



-----ENEMALTA DPS IPPC APPLICATION - FORM C-----

APPENDIX K - Sewer Discharge Permit
APPENDIX L – VOC Abatement System Report
APPENDIX M – Enemalta Noise Monitoring Method Statement
APPENDIX N – DPS Noise Monitoring Reports 2014 & 2015
APPENDIX O – NEC Emission Calculations Letter
APPENDIX P - Technically Competent Person - CV

0466 – Enemalta DPS IPPC Application

***Enemalta plc.
Ing. Fredrick Azzopardi,
Central Administration Offices,
Church Wharf,
Marsa.***

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MARSA AND DELIMARA POWER STATIONS NOISE MONITORING

REPORT AND EVALUATION

YEAR 2014

DR. ENG. ANDREA BATTISTINI

ENG. MARCO ANGELONI

DELIMARA POWER STATION NOISE MONITORING

REPORT AND EVALUATION

YEAR 2015

DR. ENG. ANDREA BATTISTINI

ENG. TIZIANO BARUZZO



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Annex 1 – Detailed Report for environmental measurements

1. INTRODUCTION

Aim of this document is to illustrate the noise monitoring at the Delimara power station and the evaluation of the results according to BS4142.

After the first inspection around the plants, the monitoring points have been chosen, according with Enemalta engineers. The monitored positions have been the four closest location respect to plant, obviously preferring areas near receptors for a correct evaluation. On the side where no receptors (sea side for example) near the plant where noise emission was identified the measurement has been made to check the significance of the noise emission (in this case for the evaluation the complaints should be considered unlikely just because of absence of people). It is however important to check the noise emission to avoid possible unwanted an uncontrolled noise emission to the surrounding area.

Below a brief description of the plants, the monitoring point, the methodology, the report and the final evaluation.

2. BACKGROUND INFORMATION

Enemalta plc to-date is the sole entity responsible for the generation and distribution of electricity in the Maltese islands.

In March 2015 the Maltese islands' electricity grid was connected to Sicily via a submarine interconnector cable. The Malta-Sicily interconnector cable is 120 kilometer long and is capable of transferring 200MW of electricity in a bidirectional flow.

In March 2015 the Marsa Power Station was shut down and put on cold standby pending final decommissioning.

To-date the Delimara Power Station is the only operating power station for the generation of electricity to the Maltese islands. It is located at 35°50'N, 14°33'E near the entrance of the Birzebbugia/Marsaxlokk port area.

Delimara Power Station has a total installed electrical capacity of 454MW.

The generation plant mix is composed of conventional steam units, gas turbine driven plant and a combined cycle diesel engines block.

A basic breakdown is shown in the Table below:

Type of plant	Power Output at MCR (Maximum Continuous Rating)
Steam Units	120MWe
Combined Cycle Gas Turbine Units	110MWe
Open Cycle Gas Turbine Units	75MWe
Combined Cycle Diesel Engine Units	149MWe

British Standard 4142 (BS 4142) contains the commonly accepted method of assessing noise impact from new industrial and commercial developments on existing residential properties. It describes a methodology for determining noise levels and procedures for assessing whether the noise is likely to give rise to complaints from residents.

The Standard was first published in 1967 and has been amended in 1975, 1980, 1982 and 1990 prior to the current version. The Standard is slightly unusual in that it is not based on substantive research, but is based on accumulated experience.

BS 4142 requires the following work to be carried out to rate a noise. The background noise level (LA90) is measured at adjacent noise sensitive properties in the absence of the noise to be assessed. The background noise level is measured at an appropriate time to represent the noise level when the source to be assessed will be operating e.g. if the noise source is 24 hour operation, the background noise levels would be taken to represent the quietest period of the night. The noise from the new source is then assessed at the noise sensitive premises. The specific noise level is predicted (or measured) at the nearest noise sensitive property in terms of LAeq.

A difference of around +10 dB or more indicates that complaints are likely.

A difference of around +5 dB is of marginal significance.

If the rating level is more than 10 dB below the measured background noise level then this is a positive indication that complaints are unlikely.

For a complete analysis the final evaluation has been made on a “Leq basis” and on a “L90 basis”. In fact the L90, for continuous noise emission is less sensitive than the Leq to other non-continuous sources (road emission, people speaking etc..). Some notes have been added too for a better comprehension of the measurement.

3. THE SURROUNDINGS

3.1 DELIMARA POWER STATION AREA



The area around the plant is rural, with few residential buildings. In front of the plant (west beyond the sea) it has been identified a beach area and on the north west the marsaxlokk turistic place(more than 1 kilometer far). Below some images of the area for a better comprehension.



Delimara Power Station Noise Monitoring – Report and Evaluation - Year 2015

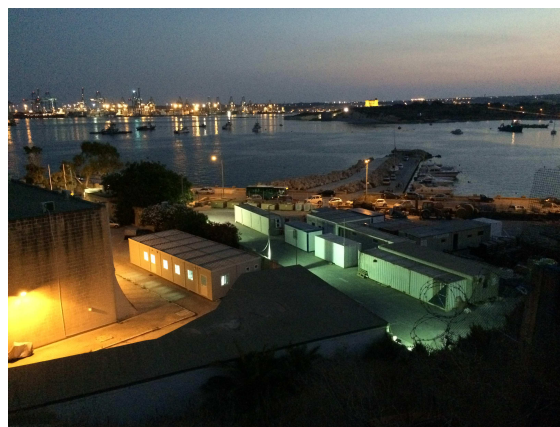


View of the plant from the beach area



View of the plant from the top (on the back the Marsaxlokk area).





View from the north of the plant area (pos C) from the top

4. REPORT

4.1 DELIMARA PLANT MEASUREMENTS POINTS

After the first inspection around the plant, the monitoring points have been chosen. The monitored receptors are the four closest locations in respect to the active turbine identified and indicated in Figures below. On the side where no receptors near the plant were identified, the measurement has been made to check the significance of the noise emission (in this case for the evaluation the complaints are unlikely just because of absence of people). It is however important to check the noise emission to avoid possible unwanted or uncontrolled noise emission.



Figure 1 - Noise monitoring locations at Delimara power station

noise monitoring locations

Pos	EAST	NORTH
Position - A	14°33'26.54"E	35°49'49.97"N
Position - B	14°33'29.30"E	35°50'1.48"N
Position - C	14°33'11.26"E	35°50'7.73"N
Position - D	14°32'44.43"E	35°49'58.77"N

5. ORGANIZATION AND METHODOLOGY STATEMENT

5.1 NOISE MEASUREMENTS DEFINITION

The noise measurements has been carried out using a class 1 sound level meter as specified in the IEC 61672-1:2002 requirements. Measurements has been taken in the locations specified in the next section, in accordance with ISO 1996-2:2007. The sound level meter has been calibrated immediately before and after each series of measurements.

Throughout all measurements the sound level meter will be set to a fast time weighting as this correlates better with the human perception of sound. The standard recommends that both L_{eq} and L_{max} measurements are taken:

- The L_{eq} (Equivalent continuous noise level) refers to is the constant noise level that would result in the same total sound energy being produced over a given period. It can be described by the following algorithm –

$$L_{eq} = 10 \log \left[\frac{1}{t_2 - t_1} \int_{t_1}^{t_2} \frac{p_A^2}{p_0^2} dt \right]$$

Where:

- L_{eq} = equivalent continuous sound pressure level [dB]
- p_0 = reference pressure level = 20 μ Pa
- p_A = acquired sound pressure in Pa
- t_1 = start time for measurement
- t_2 = end time for measurement

The measurements will take into consideration the frequency component of sound spectrum recorded. This will be done in line with ISO 1996-2 recommendations, specifically:

63 Hz, 125 Hz, 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, 8000 Hz.

L_{max} refers to the RMS (root mean squared) maximum level of a noise source. L_{max} will be recorded in parallel with L_{eq} , throughout the time periods that the proposed works will be carried out.

5.2 INSTRUMENT AND CALIBRATION MEASUREMENT

The instrument and measurement systems used have been Larson Davis 831.



Figure 2 - Larson Davis 831

Specifications

Applicable Standards

IEC 61672-1:2002 Class 1

IEC 60651:2001

IEC 60804:2000

ANSI S1.4 with NK:70 Random Incidence Adaptor

1:1 & 1:3 Octave Filters to IEC 61260 Class 1 (where fitted)

- Class 1 Instruments MK:224 pre-polarized Free-field 1/2" Condenser

Random Incidence to ANSI S1.4 with NK:70 Adaptor

Microphone Preamplifier Class 1 Instruments MV:200D Removable Preamplifier

- Time Weightings

'F' (Fast), 'S' (Slow) & 'I' (Impulse) to IEC 61672-1:2002 Class 1 or 2

- Frequency Weighting

Channel 1 'A', 'C' or 'Z'

Channel 2 'C' for Peak

Delimara Power Station Noise Monitoring – Report and Evaluation - Year 2015

Z weighting is a flat frequency response of 8Hz-20kHz ± 1.5 dB excluding microphone response. When either 1:1 or 1:3 Octave Band filters are selected the 'Z' weighting is used.

- Measurement Range (Typical)

Broadband 21 dB(A) to 140 dB(A) Class 1

143 dB(C) Peak (70 to 140 dB Range)

1:1 Octave Band Filters 19 dB(Z) to 140 dB(Z)

1:3 Octave Band Filters 14 dB(Z) to 140 dB(Z)

Noise Floor (Typical) Broadband 18 dB (A) Type 1, 20 dB (A) Type 2

1:1 Octave Band Filters 12 dB(Z) @ 1 kHz 1:1 Octave Band

1:3 Octave Band Filters 7 dB(Z) @ 1 kHz 1:3 Octave Band

Available Measurements

- Broadband Mode

LAeq, LCEq, or LZeq

LCPeak, LAF, LAS, LAI, LCF, LCS, LCI, LZf, LZS or LZI (not stored)

LAFmax, LASmax, LAImax, LCFmax, LCSmax, LCImax, LZfmax, LZSmax or LZImax

LAFmin, LASmin, LAImin, LCFmin, LCSmin, LCImin, LZfmin, LZSmin, LZImin

LAE, LCE, or LZE, LAeq, LCEq, or LZeq, LAFTeq

L0.1 to L99.9 (five simultaneous user-selected values available)

Date and time, 1 second Short Leq Noise Profile (LAeq, LCEq or LZeq)

- Filter Mode

1:1 or 1:3 filter selected

Filtered LZS, LZf or LZI (not stored)

Filtered LZeq (stored), LAeq, LCEq, or LZeq (stored)

- Frequency Bands (Nominal Frequencies)

1:1 Octave Band 31 Hz to 16 kHz

1:3 Octave Band 25 Hz to 16 kHz.

20 Hz & 20 kHz 1:3 Octave Band with MO:800/6 Factory Option

Noise Profile (LAeq, LCEq or LZeq).

ShortLeq (LAeq,LCeq, orLZeq).

Up to 12 days at 1 second acquisition with 2 second factory set option

Selected measurement parameter with level

Time & Frequency Weighting

Elapsed measurement time

Realtime short Leq (broadband mode) Graphical 1:1 and 1:3 Octave Band (recall mode only)

Recalled stored measurements

Measurement Range & Instrument settings

Broadband Mode Typically >24 hours Environmental

External Connections

USB Type B Data Out

Multipin I/O for optional connections

5.3 POSITIONING OF THE INSTRUMENTATION

Once found the monitoring point and the survey period, the operator went to the place identified in the course of the inspections for the installation of the tracking station.

Before starting the measurement was made a calibration of the instrument as required by law.

The microphone was positioned at 1,5 m off the ground. To prevent wind fluting a windshield has always been used. Also steps were taken to check that measured levels exceeded readings on the measuring instrument owing to wind influence by at least 10 dB.

Using a digital camera, photographic documentation has been collected on the workstation set up, taking care take a shot of the instrument and of the surrounding area.

All information collected has been recorded in a summary report on site used for the compilation of the measurement card.



Figure 3 - Larson Davis 831

6. MEASUREMENT REPORT

6.1 PREAMBLE

The phonometric surveys illustrated in this report have been started on 2015-08-04 for two days and two nights.

First of all an inspection around the plant has been made, analyzing the noise level around the plants area. Meanwhile during the inspection the evaluation of the residential building has been made and, evaluating this elements (noise emission and residential building near the plant) the measurement points have been chosen.

Due to the impossibility of switching off the plant (working continuously), the measurements have been made in two different positions:

- the first has always been chosen where the noise of the plant where mostly audible (the instrument could “see” the plant)
- the second (to simulate the residual noise) in acoustic shadow (near the first position but where some “shield” could make the noise plant less audible (or not audible if possible))

Below the measurement positions:

6.2 DELIMARA MONITORING POSITION

Pos	EAST	NORTH
Position - A	14°33'26.54"E	35°49'49.97"N



Figure 4 –Planimetric detection – Delimara monitoring position A



Environmental (left) and Residual (right) measurements point

Pos	EAST	NORTH
Position - B	14°33'29.30"E	35°50'1.48"N



Figure 5 –Planimetric detection – Delimara monitoring position B



Environmental (left) and Residual (right) measurements point

Pos	EAST	NORTH
Position - C	14°33'11.26"E	35°50'7.73"N



Figure 6 –Planimetric detection – Delimara monitoring position C



Environmental (left) and Residual (right) measurements point

Pos	EAST	NORTH
Position - D	14°32'44.43"E	35°49'58.77"N

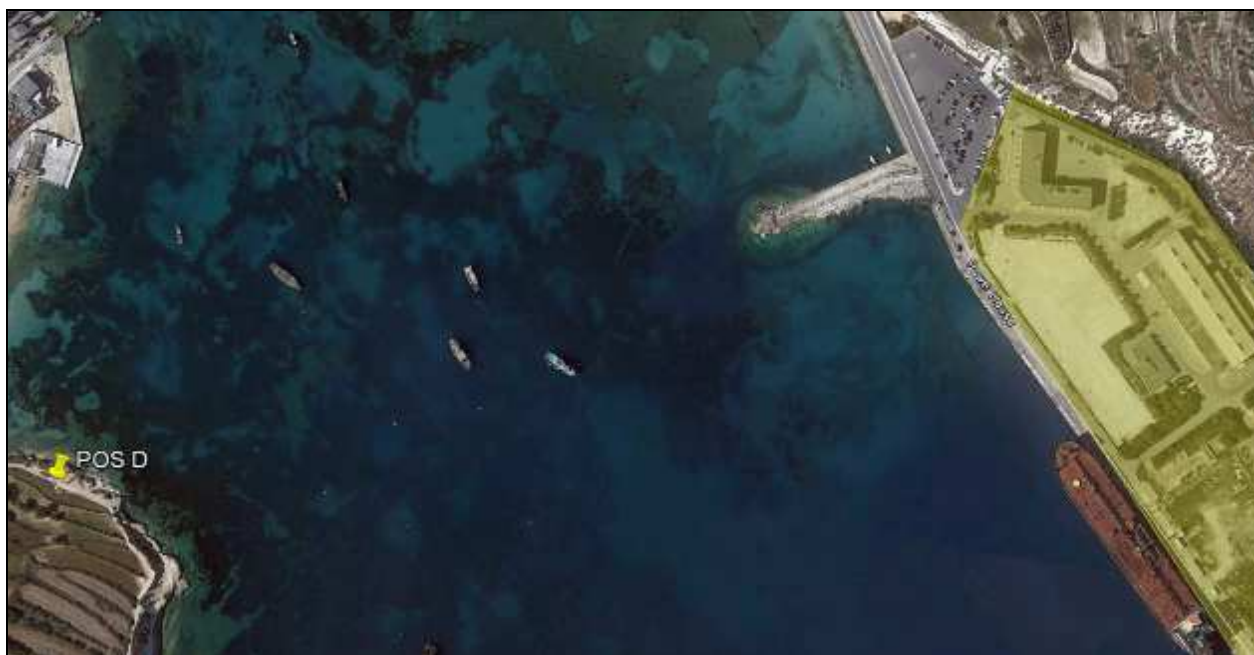
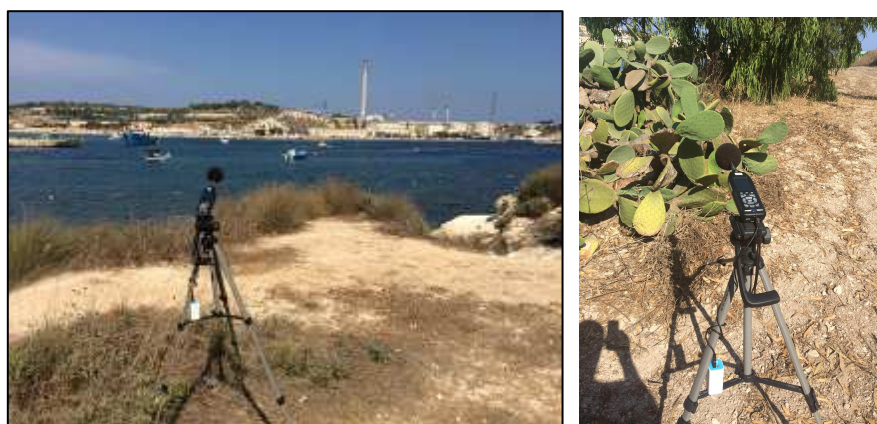


Figure 7 –Planimetric detection – Delimara monitoring position D



Environmental (left) and Residual (right) measurements point

6.3 ENVIRONMENTAL MEASUREMENT RESULTS AT DELIMARA

6.3.1 04-05/08/2015 environmental measurements

Position Date Time	L Min	L Max	L10	L50	L 90	Leq
Pos A 05/08/2015 13:38:00	39,7	61,8	49,7	44,2	41,9	46,6
Pos B 05/08/2015 13:22:36	49,7	76,1	58,6	51,7	50,8	57,0
Pos C 05/08/2015 15:33:31	44,8	66,6	53,5	49,7	47,3	51,1
Pos D 05/08/2015 15:32:39	43,8	66,9	55,0	50,4	47,5	53,1

Table 1 – environmental daytime measurements

Position Date Time	L Min	L Max	L10	L50	L 90	Leq
Pos A 04/08/2015 22:29:34	44,7	60,6	48,4	47,0	45,9	47,7
Pos B 04/08/2015 22:51:57	51,5	63,4	53,3	52,8	52,4	53,0
Pos C 05/08/2015 21:56:52	41,8	54,0	45,3	44,1	43,2	44,4
Pos D 05/08/2015 21:45:22	40,6	56,4	48,8	44,1	42,4	45,7

Table 2 – environmental nighttime measurements

6.4 RESIDUAL MEASUREMENT RESULTS AT DELIMARA

6.4.1 04-05/08/2015 residual measurements

Position Date Time	L Min	L Max	L10	L50	L 90	Leq
Pos A 05/08/2015 14:06:46	32,7	61,7	48,5	42,5	36,2	42,5
Pos B 05/08/2015 13:35:21	35,1	63,5	52,6	43,9	37,8	48,6
Pos C 05/08/2015 15:31:38	38,4	52,1	47,4	43,3	40,4	44,4
Pos D 05/08/2015 15:40:32	36,3	54,7	46,4	40,4	41,5	45,8

Table 4 – residual daytime measurements

Position Date Time	L Min	L Max	L10	L50	L 90	Leq
Pos A 04/08/2015 22:33:13	42,1	58,7	44,3	45,6	39,4	44,3
Pos B 04/08/2015 22:59:21	37,2	49,6	40,3	39,3	38,6	39,6
Pos C 05/08/2015 22:06:43	34,9	44,5	38,3	37,1	36,1	37,3
Pos D 05/08/2015 21:55:41	39,2	54,9	47,1	42,6	38,2	41,1

Table 5 – residual nighttime measurements

7. EVALUATION ACCORDING BS4142

7.1 DELIMARA POWER STATION

In the table below the analysis, based both on Leq and L90 index. The L90 should be considered were (in case of continuous noise) the measurement could be influenced from short events not correlated to the plant emission noise.

