicable national permissible limits for ambient air quality levels for urban area

Pollutant	Average Period	Egyptian Standards ($\mu g.m^{-3}$)
Sulphur dioxide (SO_2)	1 hour	300
	24 hours	125
	Annual	50
Carbon monoxide	1 hour	30,000
	8 hours	10,000
Nitrogen dioxide (NO_2)	1 hour	300
	24 hours	150
	Annual	60
Total suspended particulate T.S.P	24 hours	230
	Annual	125
Thoracic particles (PM_{10})	24 hours	150
	Annual	70
$PM_{2.5}$	24 hours	80
	Annual	50

Table 2-2 Applicable National and International Permissible Limits for Ambient Noise Levels

Location	LAeq (dBA) National Permissible Limits (Annex 7 Decree 710/2012)		LAeq (dBA) International Permissible Limits (IFC – EHS General Guidelines)	
	During Day (7 am to 10 pm)	During Night (10 pm to 7 am)	During Day (7 am to 10 pm)	During Night (10 pm to 7 am)
Mixed residential commercial are	60 [2]	50 [2]	70 [3]	70 [3]

[2] National permissible limits for ambient noise levels for mixed residential and commercial areas

[3] IFC permissible limits for ambient noise levels for industrial or commercial receptors

Table 2-3 WHO Ambient Air Quality Guidelines [4,5]

Pollutant	Average Period	Guideline value ($\mu g.m^{-3}$)
Sulphur dioxide (SO_2)	24 hours	125 (interim target 1) 50 (Interim target 2) 20 (guideline)
	10 minutes	500
Nitrogen dioxide (NO_2)	1 hour	200
	1 year	40
Thoracic particles (PM_{10})	24 hrs	150 (interim target 1) 100 (interim target 2) 75 (interim target 3) 50 (guideline)
	1 year	70 (interim target 1) 50 (interim target 2) 30 (interim target 3) 20 (guideline)
Ozone	8 hours daily maximum	160 (interim target 1) 100 (guideline)

[4] World Health Organization (WHO). Air Quality Guidelines Global Update, 2005. PM 24-hour value is the 99th percentile.
[5] Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines.

3. METHODOLOGY

3.1 Ambient air quality

Ambient Air Quality Monitoring equipment is an integrated system of which includes several analyzers with data recording devises. A typical system would include gas analyzers for ambient air analysis, data recording, and signal transmission instrumentation.

Figure 3-1 ambient air quality monitoring system

Ambient air pollutants

The most common gaseous air pollutants (also known as "criteria pollutants") are carbon monoxide, sulfur oxides, and nitrogen oxides. These pollutants can be harmful to health and the environment, and cause property damage. To acquire baseline information on background levels of Thoracic Particulates, the team conducted for one-hour active sampling using a dust sampler. The sampler measures the respirable fraction of airborne dust (of particle size 0.1 to 10 µm) with a measuring range of 0.001 to 400 mg/m^3 and an accuracy of ± 5 % of the reading. The levels measured and recorded would serve as baseline values for reference during future monitoring activities.

Ambient air quality monitoring system specifications

General Features

- Standard methods of measurement which means:
- SO_2 analyzer: ISO 10498 equivalent to(U.S.A EPA Reference method – EQSA-0486-60) – UV Fluorescence
- NOx analyzer: ISO 7996 equivalent to(U.S.A EPA Reference method – RFNA-1289-74) – Chemiluminescence
- CO analyzer: ISO 4224 equivalent to U.S.A EPA Reference method – RFCA-0981-54) – IR GFC
- PM_{10} sampler: Plow volume sampler equivalent to(EPA method, Appendix J-Reference method FR)
- T.S.P low volume sampler equivalent to(EPA method, Appendix J-Reference method FR)

Ambient Particulate Matter PM_{10} sampler

- Approval and Certification: U.S.EPA (USA), UBA/ TUV (Germany), / Sira Certification Service
- Measuring Method: Sequential Particulate sampler
- Sampling on filter membranes which can be used for further Chemical analyses as required by current regulations and standards.
- Active flow Control Flow range: 0-10 LPM
- Nominal flow: 5LPM Sampler
- Dimensions: 10" x 12" x 7" Sampler
- Weight: 9.8LBS (fully configured) Transport Case: 19.75" x 12" x 18"
- The analyzer should be equipped with batteries in order to avoid possible data losses due to power failures.
- Source: Beta Ray Source with appropriate activity
- Ranges: 0-500 µg/ m^3 (2.3 m^3/ h operating flow rate); 0-1,000 µg/ m^3 (1 m3/ h operating flow rate)
- Lower Detectable Limit: ≤ 1.5 µg/ m3 (24 hour cycle time, 2.3 m3/ h operating flow rate)

- Precision: ≤ 0.4 µg/ m^3 (24 hour cycle time, 2.3 m^3/ h operating flow rate)
- Correlation Coefficient R > 0.98

Sulphur Dioxide SO_2 Analyzer (Thermo Scientific SO_2 Analyzer model 43i-USA)

- Approval and Certification : U.S.EPA (USA), UBA/ TUV (Germany), / Sira Certification Service
- Measuring Method : UV Fluorescence Technology
- Ranges.: Auto ranging feature, Multiple Ranges to cover from 0 to 10 ppm (especially from 0 to 1 ppm)
- Zero Noise: ≤ 0.5 ppb
- Lower Detectable Limit: ≤ 1 ppb
- Zero drift (daily): ≤ 1 ppb
- Span drift (daily): ≤ 1% of full scale
- Response time: fast, ≤ 100 seconds
- ◆ Precision: ≤ 0.5% of reading
- Linearity: ≤ ± 1% of full scale
- Operating temperature: not exceed 40 °C

Nitrogen Monoxide, Nitrogen Dioxide and Nitrogen Oxides NO, NO_2 & NO_X Analyzer (Thermo Scientific NOx Analyzer - Model 42i- USA)

- Approval and Certification: U.S.EPA (USA), UBA/ TUV (Germany), / Sira Certification Service
- Measuring Method.: Chemiluminescence Technology
- Ranges.: Auto ranging feature, Multiple Ranges to cover from 0 to 20 ppm (especially from 0 to 1 ppm)
- Zero Noise: ≤ 0.2 ppb
- Lower Detectable Limit: ≤ 0.4 ppb
- Zero drift (daily): < 0.5 ppb
- Span drift (daily): < 0.5% of full scale

- Response time: fast, ≤ 100 seconds
- ◆ Precision: ≤ 0.5% of reading
- Linearity: ≤ ± 1% of full scale
- Operating temperature: not exceed 40 °C

Carbon Monoxide CO Analyzer (Thermo Scientific Carbon Monoxide CO Analyzer model 48i-USA)

- Approval and Certification: U.S.EPA (USA), UBA/ TUV (Germany), / Sira Certification Service
- Measuring Method: Non Destructive Infra-Red Gas Filter Correlation (IRGFC) Technology
- Ranges: Auto ranging feature, Multiple Ranges to cover from 0 to 200 ppm (especially from 0 to 50 ppm)
- Zero Noise: ≤ 0.02 ppm
- Lower Detectable Limit: ≤ 0.04 ppm
- Zero drift (daily): ≤ 0.1 ppm
- Span drift (daily): < 0.5% of reading
- Response time: fast, ≤ 100 seconds
- ◆ Precision: ≤ 0.5% of reading
- Linearity: ≤ ± 1% of full scale
- Operating temperature: not exceed 40 °C

3.2 Noise Measurement Methodology

The methodology adopted was to record ambient noise levels for one hour, as per the national and international standards, in the current location at the proposed transmission line route. The following devices were used during the first round of noise level measurements:

- Two B & K 2238 Mediator, Integrating Sound Level Meters, Type I (precision grade), compliant with IEC 1672 Class 1 standard;
- B & K 4198 Outdoor Weatherproof Microphone Kit;
- GPS unit (Garmin MONTANA 650); and
- Digital Camera.

Noise monitoring measurements included recording the following parameters using a Type 1 precision

grade hand-held sound-level meters:

- Equivalent continuous noise level (LAeq)
- 95th percentile noise level (LA95)
- 90th percentile noise level (LA90)
- 50th percentile noise level (LA50)
- 10th percentile noise level (LA10)
- Peak sound pressure level (LCpeak)

The following equation[6] is the main equation used to calculated day night equivalent sound pressure level:

$L_{den} = 10\log\frac{1}{n}\sum_{i=1}^{n}10^{0.1(L_i+D_i)}$ **Where** $L_{den} = \text{Day Night Equivalent}$, $L_i = \text{The hourly } L_{eq}$, $D_i = \text{the addition for the different periods of the day}$, $n = \text{number of measured hours}$.

The sound level meters were calibrated before sound measurements to ensure reliability and precision. GPS coordinates and meteorological conditions were recorded using hand-held kits at all locations prior to the start of noise measurements. It is anticipated that most of these locations would remain the same for the purpose of pre-construction, construction, performance guarantee tests and operation monitoring.

[6]The equation used to obtain the average noise level of a designated time interval based on weighted readings according to "Long-term Leq errors expected and how long to measure (Uncertainity & Noise Monitoring)", Dietrich Kuehner, Forum Acusticum 2005 Budapest.

4. RESULTS

The following tables present the results for ambient air quality measurements conducted at the proposed transmission line route location.
The objectives of the ambient air quality Monitoring activities conducted at the proposed site are:

- To verify compliance with authorized discharge limits and any other regulatory requirements concerning the impact on the public and the environment due to the normal operation of a practice or a source within a practice;
- to establish air quality baseline which will assist in the estimation of the project impact on the local physical, biological and social environment ;
- To check the conditions of operation and the adequacy of controls on discharges from the source and to provide a warning of unusual or unforeseen conditions and, where appropriate, to trigger a special environmental monitoring program.

The air quality at the proposed site of the proposed transmission line route is exhibiting acceptable levels of classic air pollutants in fact the levels are way below the international guidelines. Generation and dispersion of dust from increased vehicle traffic, especially during the rash hour, may reduce visibility, relative to baseline levels, and, together with combustion engine emissions, may affect ambient air quality. Concentration of dust particles, both total suspended particulate and respirable particulate matter and other pollutants from open burning, emissions from equipment and machinery used in transportation, various activities of operations and emissions from vehicles used to transport passengers also contribute to air pollution. These impacts may affect the human environment and, typically, arise during the preparation phase and, to a much lesser extent, during the operation phase, requiring monitoring and assessment of the natural and man-made air pollutants.

One-hour average results for 8 hours continuous measurements are shown in Table 4-1 for all the measured parameters

Table 4-1 one-hour average results

Time	NO ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	NOx ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	CO (mg/m^3)	PM_{10} ($\mu g/m^3$)	T.S.P ($\mu g/m^3$)
10:AM	25.32	33.36	58.68	15.84	4.08	101	197
11:00	16.68	22.44	38.88	13.56	4.8		
12:00	18.24	31.32	49.56	15.12	4.92		
13:00	18.6	34.92	53.52	16.56	5.16		
14:00	23.16	44.16	67.32	16.68	4.68		
15:00	45.24	50.16	95.4	17.04	3.96		
16:00	13.8	20.64	46.44	18.36	3.72		
17:00	14.64	21	35.64	18.72	3.48		
Limits		300/h		300/h	30/h	150	230

4.1 Analysis of air quality Results

In general, there are two main factors affecting the ambient air concentration of a certain pollutant emitted from a certain source or sources in a selected area:

- The intensity of the emissions (e.g. concentration and flow rate) from the source or sources.
- The uncontrollable atmospheric dispersion conditions which include but not limited to (wind speed, wind direction, temperature, humidity, rain fall, atmospheric turbulence, solar radiation intensity and atmospheric pressure).