Position Date Time (daytime)	L 90 Env.	L 90 Res.	Delta L90	Leq Env.	Leq Res.	Delta Leq
Pos A	41,9	36,2	+5,7	46,6	42,5	+4,1
Pos B	50,8	37,8	+13,0	57,0	48,6	+8,4
Pos C	47,3	40,4	+6,9	51,1	44,4	+6,7
Pos D	47,5	41,5	+6,0	53,1	45,8	+7,3

Position Date Time (nighttime)	L 90 Env.	L 90 Res.	Delta L90	Leq Env.	Leq Res.	Delta Leq
Pos A	45,9	39,4	+6,5	47,7	44,3	+3,4
Pos B	52,4	38,6	+13,8	53,0	39,6	+13,4
Pos C	43,2	36,1	+7,1	44,4	37,3	+7,1
Pos D	42,4	38,2	+4,2	45,7	41,1	+4,6

In the table below the analysis, based both on Leq and L90 index. The L90 should be considered were (in case of continuous noise) the measurement could be influenced from short events not correlated to the plant emission noise.

Delimara Power Station Noise Monitoring – Report and Evaluation - Year 2015

In annex 1 for each position, a detailed report with planimetric and photographic individuation, noise time history and cumulative curve for the environmental measurement in daytime and nighttime can be found as in the example below.



Example of environmental report in annex 1

Delimara Power Station Noise Monitoring – Report and Evaluation - Year 2015

7.1 DELIMARA POWER STATION

Position Date Time (daytime)	L 90 Env.	L 90 Res.	Delta L90	Leq Env.	Leq Res.	Delta Leq
Pos A	41,9	36,2	+5,7	46,6	42,5	+4,1
Pos B	50,8	37,8	+13,0	57,0	48,6	+8,4
Pos C	47,3	40,4	+6,9	51,1	44,4	+6,7
Pos D	47,5	41,5	+6,0	53,1	45,8	+7,3

Position Date Time (nighttime)	L 90 Env.	L 90 Res.	Delta L90	Leq Env.	Leq Res.	Delta Leq
Pos A	45,9	39,4	+6,5	47,7	44,3	+3,4
Pos B	52,4	38,6	+13,8	53,0	39,6	+13,4
Pos C	43,2	36,1	+7,1	44,4	37,3	+7,1
Pos D	42,4	38,2	+4,2	45,7	41,1	+4,6

7.1 DELIMARA POWER STATION EVALUATION

Position Date Time daytime	Delta L90	impact	Delta Leq	
Pos A	+5,7	Marginal significance	+4,1	Minor significance
Pos B	+13,0	Complaints are likely	+8,4	Marginal significance
Pos C	+6,9	Marginal significance	+6,7	Marginal significance
Pos D	+6,0	Marginal significance	+7,3	Marginal significance

Position Date Time night	Delta L90		Delta Leq	
Pos A	+6,5	Marginal significance	+3,4	Minor significance
Pos B	+13,8	Complaints are likely	+13,4	Complaints are likely
Pos C	+7,1	Marginal significance	+7,1	Marginal significance
Pos D	+4,2	Minor significance	+4,6	Minor significance

8. CONCLUSION

Aim of this document has been to illustrate the 2015 noise monitoring at the Delimara power stations and the evaluation of the results according to BS4142 .

After the first inspection around the plants, the same monitoring points of year 2014 have been chosen, according with Enemalta engineers. So the monitored positions are the four closest location respect to plant, where during inspection audible noise emission were identified, and (as possible) preferring areas near receptors for a correct evaluation. On the side where no receptors (sea side for example) near the plant where noise emission was identified the measurement has been made to check the significance of the noise emission (in this case for the evaluation the complaints should be considered unlikely just because of absence of people). It is however important to check the noise emission to avoid possible unwanted an uncontrolled noise emission to the surrounding area.

A brief description of the plants, the monitoring points, the methodology, the report and the final evaluation can be found inside the document.

At Delimara in POS B has been found that complaints are likely.

Further to BS4142 , it is important to underline that the measurements levels have always been low under 60 dB(A).

Annex 1 – Detailed Report for environmental measurements

(time history and cumulative curve)

Planimetric and photographic individuation



Noise measurement

Monitoring point : Delimara Plant - pos A - noise level daytime

Data : 05/08/2015
Time : 13:38:00
Duration time: 60 min

Instrument : Larson Davis 831
Serial: 3102

Weather : Clean Sky

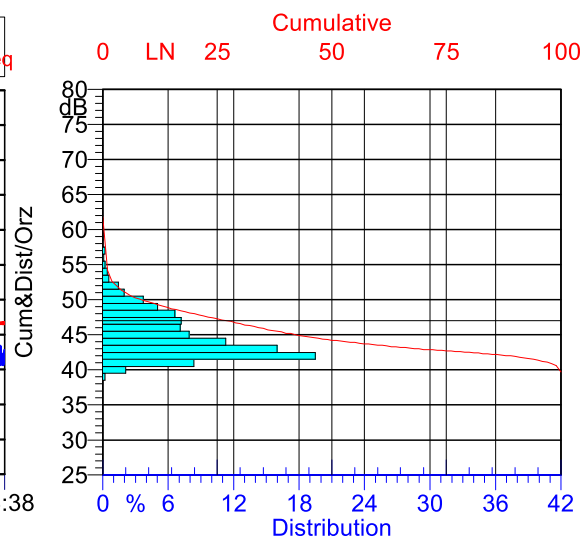
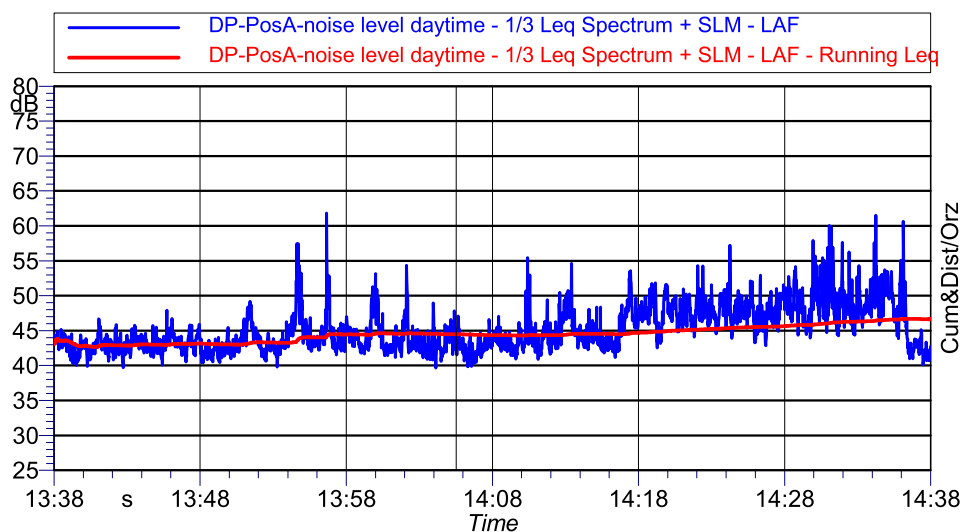
Values:

Const. time (Time History): Fast
LMin: 39.7 dB(A)
LMax: 61.8 dB(A)

LeqA : 46.6 dB(A)

Statistic Index:

L10: 49.7 dB(A)
L50: 44.2 dB(A)
L90: 41.9 dB(A)



Notes : Plant in normal working condition. Daytime

The sound level measurements and numerical calculations have been carried out in the following Technical Acoustics Environment:

Eng. Andrea BATTISTINI
Eng. Tiziano BARUZZO

Planimetric and photographic individuation



Noise measurement

Monitoring point : Delimara Plant - pos A - noise level nighttime

Data : 04/08/2015
Time : 22:29:34
Duration time: 60 min

Instrument : Larson Davis 831
Serial: 3102

Weather : Clean Sky

Values:

Const. time (Time History): Fast

LMin: 44.7 dB(A)

LMax: 60.6 dB(A)

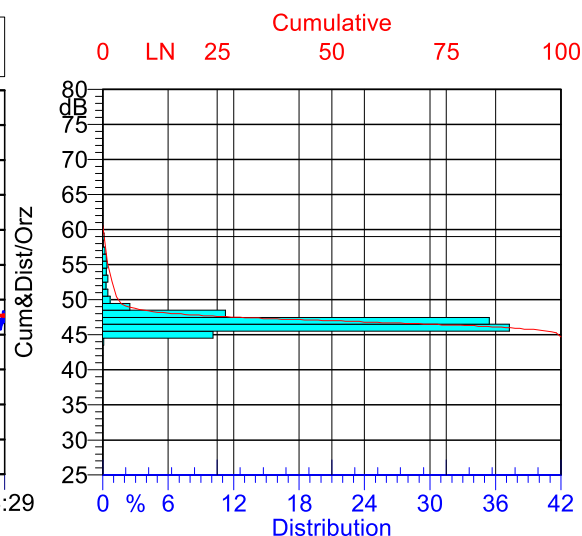
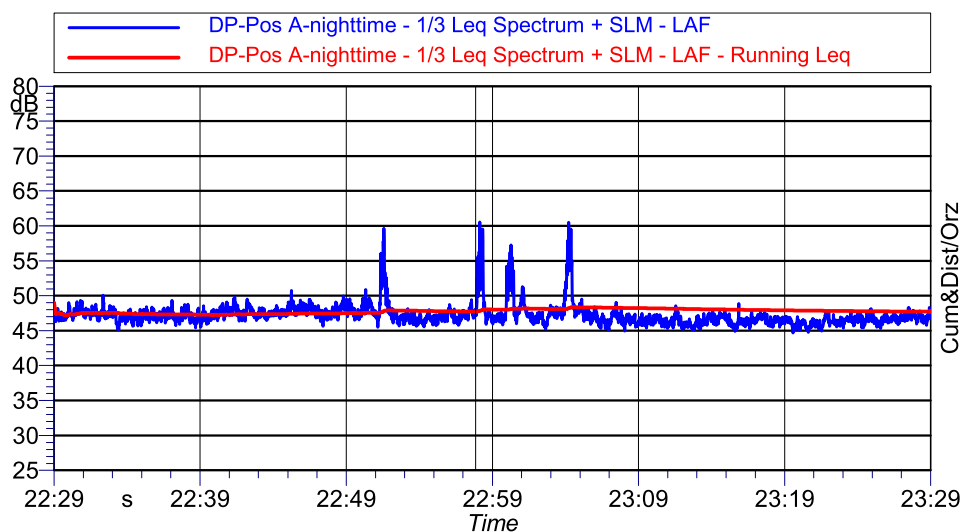
LeqA : 47.7 dB(A)

Statistic Index:

L10: 48.4 dB(A)

L50: 47.0 dB(A)

L90: 45.9 dB(A)

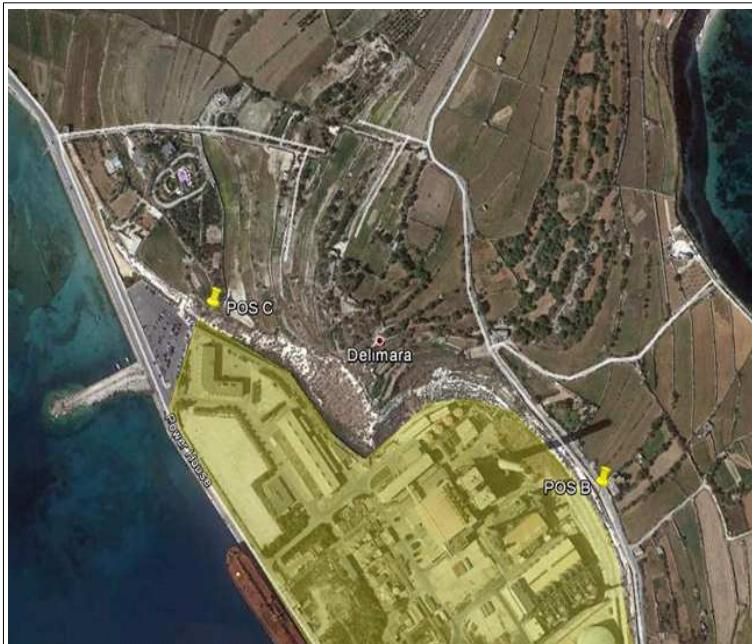


Notes : Plant in normal working condition. Nighttime

The sound level measurements and numerical calculations have been carried out in the following Technical Acoustics Environment:

Eng. Marco ANGELONI
Eng. Andrea BATTISTINI

Planimetric and photographic individuation



Noise measurement

Monitoring point : Delimara Plant - pos B - noise level daytime

Data : 05/08/2015
Time : 13:22:36
Duration time: 60 min

Instrument : Larson Davis 831
Serial: 2490

Weather : Clean Sky

Values:

Const. time (Time History): Fast

LMin: 49.7 dB(A)

LMax: 76.1 dB(A)

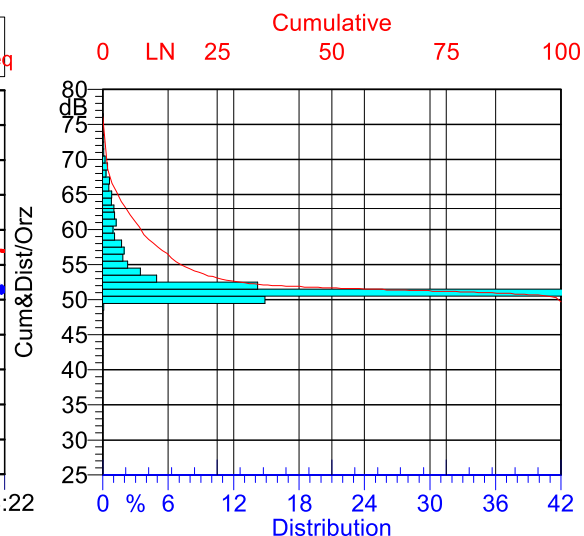
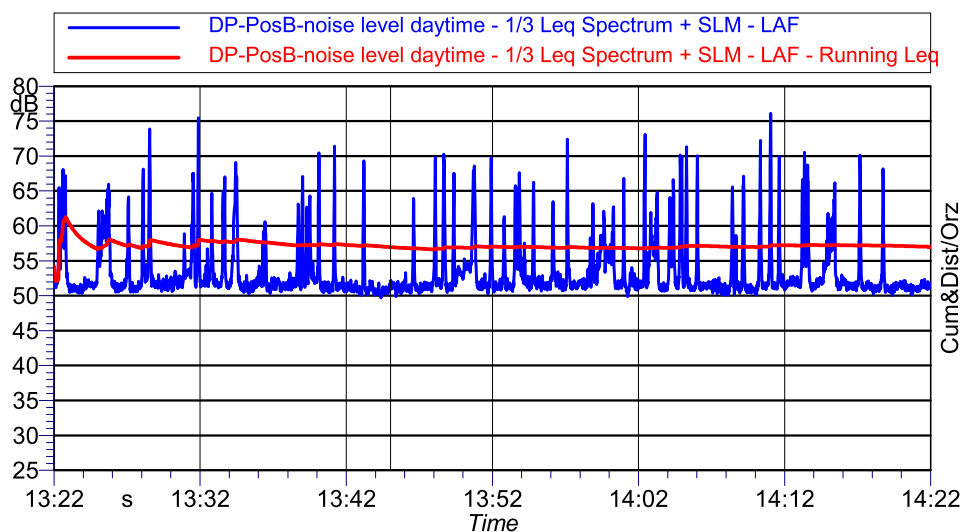
LeqA : 57.0 dB(A)

Statistic Index:

L10: 58.6 dB(A)

L50: 51.7 dB(A)

L90: 50.8 dB(A)



Notes : Plant in normal working condition. Daytime

The sound level measurements and numerical calculations have been carried out in the following Technical Acoustics Environment:

Eng. Marco ANGELONI
Eng. Andrea BATTISTINI

Planimetric and photographic individuation



Noise measurement

Monitoring point : Delimara Plant - pos B - noise level nighttime

Data : 04/08/2015
Time : 22:51:57
Duration time: 60 min

Instrument : Larson Davis 831
Serial: 2490

Weather : Clean Sky

Values:

Const. time (Time History): Fast

LMin: 51.5 dB(A)

LMax: 63.4 dB(A)