All the recorded rests showed compliance with the national and international guidelines for ambient air quality moreover most of the data recorded were way below the guidelines which indicates that the ambient air quality in the project areas is one of the best areas in Egypt in terms of ambient air quality which can be attributed to the absence of any major industrial sources.

Moreover, the area is mixed agricultural and urban with a very scarce source for any pollution other than the nearby the route.

5. NOISE LEVELS RESULTS

Table 5-1 presents the results of one-hour average ambient noise measurements and their corresponding national and international permissible limits.

Table 5-1 Ambient Noise Levels Readings at the proposed transmission line rout

Time	Sound Level Equivalent & Percentile Recordings in dBA for 8 Hours						Permissible Limits LAeq (dBA)	
	LAeq	LA10	LA50	LA90	LA95	LCpeak	National	International
10:00	52.8	43.95	46.05	39.93	37.27	116.97	60	70
11:00	52.41	42.68	34.62	28.4	27.83	121.52		
12:00	46.79	49.47	47.47	39.7	37.8	104.96		
13:00	52.72	49.92	49	41.11	39.06	105.77		
14:00	51.23	45.7	41.9	36.13	34.77	93.7		
15:00	51.47	47.43	42.65	35.86	34.17	105.57		
16:00	50.26	53.78	53.44	45.95	43.89	104.93		
17:00	48.18	51.29	49.75	38.61	36.17	99.24		

The results of ambient noise measurements were compared to the national and international permissible limits.

6. CONCLUSION

Based on the environmental monitoring and measurements, that performed for the ambient air quality. The results showed compliance with all the national and international guidelines.

7. FUTURE RECOMMENDATION

It is recommended that monitoring should continue for all the regulated parameters, in order to verify/assure compliance.

8. REFERENCES

- EU directive 2008 50 EC -ANNEX I Data quality objectives for ambient air quality assessment
- D1357-95 (Reapproved2000) Standard Practice for Planning the Sampling of the Ambient Air
- Egyptian Law 4/1994 Amended by law 9/2009 and Decree 1741/2005, amended by decree 1095 /2011 Annex 6 (amendments to executive regulations of Law 4).

Appendix I - Selection of Photos from the Air Quality Monitoring activities


REDMI NOTE 8
AI QUAD CAMERA


محافظة الأقصر
مديرية الأقصر التعليمية
مدرسة نجع الطويل الابتدائية المشتركة بالكرنك
REDMI NOTE 8
AI QUAD CAMERA

Appendix II - Selection of Photos from the noise Monitoring activities


REDMI NOTE 8
AI QUAD CAMERA


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مديرية الأقصر التعليمية
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CONTENTS

1. INTRODUCTION

Air quality and noise monitoring has been carried out as part of the baseline description for the Environmental and Social Impact Assessment of the proposed transmission line route gas project located in Esna - Luxor governorate, since the rout is passing nearby The High School in the village and it is considered as a sensitive receptor. The location was set as suitable location for ambient air quality and noise level monitoring.

Air quality monitoring has been undertaken for the pollutants of primary concerns (NO_2, SO_2, T.S.P and PM_{10}), in order to better characterize the baseline air quality as part of the environmental impact assessment required where a one-hour average measurements were conducted for carbon monoxide (CO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), Total Suspended Particulates (T.S.P) and particulate matter (PM_{10}) for one specific location in front of Esna High School in the front of the gas route, where the air quality complies with the national guidelines for all the analysed parameters. The site-specific air quality measurements were conducted using Standard ambient air quality monitoring instruments under the supervision of experienced specialists. Noise levels were conducted as per the international standard using type 1 precision noise level meter.

1.1 Objectives

The overall objectives of this monitoring round are to:

- Assess/confirm compliance of the air quality in the baseline environment with relevant national guidelines;
- identify any non-compliance issues, if any; and
- Provide general conclusions based on analysis results.

1.2 Scope of Work

- The scope of work of the present monitoring includes the sampling and analysis of active air and noise in the surrounding area as to distinguish whether air quality is impacted by the project activities or not.
- The measurement will be conducted in the herein location within the boundaries of the sensitive object.

1.2.1 Sampling strategy

The selection of the active air measurement location is based on the prevailing wind direction; site Topography, the future layout of the proposed project components and the location of the nearest sensitive receptors with respect to the project plots. Moreover, the selection is based on the guidelines stated in the American Society for Testing Materials (ASTM) reference method[1].

[1] D1357-95 (Reapproved2000) Standard Practice for Planning the Sampling of the Ambient Air

The following ambient air pollutants where the target parameters to be measured during the monitoring program:

- Total Suspended Particulate (TSP)
- Thoracic particulate (PM_{10})
- Nitrogen dioxide NO_2.
- Sulfur dioxide SO_2.
- Carbon monoxide CO.

Moreover, location of the measurements is shown in the figure below

1.3 Location

The GPS coordinates of the as Ambient Air (**AA**) measurement location

Location	Latitude	Longitude
Esna High School/ Mixed residential commercial area	25°18'4.80"N	32°33'16.50"E

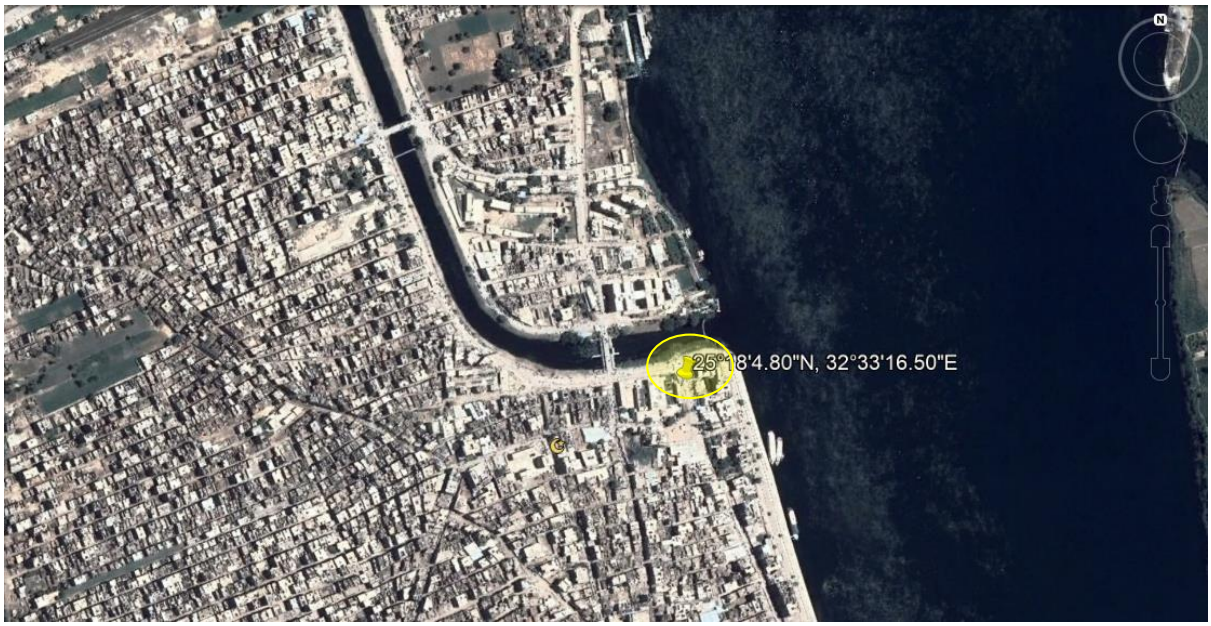

Figure 1-1 location map for Gas pipeline beside Esna High School

2. LEGISLATION AND REGULATORY FRAMEWORK

2.1 National and International Legislation

The results of ambient air quality measurements were compared to the national limits set in Annex 5 of the Executive Regulation (710/2012) and the guideline values of world health organization (WHO) for the ambient air quality.

Table 2-1 and Table 2-3 lists the corresponding applicable national and international ambient air quality permissible limits.

Table 2-1 Applicable national permissible limits for ambient air quality levels for urban area

Pollutant	Average Period	Egyptian Standards ($\mu g.m^{-3}$)
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	24 hours	125
	Annual	50
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Nitrogen dioxide (NO_2)	1 hour	300
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	Annual	60
Total suspended particulate T.S.P	24 hours	230
	Annual	125
Thoracic particles (PM_{10})	24 hours	150
	Annual	70
$PM_{2.5}$	24 hours	80
	Annual	50

Table 2-2 Applicable National and International Permissible Limits for Ambient Noise Levels

Location	LAeq (dBA) National Permissible Limits (Annex 7 Decree 710/2012)		LAeq (dBA) International Permissible Limits (IFC – EHS General Guidelines)	
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Table 2-3 WHO Ambient Air Quality Guidelines [4,5]

Pollutant	Average Period	Guideline value (µg.m^{-3})
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	1 year	40
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Ozone	8 hours daily maximum	160 (interim target 1) 100 (guideline)

[4] World Health Organization (WHO). Air Quality Guidelines Global Update, 2005. PM 24-hour value is the 99th percentile.

[5] Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines.

3. METHODOLOGY

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Figure 3-1 ambient air quality monitoring system

Ambient air pollutants

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- CO analyzer: ISO 4224 equivalent to U.S.A EPA Reference method – RFCA-0981-54) – IR GFC
- PM_{10} sampler: Plow volume sampler equivalent to(EPA method, Appendix J-Reference method FR)
- T.S.P low volume sampler equivalent to(EPA method, Appendix J-Reference method FR)

Ambient Particulate Matter PM_{10} sampler

- Approval and Certification: U.S.EPA (USA), UBA/ TUV (Germany), / Sira Certification Service
- Measuring Method: Sequential Particulate sampler
- Sampling on filter membranes which can be used for further Chemical analyses as required by current regulations and standards.
- Active flow Control Flow range: 0-10 LPM
- Nominal flow: 5LPM Sampler
- Dimensions: 10" x 12" x 7" Sampler
- Weight: 9.8LBS (fully configured) Transport Case: 19.75" x 12" x 18"
- The analyzer should be equipped with batteries in order to avoid possible data losses due to power failures.
- Source: Beta Ray Source with appropriate activity
- Ranges: 0-500 µg/ m^3 (2.3 m^3/ h operating flow rate); 0-1,000 µg/ m^3 (1 m3/ h operating flow rate)
- Lower Detectable Limit: ≤ 1.5 µg/ m3 (24 hour cycle time, 2.3 m3/ h operating flow rate)

- Precision: ≤ 0.4 µg/ m^3 (24 hour cycle time, 2.3 m^3/ h operating flow rate)
- Correlation Coefficient R > 0.98

Sulphur Dioxide SO_2 Analyzer (Thermo Scientific SO_2 Analyzer model 43i-USA)

- Approval and Certification : U.S.EPA (USA), UBA/ TUV (Germany), / Sira Certification Service
- Measuring Method : UV Fluorescence Technology
- Ranges.: Auto ranging feature, Multiple Ranges to cover from 0 to 10 ppm (especially from 0 to 1 ppm)
- Zero Noise: ≤ 0.5 ppb
- Lower Detectable Limit: ≤ 1 ppb
- Zero drift (daily): ≤ 1 ppb
- Span drift (daily): ≤ 1% of full scale
- Response time: fast, ≤ 100 seconds
- ◆ Precision: ≤ 0.5% of reading
- Linearity: ≤ ± 1% of full scale
- Operating temperature: not exceed 40 °C

Nitrogen Monoxide, Nitrogen Dioxide and Nitrogen Oxides NO, NO_2 & NO_X Analyzer (Thermo Scientific NOx Analyzer - Model 42i- USA)