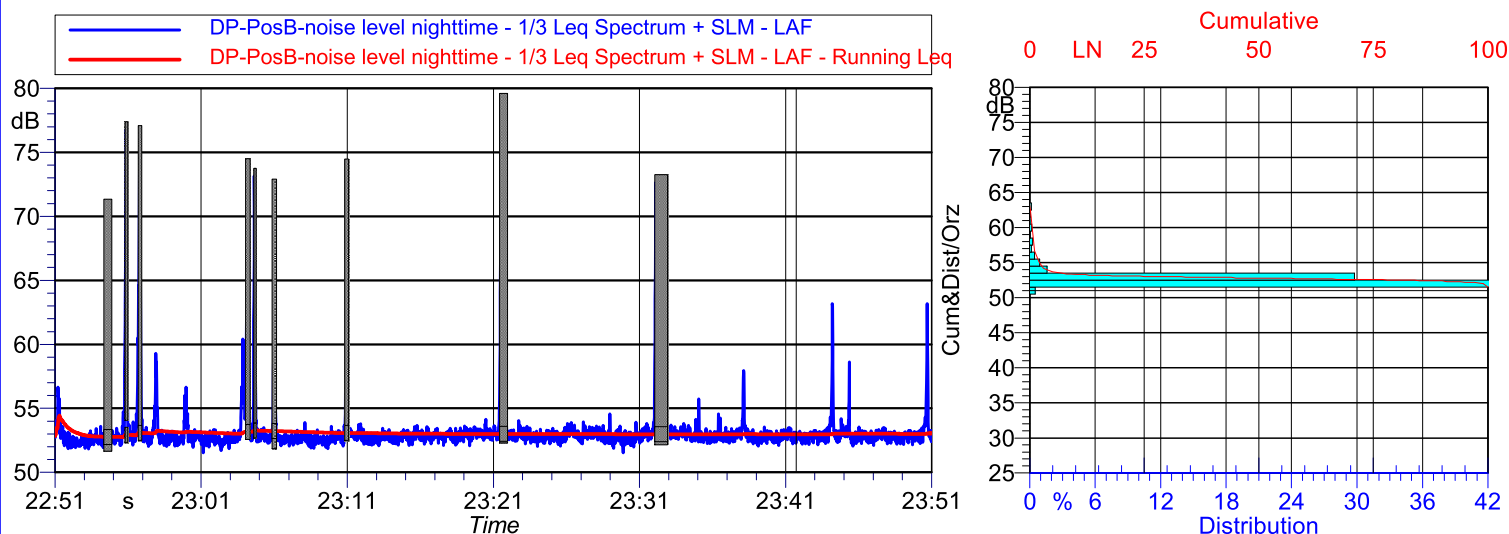
LeqA : 53.0 dB(A)

Statistic Index:

L10: 53.3 dB(A)

L50: 52.8 dB(A)

L90: 52.4 dB(A)

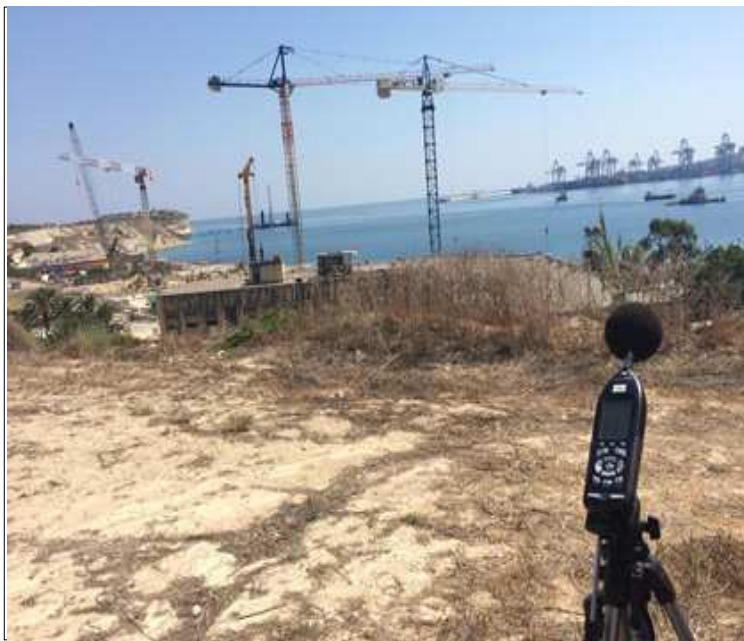


Notes : Plant in normal working condition. Nighttime

The sound level measurements and numerical calculations have been carried out in the following Technical Acoustics Environment:

Eng. Marco ANGELONI
Eng. Andrea BATTISTINI

Planimetric and photographic individuation



Noise measurement

Monitoring point : Delimara Plant - pos C - noise level daytime

Data : 05/08/2015
Time : 15:33:31
Duration time: 60 min

Instrument : Larson Davis 831
Serial: 3102

Weather : Clean Sky

Values:

Const. time (Time History): Fast

LMin: 44.8 dB(A)

LMax: 66.6 dB(A)

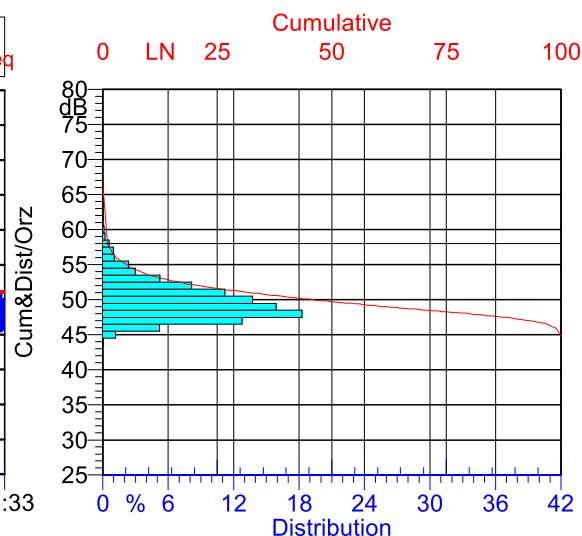
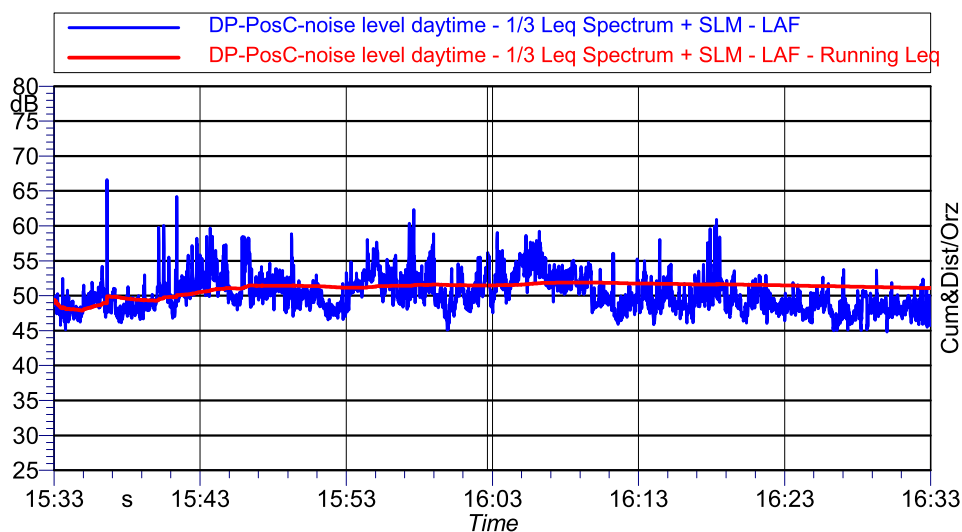
LeqA : 51.1 dB(A)

Statistic Index:

L10: 53.5 dB(A)

L50: 49.7 dB(A)

L90: 47.3 dB(A)

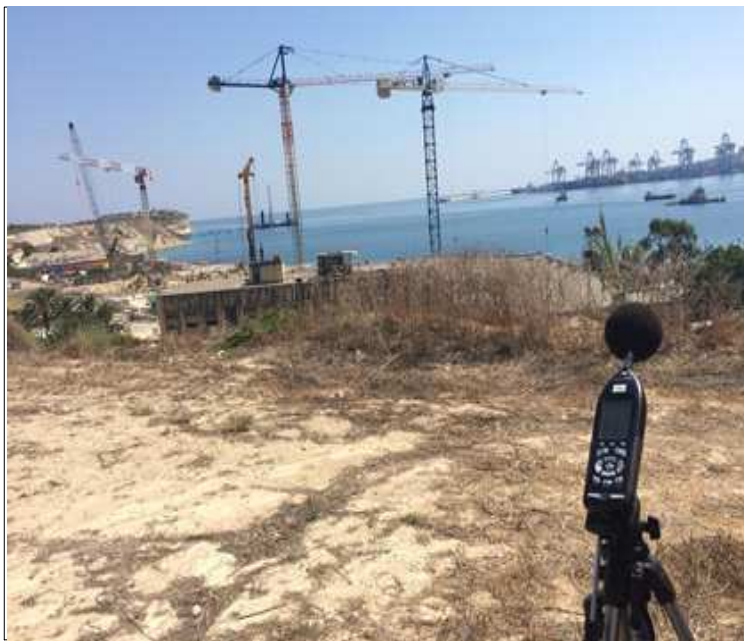


Notes : Plant in normal working condition. Daytime

The sound level measurements and numerical calculations have been carried out in the following Technical Acoustics Environment:

Eng. Marco ANGELONI
Eng. Andrea BATTISTINI

Planimetric and photographic individuation



Noise measurement

Monitoring point : Delimara Plant - pos C - noise level nighttime

Data : 05/08/2015
Time : 21:56:52
Duration time: 60 min

Instrument : Larson Davis 831
Serial: 3102

Weather : Clean Sky

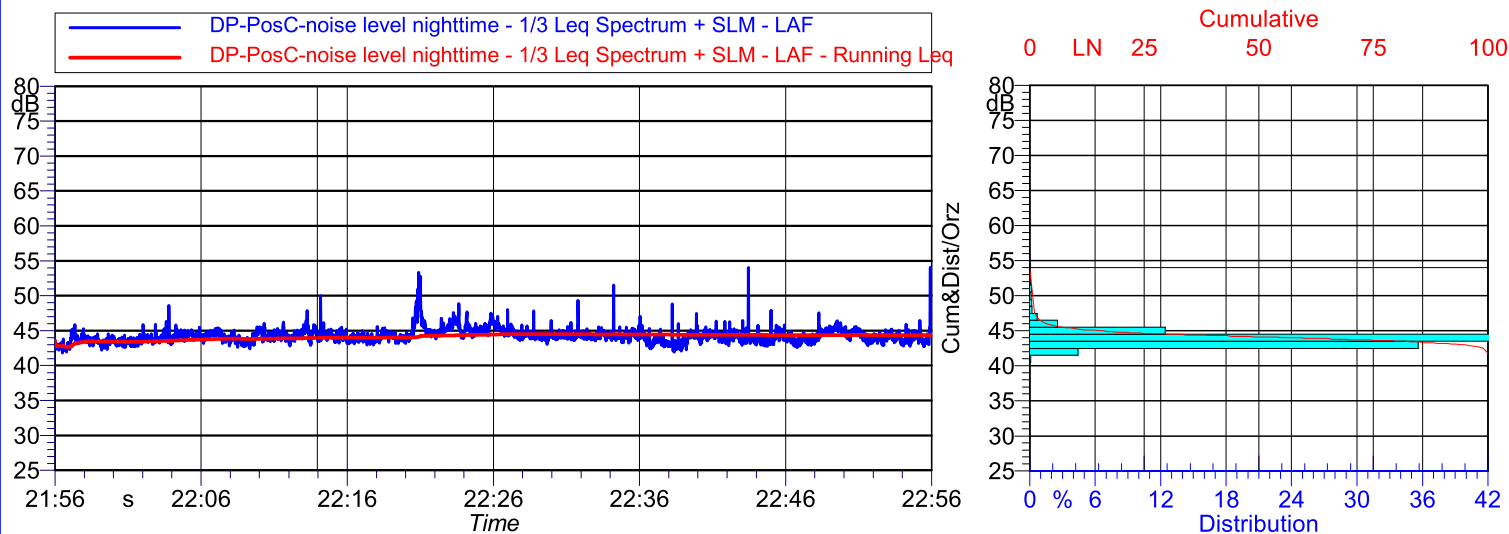
Values:

Const. time (Time History): Fast
LMin: 41.8 dB(A)
LMax: 54.0 dB(A)

LeqA : 44.4 dB(A)

Statistic Index:

L10: 45.3 dB(A)
L50: 44.1 dB(A)
L90: 43.2 dB(A)



Notes : Plant in normal working condition. Nighttime

The sound level measurements and numerical calculations have been carried out in the following Technical Acoustics Environment:

Eng. Marco ANGELONI
Eng. Andrea BATTISTINI

Planimetric and photographic individuation



Noise measurement

Monitoring point : Delimara Plant - pos D - noise level daytime

Data : 05/08/2015
Time : 15:32:39
Duration time: 60 min

Instrument : Larson Davis 831
Serial: 2490

Weather : Clean Sky

Values:

Const. time (Time History): Fast

LMin: 43.8 dB(A)

LMax: 66.9 dB(A)

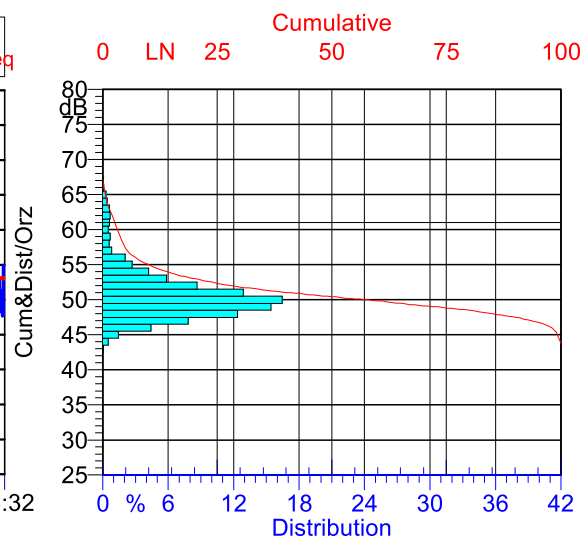
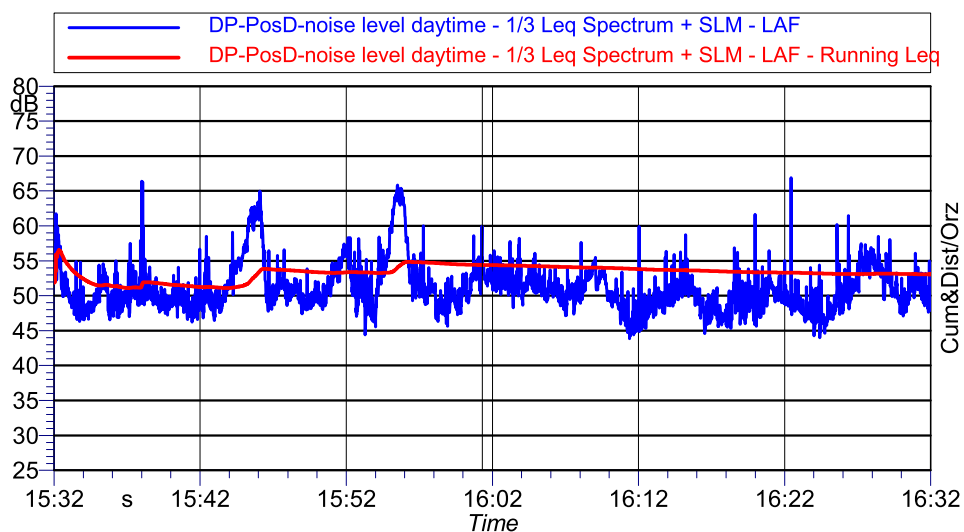
LeqA : 53.1 dB(A)

Statistic Index:

L10: 55.0 dB(A)

L50: 50.4 dB(A)

L90: 47.5 dB(A)



Notes : Plant in normal working condition. Daytime

The sound level measurements and numerical calculations have been carried out in the following Technical Acoustics Environment:

Eng. Marco ANGELONI
Eng. Andrea BATTISTINI

Planimetric and photographic individuation



Noise measurement

Monitoring point : Delimara Plant - pos D - noise level nighttime

Data : 05/08/2015
Time : 21:45:22
Duration time: 60 min

Instrument : Larson Davis 831
Serial: 2490

Weather : Clean Sky

Values:

Const. time (Time History): Fast

LMin: 40.6 dB(A)

LMax: 56.4 dB(A)

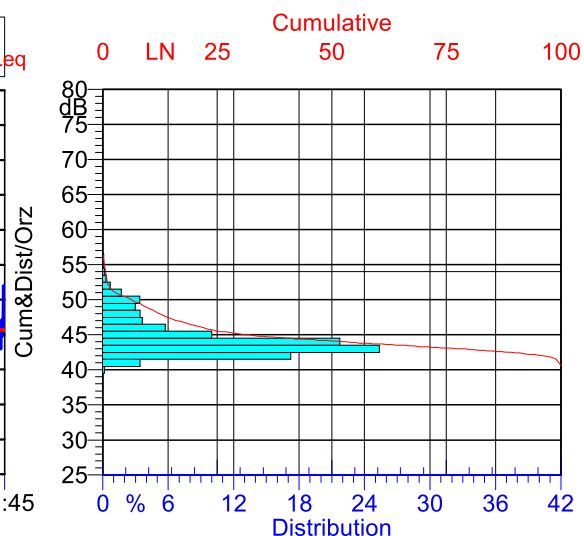
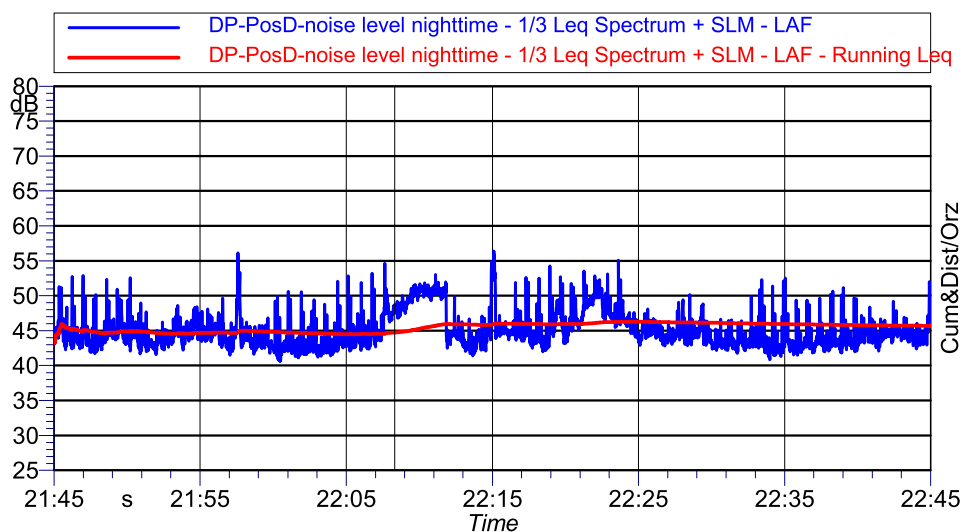
LeqA : 45.7 dB(A)

Statistic Index:

L10: 48.8 dB(A)

L50: 44.1 dB(A)

L90: 42.4 dB(A)



Notes : Plant in normal working condition. Nighttime

The sound level measurements and numerical calculations have been carried out in the following Technical Acoustics Environment:

Eng. Marco ANGELONI
Eng. Andrea BATTISTINI

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Annex 1 – Detailed Report for environmental measurements

1. INTRODUCTION

Aim of this document is to illustrate the noise monitoring at the Delimara and Marsa power stations and the evaluation of the results according to BS4142.