- Approval and Certification: U.S.EPA (USA), UBA/ TUV (Germany), / Sira Certification Service
- Measuring Method.: Chemiluminescence Technology
- Ranges.: Auto ranging feature, Multiple Ranges to cover from 0 to 20 ppm (especially from 0 to 1 ppm)
- Zero Noise: ≤ 0.2 ppb
- Lower Detectable Limit: ≤ 0.4 ppb
- Zero drift (daily): < 0.5 ppb
- Span drift (daily): < 0.5% of full scale

- Response time: fast, ≤ 100 seconds
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- Linearity: ≤ ± 1% of full scale
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Carbon Monoxide CO Analyzer (Thermo Scientific Carbon Monoxide CO Analyzer model 48i-USA)

- Approval and Certification: U.S.EPA (USA), UBA/ TUV (Germany), / Sira Certification Service
- Measuring Method: Non Destructive Infra-Red Gas Filter Correlation (IRGFC) Technology
- Ranges: Auto ranging feature, Multiple Ranges to cover from 0 to 200 ppm (especially from 0 to 50 ppm)
- Zero Noise: ≤ 0.02 ppm
- Lower Detectable Limit: ≤ 0.04 ppm
- Zero drift (daily): ≤ 0.1 ppm
- Span drift (daily): < 0.5% of reading
- Response time: fast, ≤ 100 seconds
- ◆ Precision: ≤ 0.5% of reading
- Linearity: ≤ ± 1% of full scale
- Operating temperature: not exceed 40 °C

3.2 Noise Measurement Methodology

The methodology adopted was to record ambient noise levels for one hour, as per the national and international standards, in the current location at the proposed transmission line route. The following devices were used during the first round of noise level measurements:

- Two B & K 2238 Mediator, Integrating Sound Level Meters, Type I (precision grade), compliant with IEC 1672 Class 1 standard;
- B & K 4198 Outdoor Weatherproof Microphone Kit;
- GPS unit (Garmin MONTANA 650); and
- Digital Camera.

Noise monitoring measurements included recording the following parameters using a Type 1 precision

grade hand-held sound-level meters:

- Equivalent continuous noise level (LAeq)
- 95th percentile noise level (LA95)
- 90th percentile noise level (LA90)
- 50th percentile noise level (LA50)
- 10th percentile noise level (LA10)
- Peak sound pressure level (LCpeak)

The following equation[6] is the main equation used to calculated day night equivalent sound pressure level:

$L_{den} = 10\log\frac{1}{n}\sum_{i=1}^{n}10^{0.1(L_i+D_i)}$ **Where** $L_{den} = \text{Day Night Equivalent}$, $L_i = \text{The hourly } L_{eq}$, $D_i = \text{the addition for the different periods of the day}$, $n = \text{number of measured hours}$.

The sound level meters were calibrated before sound measurements to ensure reliability and precision. GPS coordinates and meteorological conditions were recorded using hand-held kits at all locations prior to the start of noise measurements. It is anticipated that most of these locations would remain the same for the purpose of pre-construction, construction, performance guarantee tests and operation monitoring.

[6]The equation used to obtain the average noise level of a designated time interval based on weighted readings according to "Long-term Leq errors expected and how long to measure (Uncertainity & Noise Monitoring)", Dietrich Kuehner, Forum Acusticum 2005 Budapest.

4. RESULTS

The following tables present the results for ambient air quality measurements conducted at the proposed transmission line route location.
The objectives of the ambient air quality Monitoring activities conducted at the proposed site are:

- To verify compliance with authorized discharge limits and any other regulatory requirements concerning the impact on the public and the environment due to the normal operation of a practice or a source within a practice;
- to establish air quality baseline which will assist in the estimation of the project impact on the local physical, biological and social environment;
- To check the conditions of operation and the adequacy of controls on discharges from the source and to provide a warning of unusual or unforeseen conditions and, where appropriate, to trigger a special environmental monitoring program.

The air quality at the proposed site of the proposed transmission line route is exhibiting acceptable levels of classic air pollutants in fact the levels are way below the international guidelines. Generation and dispersion of dust from increased vehicle traffic, especially during the rash hour, may reduce visibility, relative to baseline levels, and, together with combustion engine emissions, may affect ambient air quality. Concentration of dust particles, both total suspended particulate and respirable particulate matter and other pollutants from open burning, emissions from equipment and machinery used in transportation, various activities of operations and emissions from vehicles used to transport passengers also contribute to air pollution. These impacts may affect the human environment and, typically, arise during the preparation phase and, to a much lesser extent, during the operation phase, requiring monitoring and assessment of the natural and man-made air pollutants.

One-hour average results for 8 hours continuous measurements are shown in Table 4-1 for all the measured parameters

Table 4-1 one-hour average results

Time	NO ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	NOx ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	CO (mg/m^3)	PM_{10} ($\mu g/m^3$)	T.S.P ($\mu g/m^3$)
10:AM	23.21	30.58	53.79	14.52	3.74	91	143
11:00	15.29	20.57	35.64	12.43	4.4		
12:00	16.72	28.71	45.43	13.86	4.51		
13:00	17.05	32.01	49.06	15.18	4.73		
14:00	21.23	40.48	61.71	15.29	4.29		
15:00	41.47	45.98	87.45	15.62	3.63		
16:00	12.65	18.92	42.57	16.83	3.41		
17:00	13.42	19.25	32.67	17.16	3.19		
Limits		300/h		300/h	30/h	150	230

4.1 Analysis of air quality Results

In general, there are two main factors affecting the ambient air concentration of a certain pollutant emitted from a certain source or sources in a selected area:

- The intensity of the emissions (e.g. concentration and flow rate) from the source or sources.
- The uncontrollable atmospheric dispersion conditions which include but not limited to (wind speed, wind direction, temperature, humidity, rain fall, atmospheric turbulence, solar radiation intensity and atmospheric pressure).

All the recorded rests showed compliance with the national and international guidelines for ambient air quality moreover most of the data recorded were way below the guidelines which indicates that the ambient air quality in the project areas is one of the best areas in Egypt in terms of ambient air quality which can be attributed to the absence of any major industrial sources.

Moreover, the area is mixed agricultural and urban with a very scarce source for any pollution other than the nearby the route.