After the first inspection around the plants, the monitoring points have been chosen, according with Enemalta engineers. The monitored positions have been the four closest location respect to plant, obviously preferring areas near receptors for a correct evaluation. On the side where no receptors (sea side for example) near the plant where noise emission was identified the measurement has been made to check the significance of the noise emission (in this case for the evaluation the complaints should be considered unlikely just because of absence of people). It is however important to check the noise emission to avoid possible unwanted an uncontrolled noise emission to the surrounding area.

Below a brief description of the plants, the monitoring point, the methodology, the report and the final evaluation.

2. BACKGROUND INFORMATION

Enemalta Corporation is the state-owned energy utility responsible for providing electricity to the Maltese islands. At present, the Maltese electrical system is a small isolated one. The Enemalta generation installations consist of 2 power stations for the production and distribution of electricity owned and operated by Enemalta Corporation at Marsa (35°52'N, 14°29'E) and Delimara (35°50'N, 14°33'E), and which are located 7.5 km apart in central and south-east Malta respectively. The two power stations have a total installed electrical capacity of 720 MW and a distribution network across the whole Maltese islands. The generation plant mix is composed of conventional steam units gas turbine driven plant and a new combined cycle diesel engines block which went into operation last December 2012. A basic breakdown is shown in Table below.

Type of plant	Power output at MCR (Maximum Continuous Rating)
Steam units	350 MWe
Combined Cycle Gas Turbine Units	110 MWe
Open Cycle Gas Turbine Units	111 MWe
Combined Cycle Diesel Engine Units	149 Mwe

British Standard 4142 (BS 4142) contains the commonly accepted method of assessing noise impact from new industrial and commercial developments on existing residential properties. It describes a methodology for determining noise levels and procedures for assessing whether the noise is likely to give rise to complaints from residents.

The Standard was first published in 1967 and has been amended in 1975, 1980, 1982 and 1990 prior to the current version. The Standard is slightly unusual in that it is not based on substantive research, but is based on accumulated experience.

BS 4142 requires the following work to be carried out to rate a noise. The background noise level (LA90) is measured at adjacent noise sensitive properties in the absence of the noise to be assessed. The background noise level is measured at an appropriate time to represent the noise level when the source to be assessed will be operating e.g. if the noise source is 24 hour operation, the background noise levels would be taken to represent the quietest period of the night. The noise from the new source is then assessed at the noise sensitive premises. The specific noise level is predicted (or measured) at the nearest noise sensitive property in terms of LAeq.

A difference of around +10 dB or more indicates that complaints are likely.

A difference of around +5 dB is of marginal significance.

If the rating level is more than 10 dB below the measured background noise level then this is a positive indication that complaints are unlikely.

For a complete analysis the final evaluation has been made on a “Leq basis” and on a “L90 basis”. In fact the L90, for continuous noise emission is less sensitive than the Leq to other non-continuous sources (road emission, people speaking etc..). Some notes have been added too for a better comprehension of the measurement.

3. THE SURROUNDINGS

3.1 DELIMARA POWER STATION AREA



The area around the plant is rural, with few residential buildings. In front of the plant (west beyond the sea) it has been identified a beach area and on the north west the marsaxlokk turistic place(more than 1 kilometer far). Below some images of the area for a better comprehension.



View of the plant fom the beach area



View of the plant from the top (on the back the Marsaxlokk area).

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View from the north of the plant area (pos 3) from the top

3.1 MARSALA POWER STATION AREA

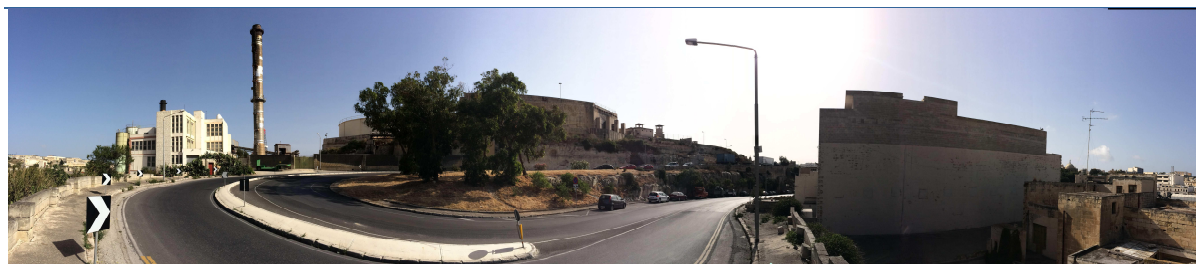


The area around the plant is a retro portual area, with presence of commercial and industrial building, with residential buildings on the north and west side. The conformation of the area is hilly and in the first inspection the monitoring inspection points have been decided, analysing the areas with residential building and the maximum emission sources (in some case also with no residential building due to the typical destination of use of a retro portual area). Below some images of the area for a better comprehension.

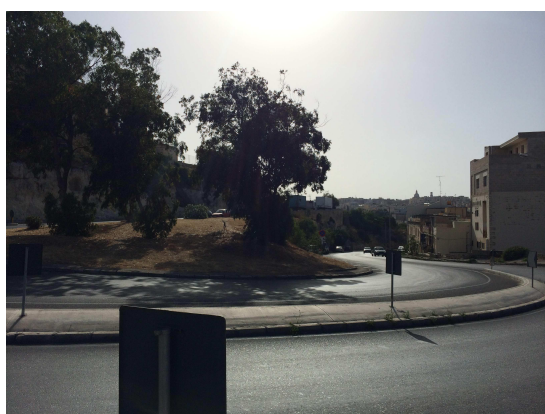


Receptors (left) and plant area from pos 1

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View of the plant area from the top (pos 2)



View of the building behind pos 2



Receptors at pos 3 (on the back of left image the plant)

4. REPORT

4.1 DELIMARA PLANT MEASUREMENTS POINTS

After the first inspection around the plant, the monitoring points have been chosen. The monitored receptors are the four closest locations respect to the active turbine identified and indicated in Figures below. On the side where no receptors near the plant were identified the measurement has been made to check the significance of the noise emission (in this case for the evaluation the complaints are unlikely just because of absence of people). It is however important to check the noise emission to avoid possible unwanted and uncontrolled noise emission.



Figure 1- Noise monitoring locations at Delimara power station

noise monitoring locations at Delimara :

Pos	EAST	NORTH
Position - A	14°33'26.54"E	35°49'49.97"N
Position - B	14°33'29.30"E	35°50'1.48"N
Position - C	14°33'11.26"E	35°50'7.73"N
Position - D	14°32'44.43"E	35°49'58.77"N

4.1 MARSALA PLANT MEASUREMENTS POINTS

After the first inspection around the plant, the monitoring points have been chosen. The monitored receptors are the four closest locations respect to the active turbine identified and indicated in Figures below. On the side where no receptors near the plant were identified the measurement has been made to check the significance of the noise emission (in this case for the evaluation the complaints are unlikely just because of absence of people). It is however important to check the noise emission to avoid possible unwanted and uncontrolled noise emission.

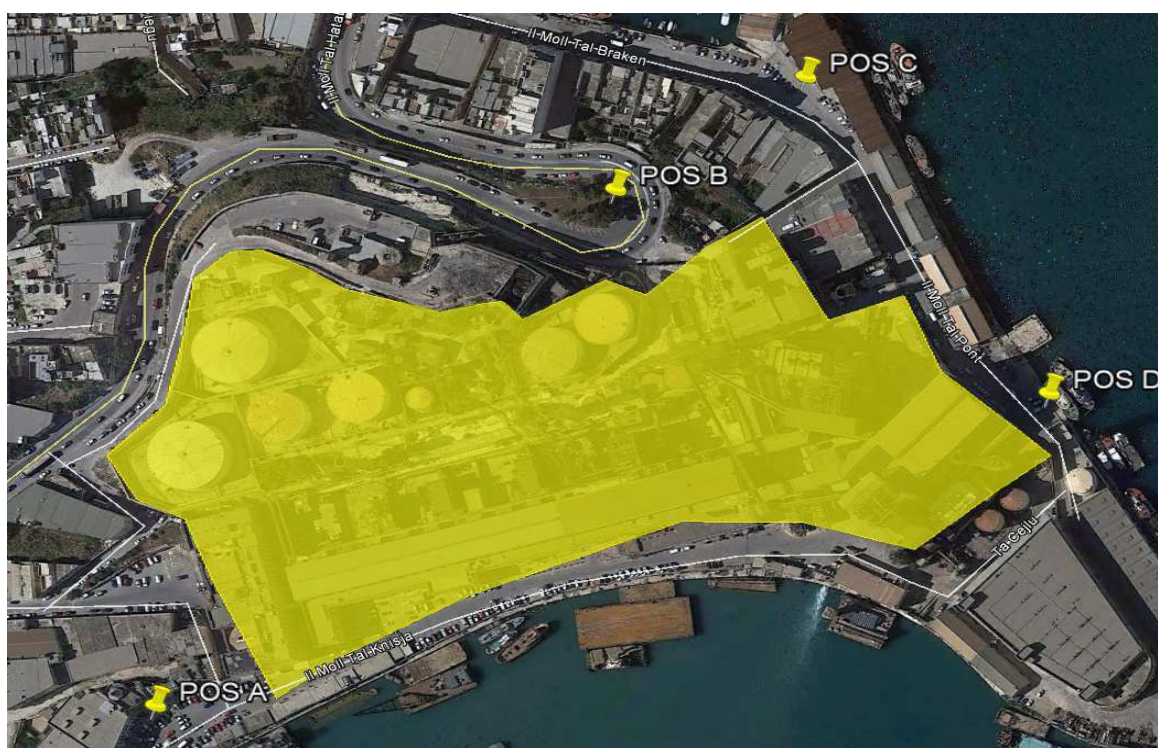


Figure 2- noise monitoring locations at Marsa power station

noise monitoring locations at Marsa :

Pos	EAST	NORTH
Position - A	14°29'47.05"E	35°52'50.67"N
Position - B	14°29'54.95"E	35°52'58.79"N
Position - C	14°29'58.23"E	35°53'0.61"N
Position - D	14°30'2.41"E	35°52'55.60"N

5. ORGANIZATION AND METHODOLOGY STATEMENT

5.1 NOISE MEASUREMENTS DEFINITION

The noise measurements has been carried out using a class 1 sound level meter as specified in the IEC 61672-1:2002 requirements. Measurements has been taken in the locations specified in the next section, in accordance with ISO 1996-2:2007. The sound level meter has been calibrated immediately before and after each series of measurements.

Throughout all measurements the sound level meter will be set to a fast time weighting as this correlates better with the human perception of sound. The standard recommends that both L_{eq} and L_{max} measurements are taken:

- The L_{eq} (Equivalent continuous noise level) refers to is the constant noise level that would result in the same total sound energy being produced over a given period. It can be described by the following algorithm –

$$L_{eq} = 10 \log \left[\frac{1}{t_2 - t_1} \int_{t_1}^{t_2} \frac{p_A^2}{p_0^2} dt \right]$$

Where:

- L_{eq} = equivalent continuous sound pressure level [dB]
- p_0 = reference pressure level = 20 μ Pa
- p_A = acquired sound pressure in Pa
- t_1 = start time for measurement
- t_2 = end time for measurement

The measurements will take into consideration the frequency component of sound spectrum recorded. This will be done in line with ISO 1996-2 recommendations, specifically:

63 Hz, 125 Hz, 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, 8000 Hz.

L_{max} refers to the RMS (root mean squared) maximum level of a noise source. L_{max} will be recorded in parallel with L_{eq} , throughout the time periods that the proposed works will be carried out.

5.2 INSTRUMENT AND CALIBRATION MEASUREMENT

The instrument and measurement systems used are 2 Larson Davis 831 and 2 Quest VI pro.



Figure 3 Larson Davis 831



Figure 4 Quest VI Pro

Specifications

Applicable Standards

IEC 61672-1:2002 Class 1

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IEC 60651:2001

IEC 60804:2000

ANSI S1.4 with NK:70 Random Incidence Adaptor

1:1 & 1:3 Octave Filters to IEC 61260 Class 1 (where fitted)

- Class 1 Instruments MK:224 pre-polarized Free-field 1/2" Condenser

Random Incidence to ANSI S1.4 with NK:70 Adaptor

Microphone Preamplifier Class 1 Instruments MV:200 D Removable Preamplifier

- Time Weightings

'F' (Fast), 'S' (Slow) & 'I' (Impulse) to IEC 61672-1:2002 Class 1 or 2

- Frequency Weighting

Channel 1 'A', 'C' or 'Z'

Channel 2 'C' for Peak

Z weighting is a flat frequency response of 8 Hz-20 kHz ± 1.5 dB excluding microphone response. When either 1:1 or 1:3 Octave Band filters are selected the 'Z' weighting is used.

- Measurement Range (Typical)

Broadband 21 dB(A) to 140 dB(A) Class 1

143 dB(C) Peak (70 to 140 dB Range)

1:1 Octave Band Filters 19 dB(Z) to 140 dB(Z)

1:3 Octave Band Filters 14 dB(Z) to 140 dB(Z)

Noise Floor (Typical) Broadband 18 dB (A) Type 1, 20 dB (A) Type 2

1:1 Octave Band Filters 12 dB(Z) @ 1 kHz 1:1 Octave Band

1:3 Octave Band Filters 7 dB(Z) @ 1 kHz 1:3 Octave Band

Available Measurements

- Broadband Mode

LAeq, LCEq, or LZeq

LCPeak, LAF, LAS, LAI, LCF, LCS, LCI, LZf, LZS or LZI (not stored)

LAFmax, LASmax, LAImax, LCFmax, LCSmax, LCImax, LZfmax, LZSmax or LZImax

LAFmin, LASmin, LAImin, LCFmin, LCSmin, LCImin, LZfmin, LZSmin, LZImin

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LAE, LCE, or LZE, LAeq, LCeq, or LZeq, LAFTeq

L0.1 to L99.9 (five simultaneous user-selected values available)

Date and time, 1 second Short Leq Noise Profile (LAeq, LCeq or LZeq)

- Filter Mode

1:1 or 1:3 filters selected

Filtered LZS, LZF or LZI (not stored)

Filtered LZeq (stored), LAeq, LCeq, or LZeq (stored)

- Frequency Bands (Nominal Frequencies)

1:1 Octave Band 31 Hz to 16 kHz

1:3 Octave Band 25 Hz to 16 kHz.

20 Hz & 20 kHz 1:3 Octave Band with MO:800/6 Factory Option

Noise Profile (LAeq, LCeq or LZeq).

Short Leq (LAeq, LCeq, or LZeq).

Up to 12 days at 1 second acquisition with 2 second factory set option

Selected measurement parameter with level

Time & Frequency Weighting

Elapsed measurement time

Realtime short Leq (broadband mode) Graphical 1:1 and 1:3 Octave Band (recall mode only)

Recalled stored measurements

Measurement Range & Instrument settings

Broadband Mode Typically >24 hours Environmental

External Connections

USB Type B Data Out

Multipin I/O for optional connections

5.3 POSITIONING OF THE INSTRUMENTATION

Once found the monitoring point and the survey period, the operator went to the place identified in the course of the inspections for the installation of the tracking station.

Before starting the measurement was made a calibration of the instrument as required by law.

The microphone was positioned at 1,5 m off the ground. To prevent wind fluting a windshield has always been used. Also steps were taken to check that measured levels exceeded readings on the measuring instrument owing to wind influence by at least 10 dB.

Using a digital camera, photographic documentation has been collected on the workstation set up, taking care take a shot of the instrument and of the surrounding area.

All information collected has been recorded in a summary report on site used for the compilation of the measurement card.



Figure 5- Larson Davis 831 (right picture) and Quest VI pro

6. MEASUREMENT REPORT

6.1 PREAMBLE

The phonometric surveys illustrated in this report have been started on 2014-05-20 for two days and two nights.

First of all an inspection around the plant has been made, analysing the noise level around the plants area. Meanwhile during the inspection the evaluation of the residential building has been made and, evaluating this elements (noise emission and residential building near the plant) the measurement points have been chosen.