5. NOISE LEVELS RESULTS

Table 5-1 presents the results of one-hour average ambient noise measurements and their corresponding national and international permissible limits.

Table 5-1 Ambient Noise Levels Readings at the proposed transmission line rout

Time	Sound Level Equivalent & Percentile Recordings in dBA for 8 Hours						Permissible Limits LAeq (dBA)	
	LAeq	LA10	LA50	LA90	LA95	LCpeak	National	International
10:00	54.63	45.8	41.5	35.7	33.3	105.2	60	70
11:00	54.27	44.4	31.8	25.6	25.7	109.3		
12:00	48.33	51.3	42.3	35.3	34.2	94.4		
13:00	54.54	51.2	44.1	36.9	35.4	95.1		
14:00	53.01	47.6	37.1	32.7	31.3	84.1		
15:00	53.19	49.8	38.5	32.4	30.3	95.3		
16:00	52.02	54.6	48.6	41.5	39.1	94.7		
17:00	51.66	52.3	44.5	34.9	32.3	89.6		

The results of ambient noise measurements were compared to the national and international permissible limits.

6. CONCLUSION

Based on the environmental monitoring and measurements, that performed for the ambient air quality. The results showed compliance with all the national and international guidelines.

7. FUTURE RECOMMENDATION

It is recommended that monitoring should continue for all the regulated parameters, in order to verify/assure compliance.

8. REFERENCES

- EU directive 2008 50 EC -ANNEX I Data quality objectives for ambient air quality assessment
- D1357-95 (Reapproved2000) Standard Practice for Planning the Sampling of the Ambient Air
- Egyptian Law 4/1994 Amended by law 9/2009 and Decree 1741/2005, amended by decree 1095 /2011 Annex 6 (amendments to executive regulations of Law 4).

Appendix I - Selection of Photos from the Air Quality Monitoring activities


مدرسة إسنا الثانوية بنات
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Appendix II - Selection of Photos from the noise Monitoring activities


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Ambient Air Quality and noise Measurements Report

Gas pipeline network in Armant- Luxor governorate

October 2020

Petro Safe

CONTENTS

1. INTRODUCTION

Air quality and noise monitoring has been carried out as part of the baseline description for the Environmental and Social Impact Assessment of the proposed transmission line route gas project located in Armant Luxor governorate, since the rout is passing nearby The Medical Centre in the village and it is considered as a sensitive receptor. The location was set as suitable location for ambient air quality and noise level monitoring.

Air quality monitoring has been undertaken for the pollutants of primary concerns (NO_2, SO_2, T.S.P and PM_{10}), in order to better characterize the baseline air quality as part of the environmental impact assessment required where a one-hour average measurements were conducted for carbon monoxide (CO), nitrogen dioxide (NO_2), sulphur dioxide (SO_2), Total Suspended Particulates (T.S.P) and particulate matter (PM_{10}) for one specific location in front of The Family Medical Centre in the front of the gas route, where the air quality complies with the national guidelines for all the analysed parameters. The site-specific air quality measurements were conducted using Standard ambient air quality monitoring instruments under the supervision of experienced specialists. Noise levels were conducted as per the international standard using type 1 precision noise level meter.

1.1 Objectives

The overall objectives of this monitoring round are to:

- Assess/confirm compliance of the air quality in the baseline environment with relevant national guidelines;
- identify any non-compliance issues, if any; and
- Provide general conclusions based on analysis results.

1.2 Scope of Work

- The scope of work of the present monitoring includes the sampling and analysis of active air and noise in the surrounding area as to distinguish whether air quality is impacted by the project activities or not.
- The measurement will be conducted in the herein location within the boundaries of the sensitive object.

1.2.1 Sampling strategy

The selection of the active air measurement location is based on the prevailing wind direction; site Topography, the future layout of the proposed project components and the location of the nearest sensitive receptors with respect to the project plots. Moreover, the selection is based on the guidelines stated in the American Society for Testing Materials (ASTM) reference method[1].

[1] D1357-95 (Reapproved2000) Standard Practice for Planning the Sampling of the Ambient Air

The following ambient air pollutants where the target parameters to be measured during the monitoring program:

- Total Suspended Particulate (TSP)
- Thoracic particulate (PM_{10})
- Nitrogen dioxide NO_2.
- Sulfur dioxide SO_2.
- Carbon monoxide CO.

Moreover, location of the measurements is shown in the figure below

1.3 Location

The GPS coordinates of the as Ambient Air (**AA**) measurement location

Location	Latitude	Longitude
The Family Medical Centre/Mixed residential commercial area	25°37'32.90"N	32°32'31.20"E

Figure 1-1 location map for Gas pipeline beside The Family Medical Centre

2. LEGISLATION AND REGULATORY FRAMEWORK

2.1 National and International Legislation

The results of ambient air quality measurements were compared to the national limits set in Annex 5 of the Executive Regulation (710/2012) and the guideline values of world health organization (WHO) for the ambient air quality.

Table 2-1 and Table 2-3 lists the corresponding applicable national and international ambient air quality permissible limits.

Table 2-1 Applicable national permissible limits for ambient air quality levels for urban area

Pollutant	Average Period	Egyptian Standards ($\mu g.m^{-3}$)
Sulphur dioxide (SO_2)	1 hour	300
	24 hours	125
	Annual	50
Carbon monoxide	1 hour	30,000
	8 hours	10,000
Nitrogen dioxide (NO_2)	1 hour	300
	24 hours	150
	Annual	60
Total suspended particulate T.S.P	24 hours	230
	Annual	125
Thoracic particles (PM_{10})	24 hours	150
	Annual	70
$PM_{2.5}$	24 hours	80
	Annual	50

Table 2-2 Applicable National and International Permissible Limits for Ambient Noise Levels

Location	LAeq (dBA) National Permissible Limits (Annex 7 Decree 710/2012)		LAeq (dBA) International Permissible Limits (IFC – EHS General Guidelines)	
	During Day (7 am to 10 pm)	During Night (10 pm to 7 am)	During Day (7 am to 10 pm)	During Night (10 pm to 7 am)
Mixed residential commercial area	60 [2]	50 [2]	70 [3]	70 [3]

[2] National permissible limits for ambient noise levels for mixed residential and commercial areas

[3] IFC permissible limits for ambient noise levels for industrial or commercial receptors

Table 2-3 WHO Ambient Air Quality Guidelines [4,5]

Pollutant	Average Period	Guideline value (µg.m^{-3})
Sulphur dioxide (SO_2)	24 hours	125 (interim target 1) 50 (Interim target 2) 20 (guideline)
	10 minutes	500
Nitrogen dioxide (NO_2)	1 hour	200
	1 year	40
Thoracic particles (PM_{10})	24 hrs	150 (interim target 1) 100 (interim target 2) 75 (interim target 3) 50 (guideline)
	1 year	70 (interim target 1) 50 (interim target 2) 30 (interim target 3) 20 (guideline)
Ozone	8 hours daily maximum	160 (interim target 1) 100 (guideline)

[4] World Health Organization (WHO). Air Quality Guidelines Global Update, 2005. PM 24-hour value is the 99th percentile.
[5] Interim targets are provided in recognition of the need for a staged approach to achieving the recommended guidelines.

3. METHODOLOGY

3.1 Ambient air quality

Ambient Air Quality Monitoring equipment is an integrated system of which includes several analyzers with data recording devises. A typical system would include gas analyzers for ambient air analysis, data recording, and signal transmission instrumentation.

Figure 3-1 ambient air quality monitoring system

Ambient air pollutants

The most common gaseous air pollutants (also known as "criteria pollutants") are carbon monoxide, sulfur oxides, and nitrogen oxides. These pollutants can be harmful to health and the environment, and cause property damage. To acquire baseline information on background levels of Thoracic Particulates, the team conducted for one-hour active sampling using a dust sampler. The sampler measures the respirable fraction of airborne dust (of particle size 0.1 to 10 µm) with a measuring range of 0.001 to 400 mg/m^3 and an accuracy of ± 5 % of the reading. The levels measured and recorded would serve as baseline values for reference during future monitoring activities.

Ambient air quality monitoring system specifications

General Features

- Standard methods of measurement which means:
- SO_2 analyzer: ISO 10498 equivalent to(U.S.A EPA Reference method – EQSA-0486-60) – UV Fluorescence
- NOx analyzer: ISO 7996 equivalent to(U.S.A EPA Reference method – RFNA-1289-74) – Chemiluminescence
- CO analyzer: ISO 4224 equivalent to U.S.A EPA Reference method – RFCA-0981-54) – IR GFC
- PM_{10} sampler: Plow volume sampler equivalent to(EPA method, Appendix J-Reference method FR)
- T.S.P low volume sampler equivalent to(EPA method, Appendix J-Reference method FR)

Ambient Particulate Matter PM_{10} sampler

- Approval and Certification: U.S.EPA (USA), UBA/ TUV (Germany), / Sira Certification Service
- Measuring Method: Sequential Particulate sampler
- Sampling on filter membranes which can be used for further Chemical analyses as required by current regulations and standards.
- Active flow Control Flow range: 0-10 LPM
- Nominal flow: 5LPM Sampler
- Dimensions: 10" x 12" x 7" Sampler
- Weight: 9.8LBS (fully configured) Transport Case: 19.75" x 12" x 18"
- The analyzer should be equipped with batteries in order to avoid possible data losses due to power failures.
- Source: Beta Ray Source with appropriate activity
- Ranges: 0-500 µg/ m^3 (2.3 m^3/ h operating flow rate); 0-1,000 µg/ m^3 (1 m3/ h operating flow rate)
- Lower Detectable Limit: ≤ 1.5 µg/ m3 (24 hour cycle time, 2.3 m3/ h operating flow rate)

- Precision: ≤ 0.4 µg/ m^3 (24 hour cycle time, 2.3 m^3/ h operating flow rate)
- Correlation Coefficient R > 0.98

Sulphur Dioxide SO_2 Analyzer (Thermo Scientific SO_2 Analyzer model 43i-USA)

- Approval and Certification : U.S.EPA (USA), UBA/ TUV (Germany), / Sira Certification Service
- Measuring Method : UV Fluorescence Technology
- Ranges.: Auto ranging feature, Multiple Ranges to cover from 0 to 10 ppm (especially from 0 to 1 ppm)
- Zero Noise: ≤ 0.5 ppb
- Lower Detectable Limit: ≤ 1 ppb
- Zero drift (daily): ≤ 1 ppb
- Span drift (daily): ≤ 1% of full scale
- Response time: fast, ≤ 100 seconds
- ◆ Precision: ≤ 0.5% of reading
- Linearity: ≤ ± 1% of full scale
- Operating temperature: not exceed 40 °C

Nitrogen Monoxide, Nitrogen Dioxide and Nitrogen Oxides NO, NO_2 & NO_X Analyzer (Thermo Scientific NOx Analyzer - Model 42i- USA)

- Approval and Certification: U.S.EPA (USA), UBA/ TUV (Germany), / Sira Certification Service
- Measuring Method.: Chemiluminescence Technology
- Ranges.: Auto ranging feature, Multiple Ranges to cover from 0 to 20 ppm (especially from 0 to 1 ppm)
- Zero Noise: ≤ 0.2 ppb
- Lower Detectable Limit: ≤ 0.4 ppb
- Zero drift (daily): < 0.5 ppb
- Span drift (daily): < 0.5% of full scale

- Response time: fast, ≤ 100 seconds
- ◆ Precision: ≤ 0.5% of reading
- Linearity: ≤ ± 1% of full scale
- Operating temperature: not exceed 40 °C

Carbon Monoxide CO Analyzer (Thermo Scientific Carbon Monoxide CO Analyzer model 48i-USA)