Due to the impossibility of switching off the plant (working continuously) , the measurements have been made in two different positions:

- the first has always been chosen where the noise of the plant where mostly audible (the instrument could “see” the plant)
- the second (to simulate the residual noise) in acoustic shadow (near the first position but where some “shield” could make the noise plant less audible (or not audible if possible)

Below the measurement positions:

6.2 DELIMARA MONITORING POSITION

Pos	EAST	NORTH
Position - A	14°33'26.54"E	35°49'49.97"N



Figure 6 –Planimetric detection – Delimara monitoring position A



Environmental (left) and Residual (right) measurements point

Pos	EAST	NORTH
Position - B	14°33'29.30"E	35°50'1.48"N

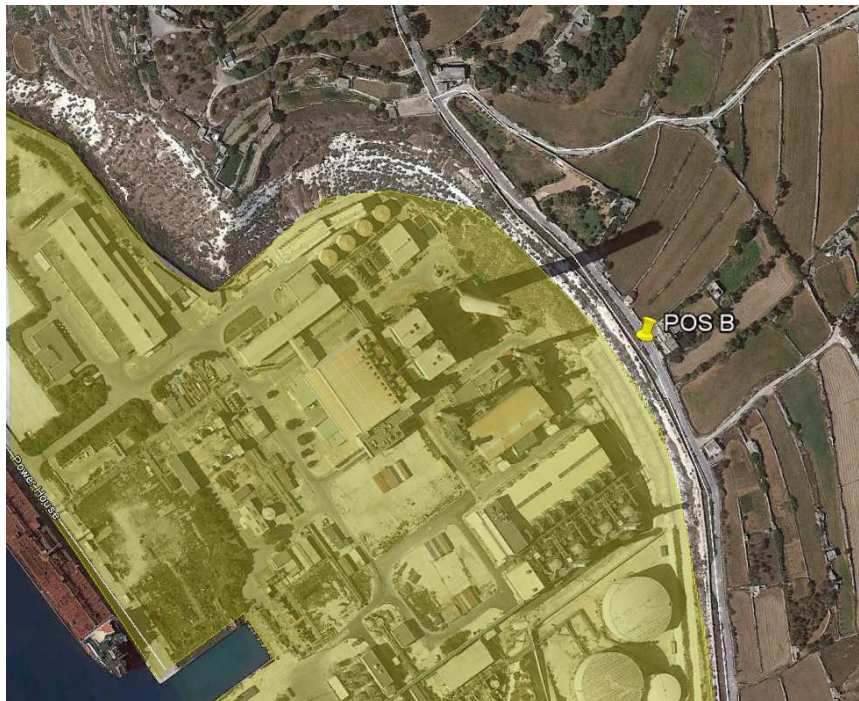


Figure 7 –Planimetric detection – Delimara monitoring position B



Environmental (left) and Residual (right) measurements point

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Pos	EAST	NORTH
Position - C	14°33'11.26"E	35°50'7.73"N



Figure 8 –Planimetric detection – Delimara monitoring position C



Environmental measurement point- (Residual acoustic shadow behind the wall)

Pos	EAST	NORTH
Position - D	14°32'44.43"E	35°49'58.77"N

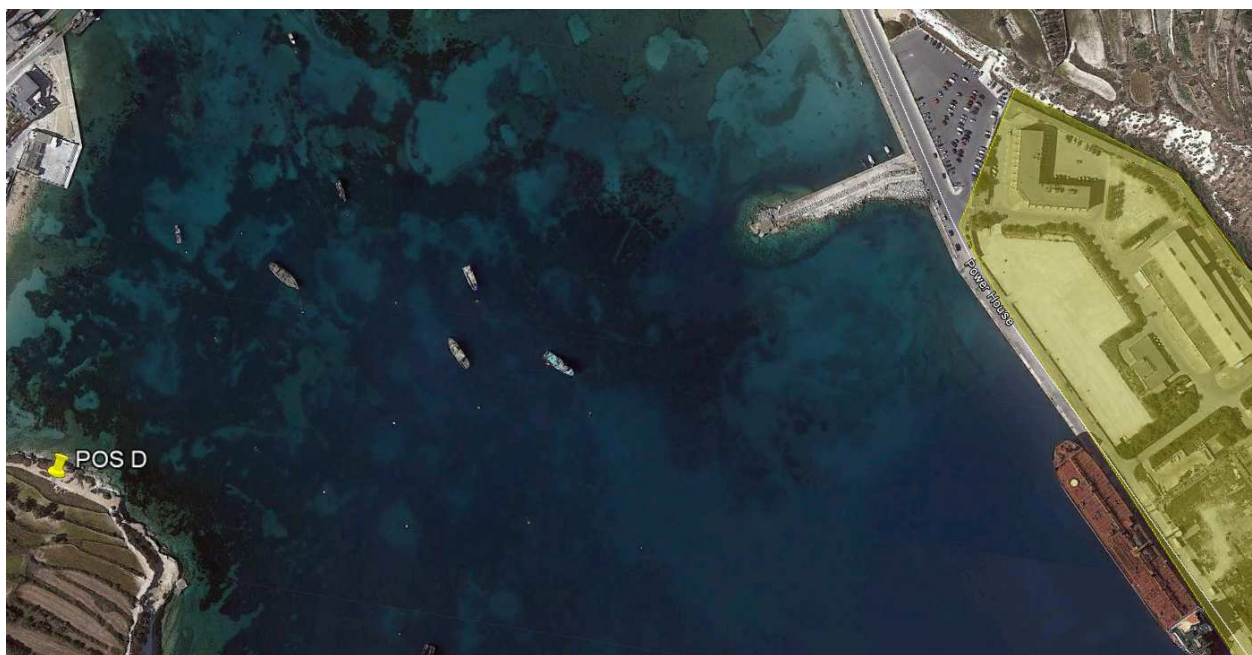


Figure 9 –Planimetric detection – Delimara monitoring position D



Environmental (left) and Residual (right) measurements point

6.3 MARSA MONITORING POSITIONS

Around t

Pos	EAST	NORTH
Position - A	14°29'47.05"E	35°52'50.67"N

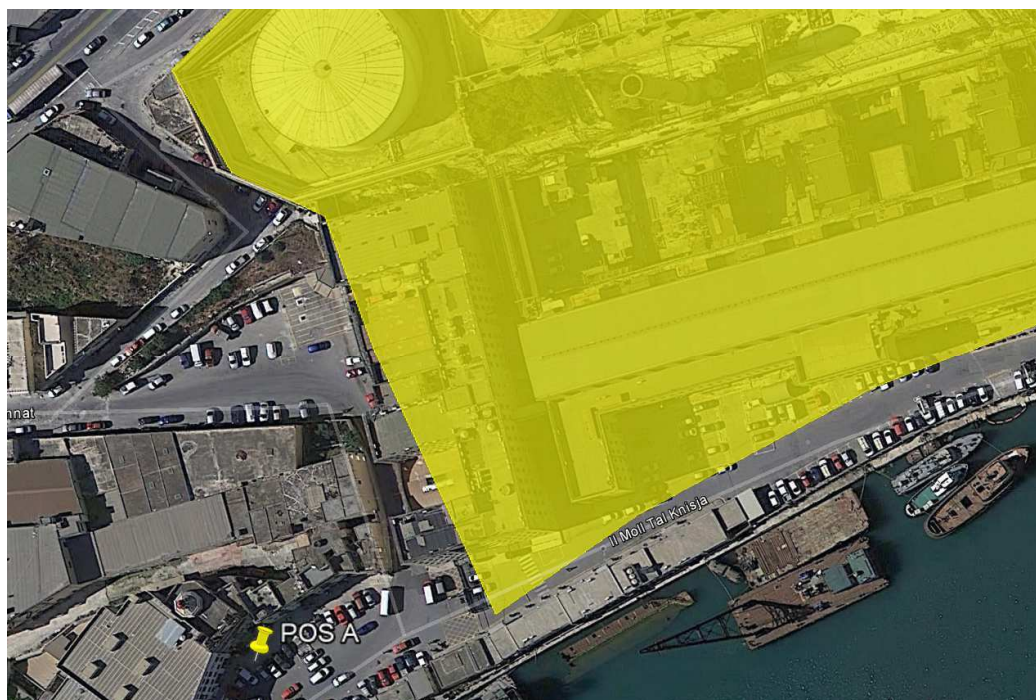


Figure 10 –Planimetric detection – Marsa monitoring position A



Environmental (left) and Residual (right) measurements point

Marsa And Delimara Power Stations Noise Monitoring – Report and Evaluation

Pos	EAST	NORTH
Position - B	14°29'54.95"E	35°52'58.79"N



Figure 11 –Planimetric detection – Marsa monitoring position B



Environmental (left) and Residual (right) measurements point

Marsa And Delimara Power Stations Noise Monitoring – Report and Evaluation

Pos	EAST	NORTH
Position - C	14°29'58.23"E	35°53'0.61"N

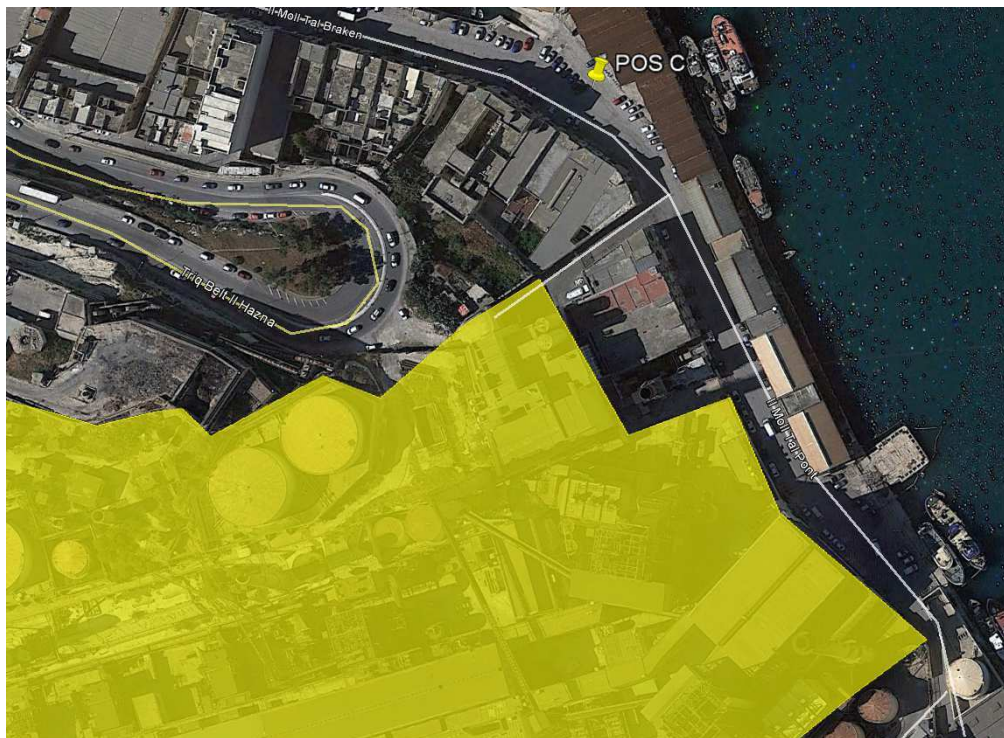


Figure 12 –Planimetric detection – Marsa monitoring position C



Environmental (left) and Residual (right) measurements point

Marsa And Delimara Power Stations Noise Monitoring – Report and Evaluation

Pos	EAST	NORTH
Position - D	14°30'2.41"E	35°52'55.60"N

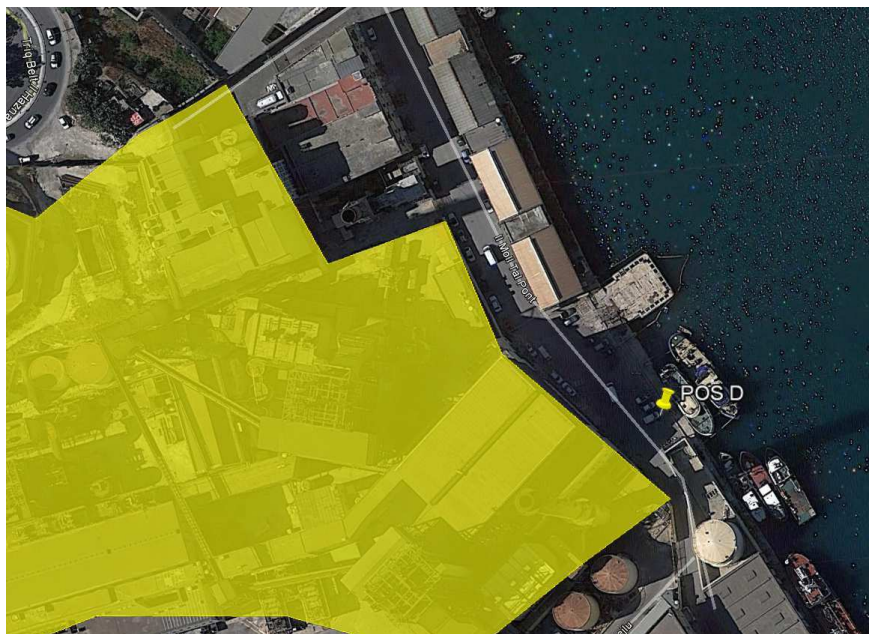
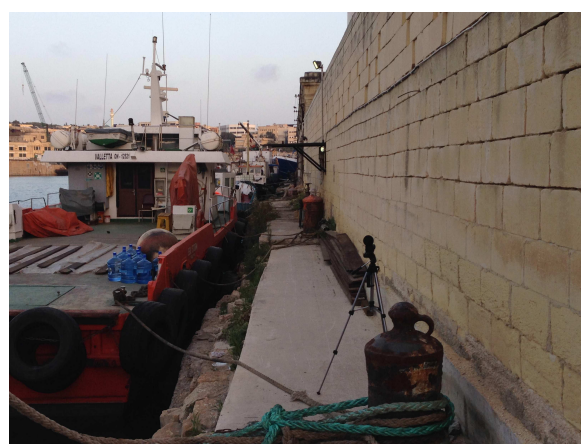


Figure 13 –Planimetric detection – Marsa monitoring position D



Environmental (left) and Residual (right) measurements point

6.4 ENVIRONMENTAL MEASUREMENT RESULTS AT DELIMARA

6.4.1 21-22/05/2014 environmental measurements

Position Date Time	L Min	L Max	L10	L50	L 90	Leq
Pos A 21/05/2014 11:06:38	35,0	56,8	43,8	39,3	37,0	42,2
Pos B 21/05/2014 12:27:30	48,7	77,1	53,9	51,0	49,9	55,4
Pos C 21/05/2014 13:47:19	45,1	65,1	55,2	52,1	49,3	52,9
Pos D 21/05/2014 17:13:32	41,5	61,9	50,1	45,9	44,0	48,3

Table 1 – environmental daytime measurements

Position Date Time	L Min	L Max	L10	L50	L 90	Leq
Pos A 21/05/2014 23:11:18	34,8	42,0	41,2	38,9	37,0	39,3
Pos B 21/05/2014 22:45:33	48,8	55,0	53,1	50,9	50,0	51,4
Pos C 21/05/2014 00:34:44	41,9	53,3	49,9	47,3	44,5	47,7
Pos D 22/05/2014 00:01:25	39,5	57,2	46,3	44,2	42,3	44,7

Table 2 – environmental nighttime measurements

6.5 ENVIRONMENTAL MEASUREMENT RESULTS AT MARSA

6.5.1 2014-20-21/05/2014 environmental measurements

Position Date Time	L Min	L Max	L10	L50	L 90	Leq
Pos A 20/05/2014 16:54:42	47,7	73,6	56,2	51,7	49,7	54,8
Pos B 20/05/2014 16:57:42	54,1	74,0	63,6	60,1	57,0	61,4
Pos C 20/05/2014 18:41:52	51,6	74,1	57,5	54,9	53,3	56,8
Pos D 20/05/2014 18:38:40	58,8	71,5	62,2	60,9	60,0	61,1

Table 3 – environmental daytime measurements

Position Date Time	L Min	L Max	L10	L50	L 90	Leq
Pos A 20/05/2014 22:30:01	46,9	70,7	51,7	50,4	49,3	51,6
Pos B 20/05/2014 22:33:20	48,2	69,5	58,6	55,9	49,7	56,1
Pos C 20/05/2014 23:52:52	45,6	64,1	51,8	49,5	47,5	50,2
Pos D 20/05/2014 23:41:48	57,1	67,2	63,8	61,2	58,7	61,7

Table 4 – environmental nighttime measurements

6.6 RESIDUAL MEASUREMENT RESULTS AT DELIMARA

6.6.1 21-22/05/2014 residual measurements

Position Date Time	L Min	L Max	L10	L50	L 90	Leq
Pos A 21/05/2014 11:09:54	33,4	60,9	49,7	40,4	36,7	45,7
Pos B 21/05/2014 10:24:16	34,0	62,3	51,3	43,2	36,2	48,1
Pos C 21/05/2014 12:49:08	33,4	56,6	42,2	37,2	34,9	39,7
Pos D 21/05/2014 16:16:32	34,7	53,5	45,0	39,6	36,3	42,0

Table 5 – residual daytime measurements

Position Date Time	L Min	L Max	L10	L50	L 90	Leq
Pos A 21/05/2014 22:18:13	33,8	40,0	39,9	39,3	36,2	38,8
Pos B 21/05/2014 21:30:35	34,5	45,0	43,8	42,8	36,9	42,2
Pos C 21/05/2014 22:08:13	34,0	44,1	39,6	37,3	35,4	37,7
Pos D 21/05/2014 22:12:36	35,7	49,7	42,6	38,8	37,1	40,1

Table 6– residual nighttime measurements

6.7 RESIDUAL MEASUREMENT RESULTS AT MARSA

6.7.1 20-21/05/2014 residual measurements

	L Min	L Max	L10	L50	L 90	Leq
Pos A 20/05/2014 17:56:02	43,8	63,5	51,5	46,7	45,1	48,9
Pos B 20/05/2014 17:58:36	52,8	72,6	66,1	56,5	54,0	61,4
Pos C 20/05/2014 19:44:38	50,1	65,9	57,1	53,3	51,3	54,7
Pos D 20/05/2014 19:41:06	51,8	60,0	55,5	54,0	52,9	54,3

Table 7– residual daytime measurements

Position Date Time	L Min	L Max	L10	L50	L 90	Leq
Pos A 20/05/2014 22:32:06	46,5	74,3	50,8	49,0	48,0	50,6
Pos B 20/05/2014 22:37:04	46,5	65,8	52,8	50,8	49,7	52,6
Pos C 20/05/2014 23:59:01	46,8	50,3	49,2	48,3	47,5	48,4
Pos D 20/05/2014 23:47:50	54,6	60,6	57,9	56,4	55,5	56,7

Table 8– residual nighttime measurements

7. EVALUATION ACCORDING BS4142

7.1 DELIMARA POWER STATION

In the table below the analysis, based both on Leq and L90 index. The L90 should be considered were (in case of continuous noise) the measurement could be influenced from short events not correlated to the plant emission noise.