- Approval and Certification: U.S.EPA (USA), UBA/ TUV (Germany), / Sira Certification Service
- Measuring Method: Non Destructive Infra-Red Gas Filter Correlation (IRGFC) Technology
- Ranges: Auto ranging feature, Multiple Ranges to cover from 0 to 200 ppm (especially from 0 to 50 ppm)
- Zero Noise: ≤ 0.02 ppm
- Lower Detectable Limit: ≤ 0.04 ppm
- Zero drift (daily): ≤ 0.1 ppm
- Span drift (daily): < 0.5% of reading
- Response time: fast, ≤ 100 seconds
- ◆ Precision: ≤ 0.5% of reading
- Linearity: ≤ ± 1% of full scale
- Operating temperature: not exceed 40 °C

3.2 Noise Measurement Methodology

The methodology adopted was to record ambient noise levels for one hour, as per the national and international standards, in the current location at the proposed transmission line route. The following devices were used during the first round of noise level measurements:

- Two B & K 2238 Mediator, Integrating Sound Level Meters, Type I (precision grade), compliant with IEC 1672 Class 1 standard;
- B & K 4198 Outdoor Weatherproof Microphone Kit;
- GPS unit (Garmin MONTANA 650); and
- Digital Camera.

Noise monitoring measurements included recording the following parameters using a Type 1 precision

grade hand-held sound-level meters:

- Equivalent continuous noise level (LAeq)
- 95th percentile noise level (LA95)
- 90th percentile noise level (LA90)
- 50th percentile noise level (LA50)
- 10th percentile noise level (LA10)
- Peak sound pressure level (LCpeak)

The following equation[6] is the main equation used to calculated day night equivalent sound pressure level:

$L_{den} = 10\log\frac{1}{n}\sum_{i=1}^{n}10^{0.1(L_i+D_i)}$ **Where** $L_{den} = \text{Day Night Equivalent}$, $L_i = \text{The hourly } L_{eq}$, $D_i = \text{the addition for the different periods of the day}$, $n = \text{number of measured hours}$.

The sound level meters were calibrated before sound measurements to ensure reliability and precision. GPS coordinates and meteorological conditions were recorded using hand-held kits at all locations prior to the start of noise measurements. It is anticipated that most of these locations would remain the same for the purpose of pre-construction, construction, performance guarantee tests and operation monitoring.

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4. RESULTS

The following tables present the results for ambient air quality measurements conducted at the proposed transmission line route location.
The objectives of the ambient air quality Monitoring activities conducted at the proposed site are:

- To verify compliance with authorized discharge limits and any other regulatory requirements concerning the impact on the public and the environment due to the normal operation of a practice or a source within a practice;
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One-hour average results for 8 hours continuous measurements are shown in Table 4-1 for all the measured parameters

Table 4-1 one-hour average results

Time	NO ($\mu g/m^3$)	NO_2 ($\mu g/m^3$)	NOx ($\mu g/m^3$)	SO_2 ($\mu g/m^3$)	CO (mg/m^3)	PM_{10} ($\mu g/m^3$)	T.S.P ($\mu g/m^3$)
10:AM	18.99	25.02	44.01	11.88	3.06	88	123
11:00	12.51	16.83	29.16	10.17	3.6		
12:00	13.68	23.49	37.17	11.34	3.69		
13:00	13.95	26.19	40.14	12.42	3.87		
14:00	17.37	33.12	50.49	12.51	3.51		
15:00	33.93	37.62	71.55	12.78	2.97		
16:00	10.35	15.48	34.83	13.77	2.79		
17:00	10.98	15.75	26.73	14.04	2.61		
Limits		300		300	30/h	150	230

4.1 Analysis of air quality Results

In general, there are two main factors affecting the ambient air concentration of a certain pollutant emitted from a certain source or sources in a selected area:

- The intensity of the emissions (e.g. concentration and flow rate) from the source or sources.
- The uncontrollable atmospheric dispersion conditions which include but not limited to (wind speed, wind direction, temperature, humidity, rain fall, atmospheric turbulence, solar radiation intensity and atmospheric pressure).

All the recorded rests showed compliance with the national and international guidelines for ambient air quality moreover most of the data recorded were way below the guidelines which indicates that the ambient air quality in the project areas is one of the best areas in Egypt in terms of ambient air quality which can be attributed to the absence of any major industrial sources.

Moreover, the area is mixed agricultural and urban with a very scarce source for any pollution other than the nearby the route.

5. NOISE LEVELS RESULTS

Table 5-1 presents the results of one-hour average ambient noise measurements and their corresponding national and international permissible limits.

Table 5-1 Ambient Noise Levels Readings at the proposed transmission line rout

Time	Sound Level Equivalent & Percentile Recordings in dBA for 8 Hours						Permissible Limits LAeq (dBA)	
	LAeq	LA10	LA50	LA90	LA95	LCpeak	National	International
10:00	**59.7**	50.52	46.05	39.93	37.27	116.97	**60**	**70**
11:00	**58.3**	49.06	34.62	28.4	27.83	121.52		
12:00	**55.2**	56.87	47.47	39.7	37.8	104.96		
13:00	**59**	57.38	49	41.11	39.06	105.77		
14:00	**57.9**	52.54	41.9	36.13	34.77	93.7		
15:00	**52.1**	54.52	42.65	35.86	34.17	105.57		
16:00	**51.8**	60.94	53.44	45.95	43.89	104.93		
17:00	**57.4**	58.67	49.75	38.61	36.17	99.24		

The results of ambient noise measurements were compared to the national and international permissible limits.

6. CONCLUSION

Based on the environmental monitoring and measurements, that performed for the ambient air quality. The results showed compliance with all the national and international guidelines.

7. FUTURE RECOMMENDATION

It is recommended that monitoring should continue for all the regulated parameters, in order to verify/assure compliance.

8. REFERENCES

- EU directive 2008 50 EC -ANNEX I Data quality objectives for ambient air quality assessment
- D1357-95 (Reapproved2000) Standard Practice for Planning the Sampling of the Ambient Air
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