Position Date Time (daytime)	L 90 Env.	L 90 Res.	Delta L90	Leq Env.	Leq Res.	Delta Leq
Pos A	37,0	36,7	+0,3	42,2	45,7	-3,5
Pos B	49,9	36,2	+13,8	55,4	48,1	+7,3
Pos C	49,3	34,9	+14,4	52,9	39,7	+13,2
Pos D	44,0	36,3	+7,7	48,3	42,0	+6,3

Position Date Time (nighttime)	L 90 Env.	L 90 Res.	Delta L90	Leq Env.	Leq Res.	Delta Leq
Pos A	37,0	36,2	+0,8	39,3	38,8	+0,5
Pos B	50,0	36,9	+13,1	51,4	42,2	+9,2
Pos C	44,5	35,4	+9,1	47,7	37,7	+10,0
Pos D	42,3	37,1	+5,2	44,7	40,1	+4,6

7.2 MARSJA POWER STATION

In the table below the analysis, based both on Leq and L90 index. The L90 should be considered were (in case of continuous noise) the measurement could be influenced from short events not correlated to the plant emission noise.

Position Date Time daytime	L 90 Env.	L 90 Res.	Delta L90	Leq Env.	Leq Res.	Delta Leq
Pos A	49,7	45,1	+4,6	54,8	48,9	+5,9
Pos B	57,0	54,0	+3	61,4	61,4	0,0
Pos C	53,3	51,3	+2,0	56,8	54,7	+1,9
Pos D	60,0	52,9	+7,1	61,1	54,3	+6,8

Position Date Time night	L 90 Env.	L 90 Res.	Delta L90	Leq Env.	Leq Res.	Delta Leq
Pos A	49,3	48,0	+1,3	51,6	50,6	+1,0
Pos B	49,7	49,7	0,0	56,1	52,6	+3,5
Pos C	47,5	47,5	0,0	50,2	48,4	+1,8
Pos D	58,7	55,5	+3,2	61,7	56,7	+5,0

Note to the measurements:

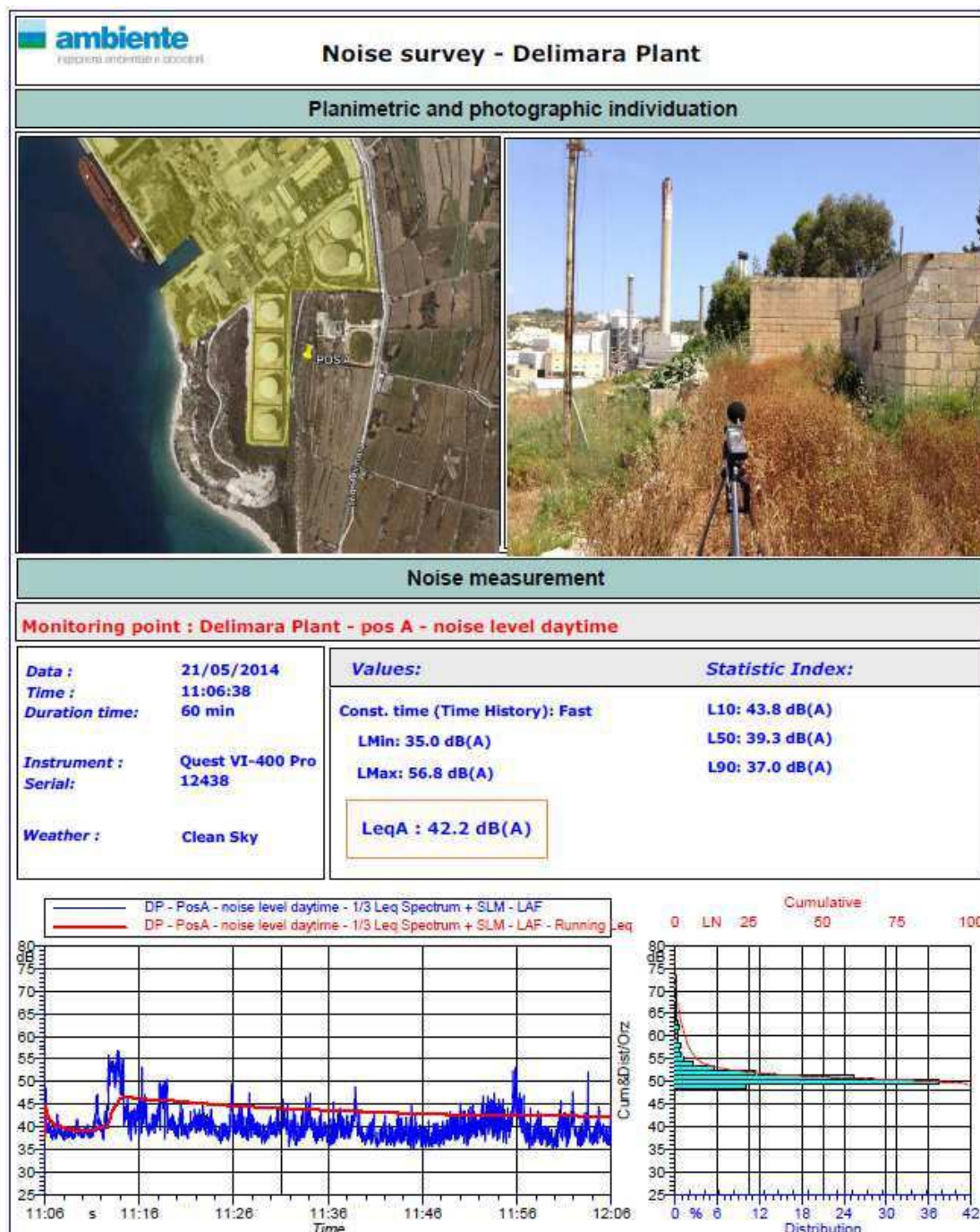
Position D: In position D it has been identified an emission source from an open gate more than from the inside of the plant. Although the impact is marginal or less and there are no residential building, it



might result a lower level with the gates closed.

Marsa And Delimara Power Stations Noise Monitoring – Report and Evaluation

In annex 1 for each position, a detailed report with planimetric and photographic individuation, noise time history and cumulative curve for the environmental measurement in daytime and nighttime can be found as in the example below.



Example of environmental report in annex 1

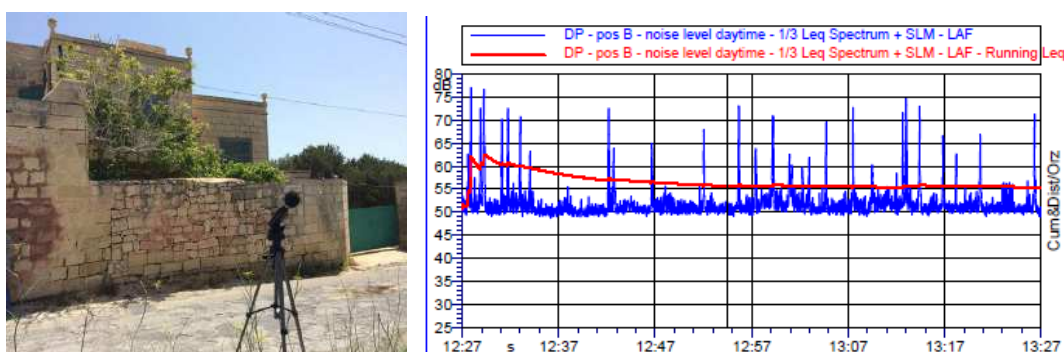
7.1 DELIMARA POWER STATION

Position Date Time (daytime)	L 90 Env.	L 90 Res.	Delta L90	Leq Env.	Leq Res.	Delta Leq
Pos A	37,0	36,7	+0,3	42,2	45,7	-3,5
Pos B	49,9	36,2	+13,7	55,4	48,1	+7,3
Pos C	49,3	34,9	+14,4	52,9	39,7	+13,2
Pos D	44,0	36,3	+7,7	48,3	42,0	+6,3

Position Date Time (nighttime)	L 90 Env.	L 90 Res.	Delta L90	Leq Env.	Leq Res.	Delta Leq
Pos A	37,0	36,2	+0,8	39,3	38,8	+0,5
Pos B	50,0	36,9	+13,1	51,4	42,2	+9,2
Pos C	44,5	35,4	+9,1	47,7	37,7	+10,0
Pos D	42,3	37,1	+5,2	44,7	40,1	+4,6

Note to the measurements:

POS B: (environmental Leq) has been influenced by car passages (see the peaks in the time history below). Due to continuous plant noise the Delta L90 should be considered for a correct evaluation.



POS C: (environmental Leq): Mostly of noise emission in daytime measurement was not from the plant but it has been identified from the air conditioning plant on the roof that maybe can be limited with some maintenance.

7.2 MARSA POWER STATION EVALUATION

Position Date Time daytime	Delta L90	impact	Delta Leq	
Pos A	+4,6	Minor significance	+5,9	Marginal significance
Pos B	+3	Minor significance	0,0	Minor significance
Pos C	+2,0	Minor significance	+1,9	Minor significance
Pos D	+7,1	Marginal significance	+6,8	Marginal significance

Position Date Time night	Delta L90		Delta Leq	
Pos A	+1,3	Minor significance	+1,0	Minor significance
Pos B	0,0	Minor significance	+3,5	Minor significance
Pos C	0,0	Minor significance	+1,8	Minor significance
Pos D	+3,2	Minor significance	+5,0	Marginal significance

7.1 DELIMARA POWER STATION EVALUATION

Position Date Time daytime	Delta L90	impact	Delta Leq	
Pos A	+0,3	Minor significance	-3,5	Minor significance
Pos B	+13,7	Compliants are likely	+7,3	Marginal significance
Pos C	+14,4	Compliants are likely	+13,2	Compliants are likely
Pos D	+7,7	Marginal significance	+6,3	Marginal significance

Position Date Time night	Delta L90		Delta Leq	
Pos A	+0,8	Minor significance	+0,5	Minor significance
Pos B	+13,1	Compliants are likely	+9,2	Marginal significance
Pos C	+9,1	Marginal significance	+10,0	Compliants are likely
Pos D	+5,2	Minor significance	+4,6	Marginal significance

8. CONCLUSION

Aim of this document has been to illustrate the noise monitoring at the Delimara and Marsa power stations and the evaluation of the results according to BS4142.

After the first inspection around the plants, the monitoring points have been chosen, according with Enemalta engineers. The monitored positions have been chosen as the four closest location respect to plant, where during inspection audible noise emission were identified, and (as possible) preferring areas near receptors for a correct evaluation. On the side where no receptors (sea side for example) near the plant where noise emission was identified the measurement has been made to check the significance of the noise emission (in this case for the evaluation the complaints should be considered unlikely just because of absence of people). It is however important to check the noise emission to avoid possible unwanted an uncontrolled noise emission to the surrounding area.

A brief description of the plants, the monitoring points, the methodology, the report and the final evaluation can be found inside the document.

At Marsa power station no major significance has been identified, while at Delimara in POS B and POS C has been found that compliants are likely.

It is to underline that in Pos C no receptor has been found and that the noise source emission has been identified from the air conditioning unit on the roof of the office building (and not from the plant itself). A good maintenance for the units could resolve the problem.

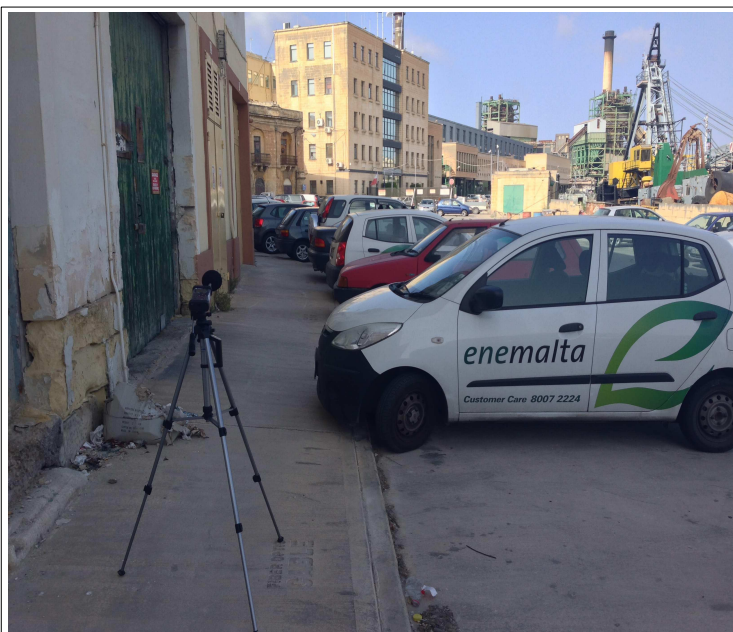
In Pos B, the environmental measurement has been made in proximity of a road and some car passages have influenced the measurements. The residual measurement (in acoustic shadow behind the building to shield the plant emission) has not been influenced by any car passages.

Further to BS4142 , it is important to underline that the measurements levels have always been low, under 60 dB(A), except in POS C at delimara were the air conditioning unit has influenced the measurement.

Annex 1 – Detailed Report for environmental measurements

(time history and cumulative curve)

Planimetric and photographic individuation



Noise measurement

Monitoring point : Marsa Plant - pos A - noise level daytime

Data : 20/05/2014
Time : 16:54:42
Duration time: 60 min

Instrument : Quest VI-400 Pro
Serial: 12438

Weather : Clean Sky

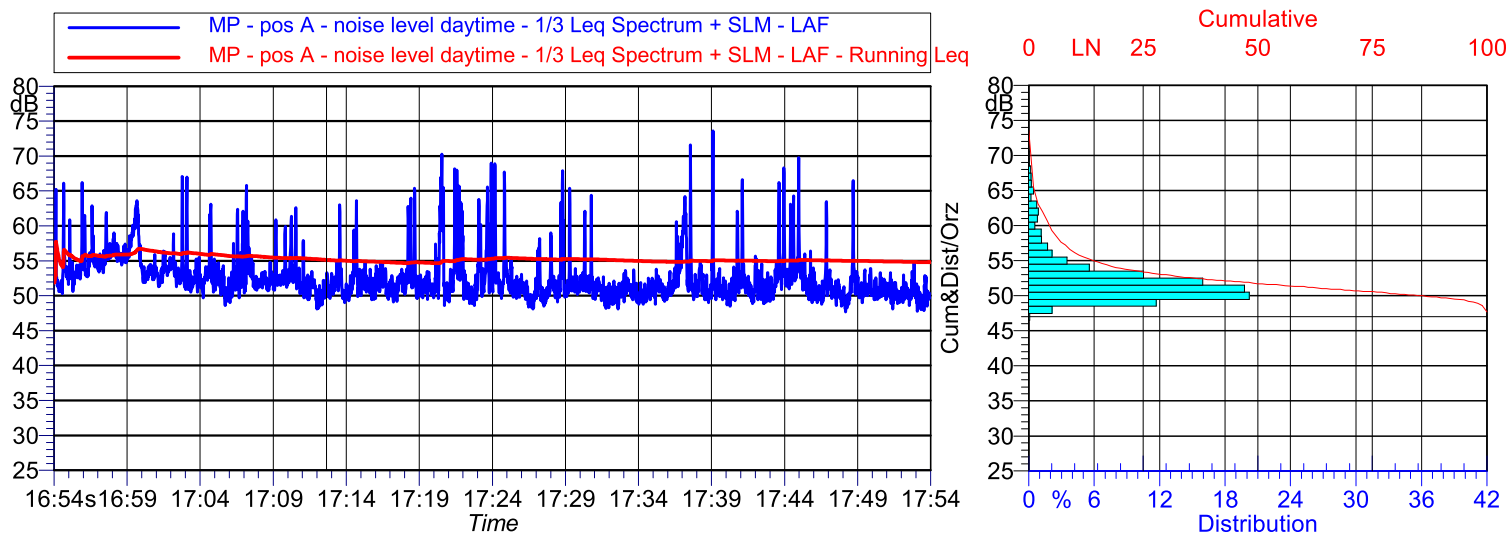
Values:

Const. time (Time History): Fast
LMin: 47.7 dB(A)
LMax: 73.6 dB(A)

LeqA : 54.8 dB(A)

Statistic Index:

L10: 56.2 dB(A)
L50: 51.7 dB(A)
L90: 49.7 dB(A)

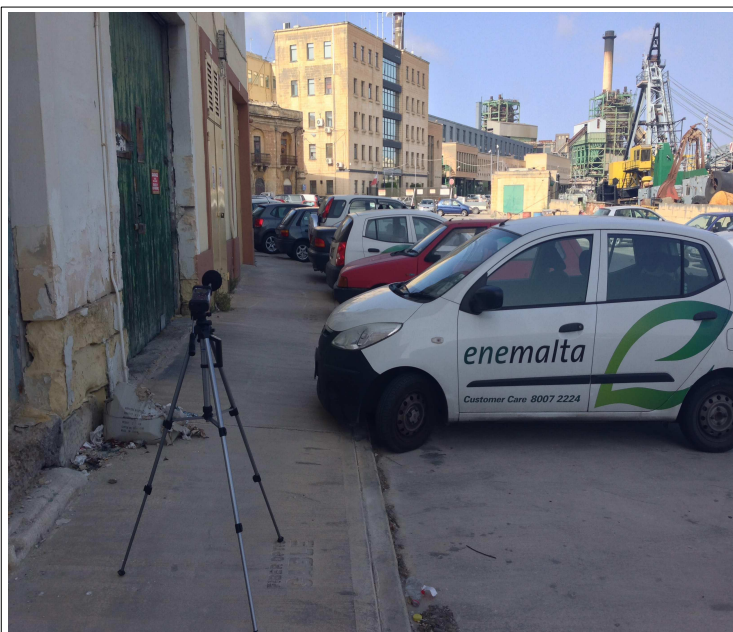


Notes : Plant in normal working condition. Daytime

The sound level measurements and numerical calculations have been carried out in the following Technical Acoustics Environment:

Eng. Marco ANGELONI
Eng. Andrea BATTISTINI

Planimetric and photographic individuation



Noise measurement

Monitoring point : Marsa Plant - pos A - noise level nighttime

Data : 20/05/2014
Time : 22:30:02
Duration time: 60 min

Instrument : Quest VI-400 Pro
Serial: 12438

Weather : Clean Sky

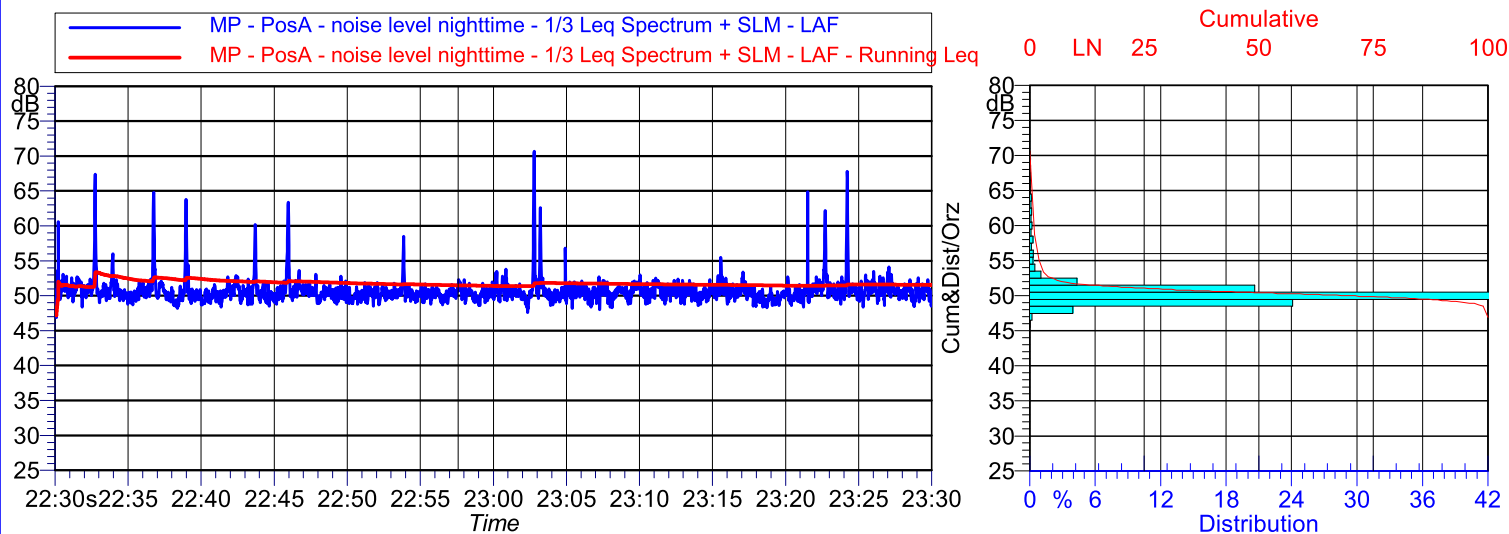
Values:

Const. time (Time History): Fast
LMin: 46.9 dB(A)
LMax: 70.7 dB(A)

LeqA : 51.6 dB(A)

Statistic Index:

L10: 51.7 dB(A)
L50: 50.4 dB(A)
L90: 49.3 dB(A)

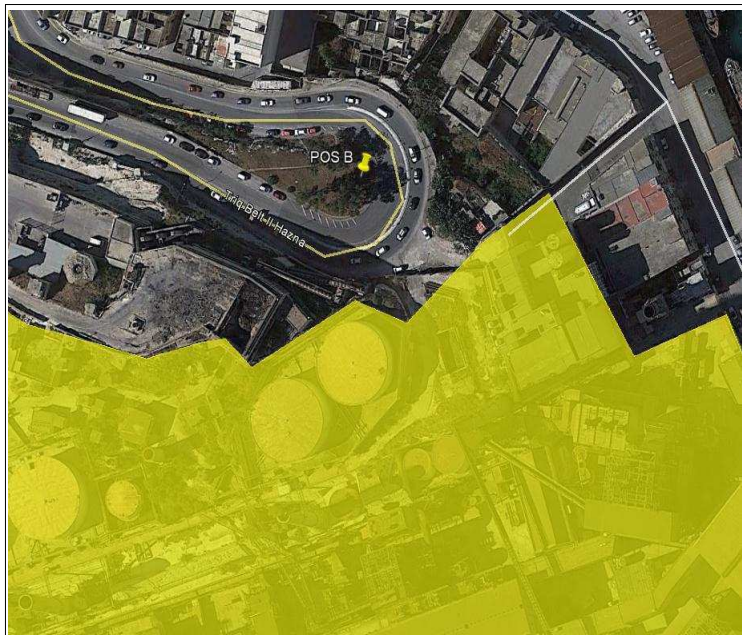


Notes : Plant in normal working condition. Nighttime
 Residual (due to impossibility in stopping the plant, a reading in acoustic shadow has been taken)

The sound level measurements and numerical calculations have been carried out in the following Technical Acoustics Environment:

Eng. Marco ANGELONI
Eng. Andrea BATTISTINI

Planimetric and photographic individuation



Noise measurement

Monitoring point : Marsa Plant - pos B - noise level daytime

Data : 20/05/2014
Time : 16:57:42
Duration time: 60 min

Instrument : L&D831
Serial: 2490

Weather : Clean Sky

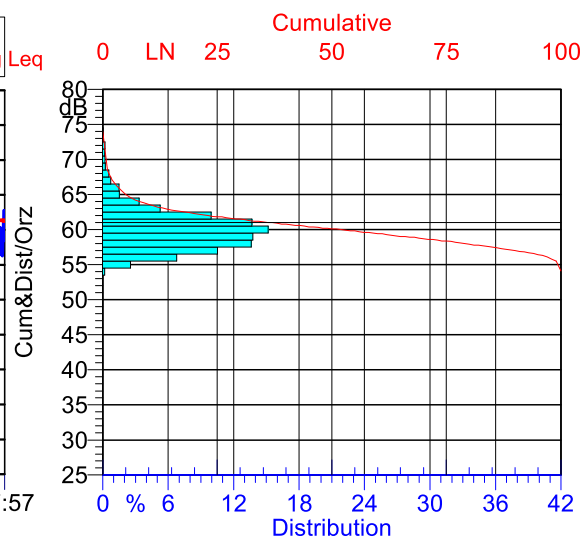
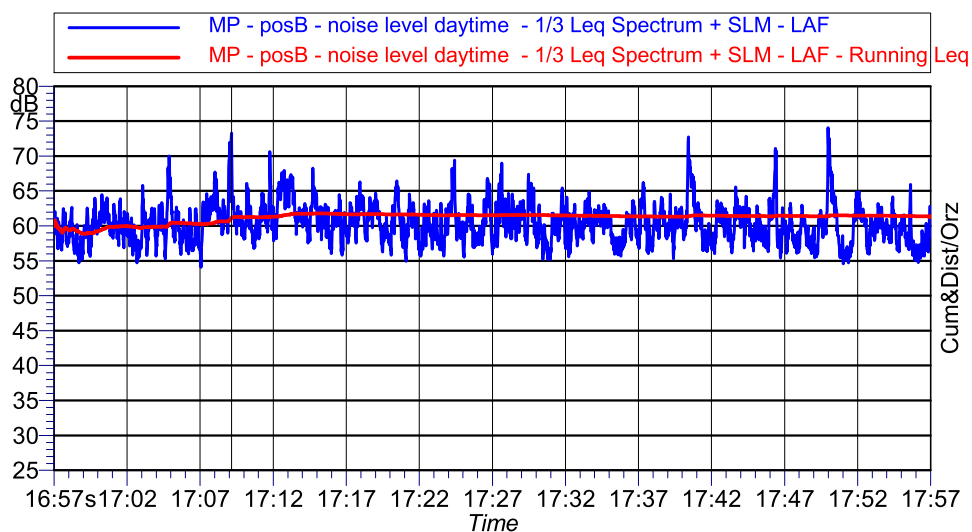
Values:

Const. time (Time History): Fast
LMin: 54.1 dB(A)
LMax: 74.0 dB(A)

LeqA : 61.4 dB(A)

Statistic Index:

L10: 63.6 dB(A)
L50: 60.1 dB(A)
L90: 57.0 dB(A)

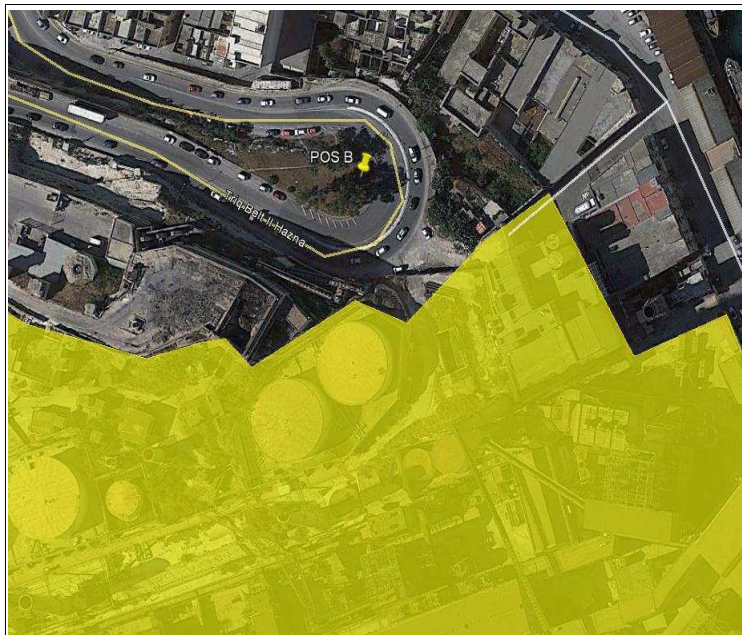


Notes : Plant in normal working condition. Daytime

The sound level measurements and numerical calculations have been carried out in the following Technical Acoustics Environment:

Eng. Marco ANGELONI
Eng. Andrea BATTISTINI

Planimetric and photographic individuation



Noise measurement

Monitoring point : Marsa Plant - pos B - noise level nighttime

Data : 20/05/2014
Time : 22:33:20
Duration time: 60 min

Instrument : L&D 831
Serial: 2489

Weather : Clean Sky

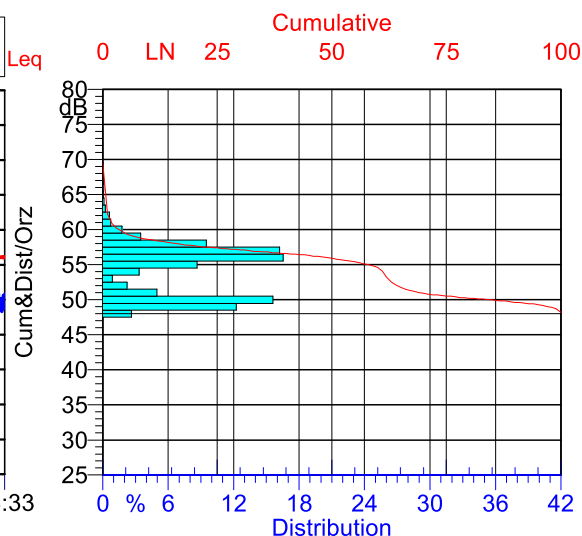
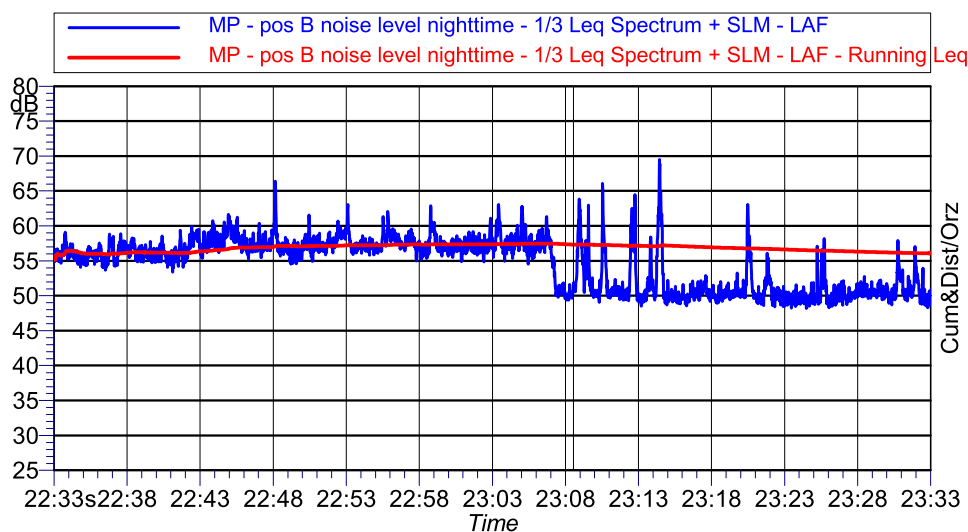
Values:

Const. time (Time History): Fast
LMin: 48.2 dB(A)
LMax: 69.5 dB(A)

LeqA : 56.1 dB(A)

Statistic Index:

L10: 58.6 dB(A)
L50: 55.9 dB(A)
L90: 49.7 dB(A)

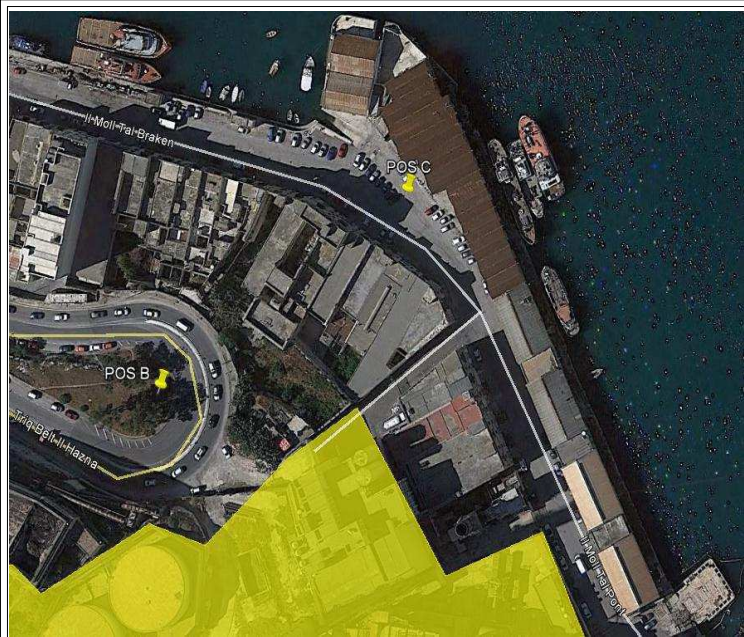


Notes : Plant in normal working condition. Nighttime

The sound level measurements and numerical calculations have been carried out in the following Technical Acoustics Environment:

Eng. Marco ANGELONI
Eng. Andrea BATTISTINI

Planimetric and photographic individuation



Noise measurement

Monitoring point : Marsa Plant - pos C - noise level daytime

Data : 20/05/2014
Time : 18:41:52
Duration time: 60 min

Instrument : L&D 831
Serial: 2490

Weather : Clean Sky

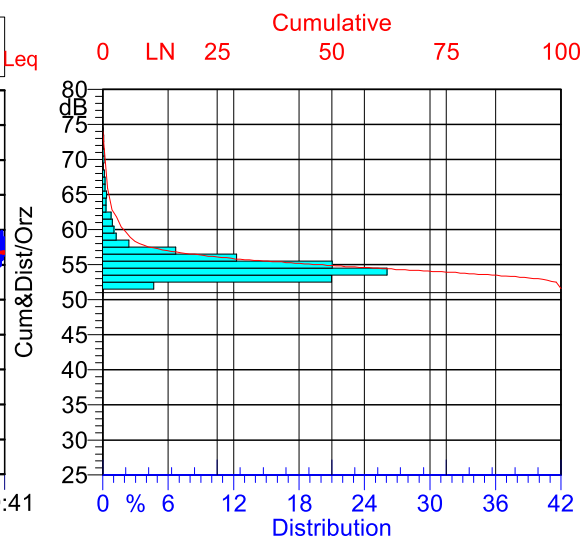
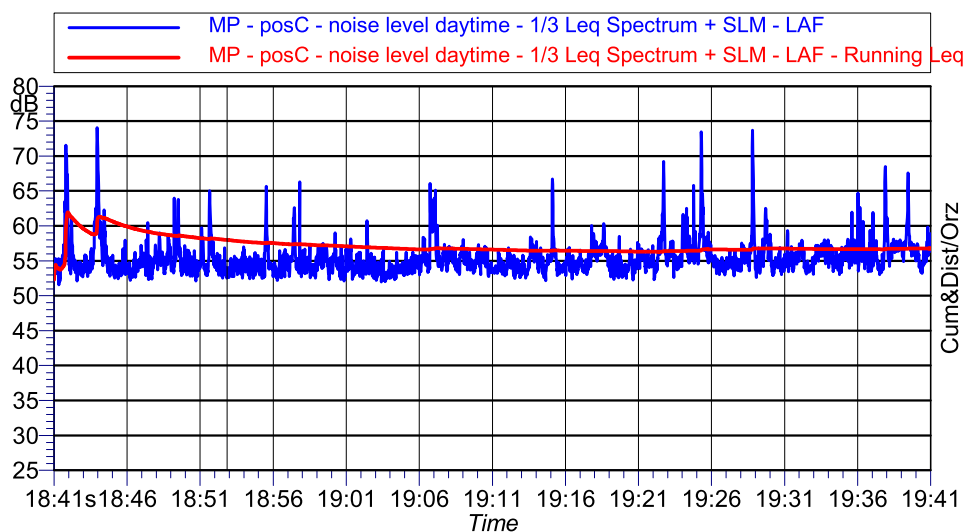
Values:

Const. time (Time History): Fast
LMin: 51.6 dB(A)
LMax: 74.1 dB(A)

LeqA : 56.8 dB(A)

Statistic Index:

L10: 57.5 dB(A)
L50: 54.9 dB(A)
L90: 53.3 dB(A)

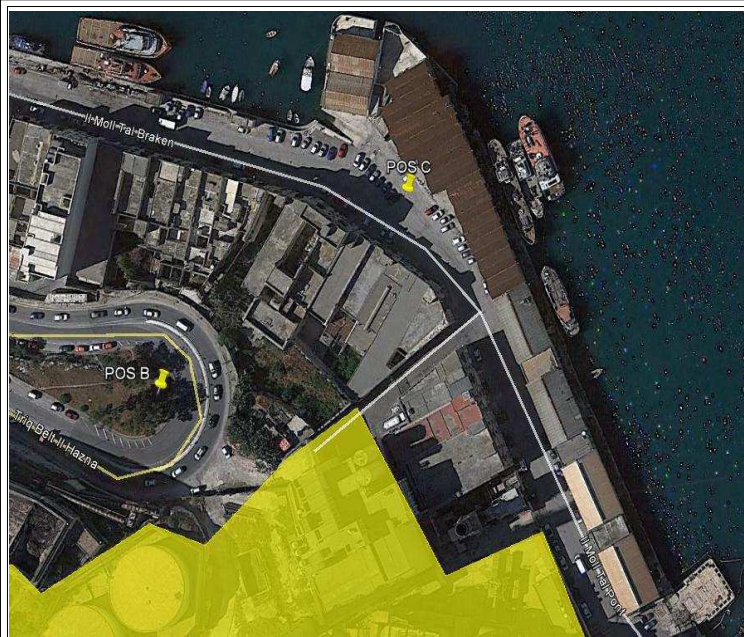


Notes : Plant in normal working condition. Daytime

The sound level measurements and numerical calculations have been carried out in the following Technical Acoustics Environment:

Eng. Marco ANGELONI
Eng. Andrea BATTISTINI

Planimetric and photographic individuation



Noise measurement

Monitoring point : Marsa Plant - pos C - noise level nighttime

Data : 20/05/2014
Time : 23:52:53
Duration time: 60 min

Instrument : L&D 831
Serial: 2490

Weather : Clean Sky

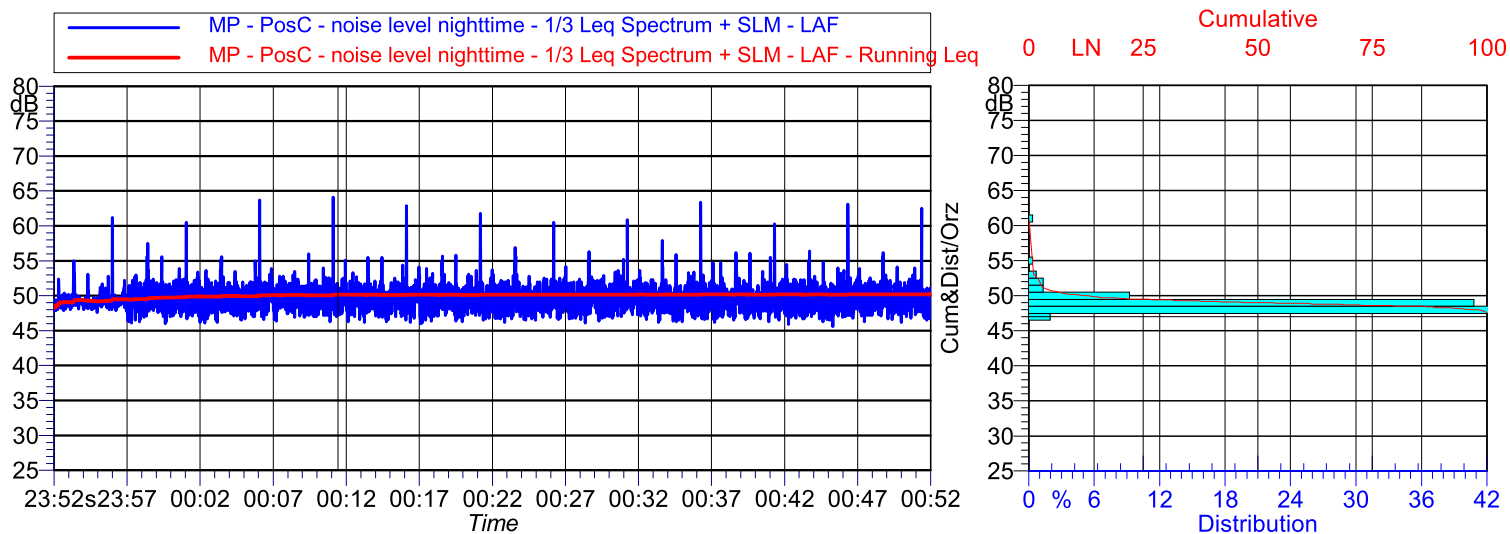
Values:

Const. time (Time History): Fast
LMin: 45.6 dB(A)
LMax: 64.1 dB(A)

LeqA : 50.2 dB(A)

Statistic Index:

L10: 51.8 dB(A)
L50: 49.5 dB(A)
L90: 47.5 dB(A)

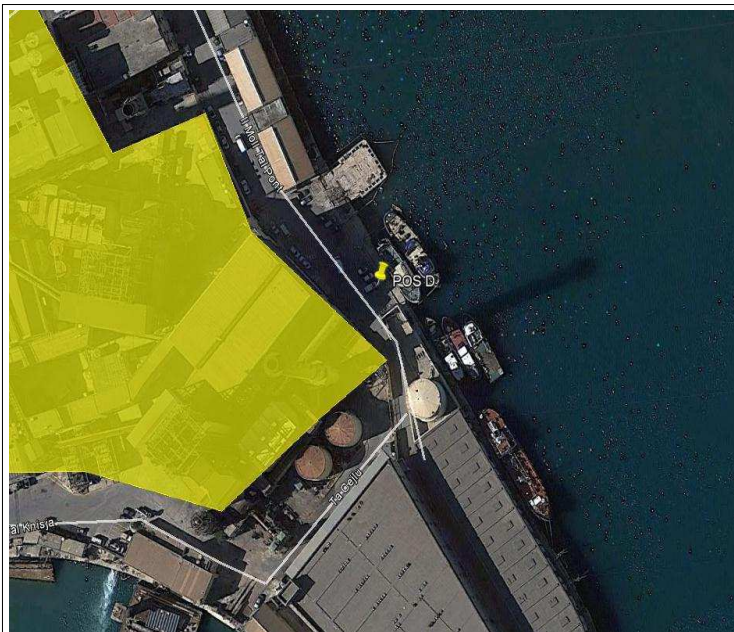


Notes : Plant in normal working condition. Nighttime

The sound level measurements and numerical calculations have been carried out in the following Technical Acoustics Environment:

Eng. Marco ANGELONI
Eng. Andrea BATTISTINI

Planimetric and photographic individuation



Noise measurement

Monitoring point : Marsa Plant - pos D - noise level daytime

Data : 20/05/2014
Time : 18:38:40
Duration time: 60 min

Instrument : Quest VI-400 Pro
Serial: 12435

Weather : Clean Sky

Values:

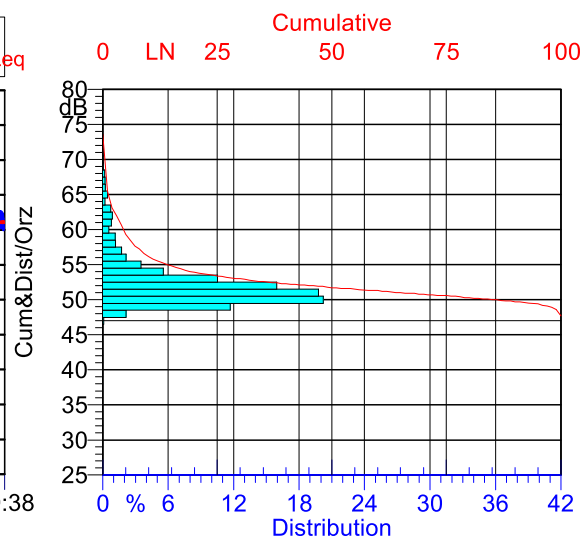
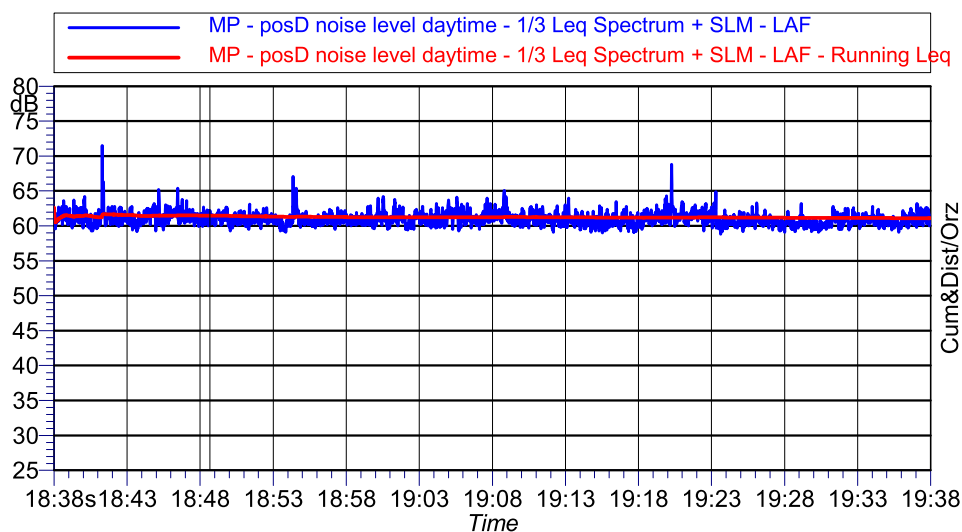
Const. time (Time History): Fast

LMin: 58.8 dB(A)
LMax: 71.5 dB(A)

LeqA : 61.1 dB(A)

Statistic Index:

L10: 62.2 dB(A)
L50: 60.9 dB(A)
L90: 60.0 dB(A)

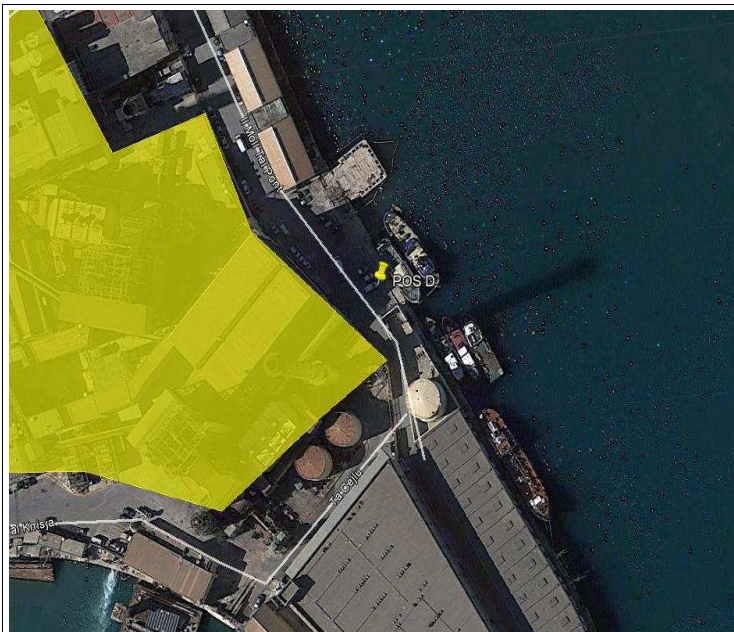


Notes : Plant in normal working condition. Daytime

The sound level measurements and numerical calculations have been carried out in the following Technical Acoustics Environment:

Eng. Marco ANGELONI
Eng. Andrea BATTISTINI

Planimetric and photographic individuation



Noise measurement

Monitoring point : Marsa Plant - pos D - noise level nighttime

Data : 20/05/2014
Time : 23:41:49
Duration time: 60 min

Instrument : L&D 831
Serial: 2489

Weather : Clean Sky

Values:

Const. time (Time History): Fast

LMin: 57.1 dB(A)

LMax: 67.2 dB(A)

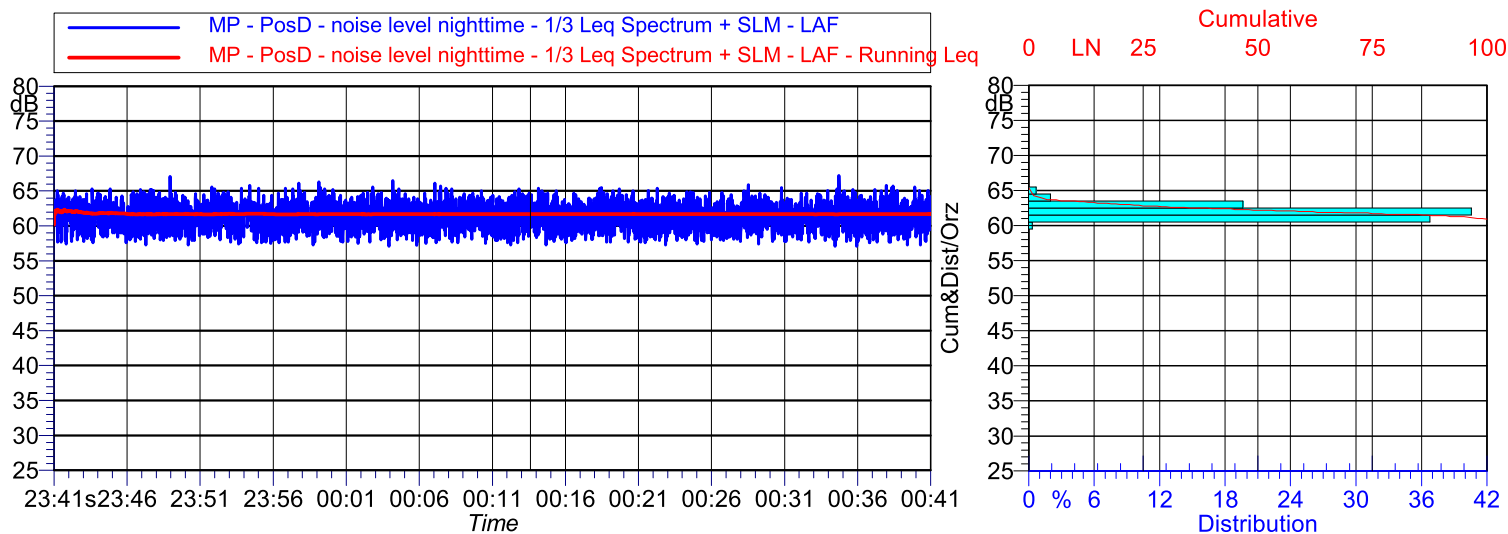
LeqA : 61.7 dB(A)

Statistic Index:

L10: 63.8 dB(A)

L50: 61.2 dB(A)

L90: 58.7 dB(A)



Notes : Plant in normal working condition. Nighttime

The sound level measurements and numerical calculations have been carried out in the following Technical Acoustics Environment:

Eng. Marco ANGELONI
Eng. Andrea BATTISTINI

Planimetric and photographic individuation



Noise measurement

Monitoring point : Delimara Plant - pos A - noise level daytime

Data : 21/05/2014
Time : 11:06:38
Duration time: 60 min

Instrument : Quest VI-400 Pro
Serial: 12438

Weather : Clean Sky

Values:

Const. time (Time History): Fast

LMin: 35.0 dB(A)

LMax: 56.8 dB(A)

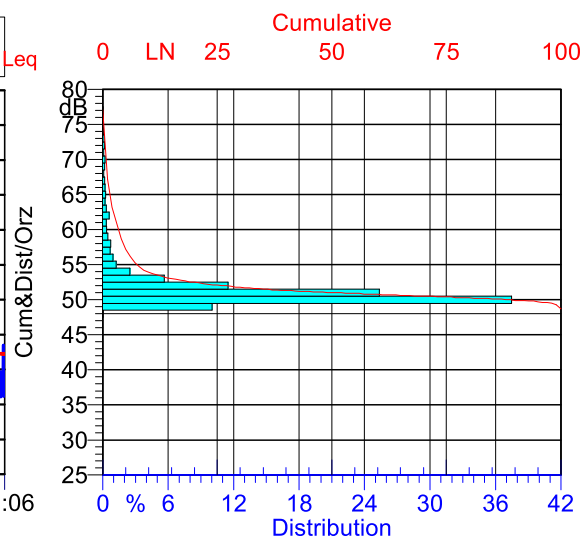
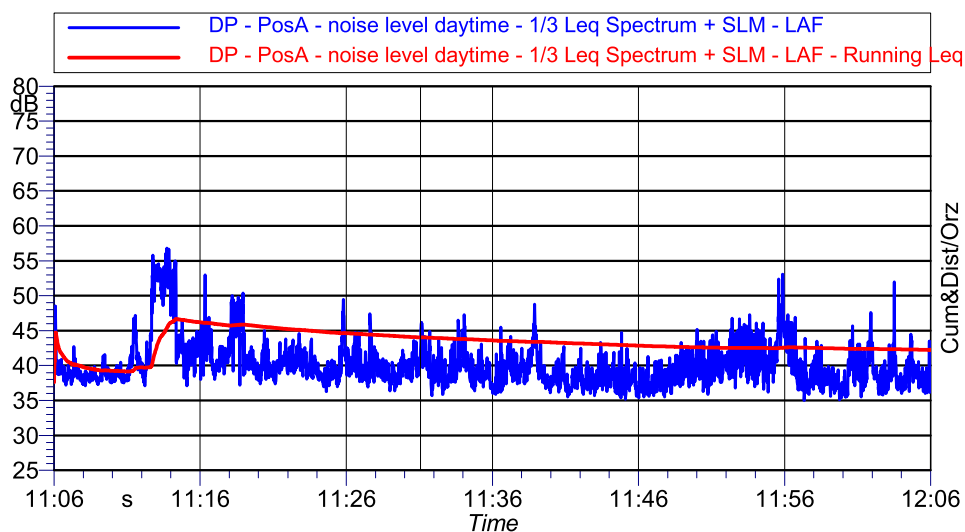
LeqA : 42.2 dB(A)

Statistic Index:

L10: 43.8 dB(A)

L50: 39.3 dB(A)

L90: 37.0 dB(A)



Notes : Plant in normal working condition. Daytime

The sound level measurements and numerical calculations have been carried out in the following Technical Acoustics Environment:

Eng. Marco ANGELONI
Eng. Andrea BATTISTINI

Planimetric and photographic individuation



Noise measurement

Monitoring point : Delimara Plant - pos A - noise level nighttime

Data : 21/05/2014
Time : 23:11:18
Duration time: 60 min

Instrument : Quest VI-400 Pro
Serial: 12438

Weather : Clean Sky

Values:

Const. time (Time History): Fast

LMin: 34.8 dB(A)

LMax: 42.0 dB(A)

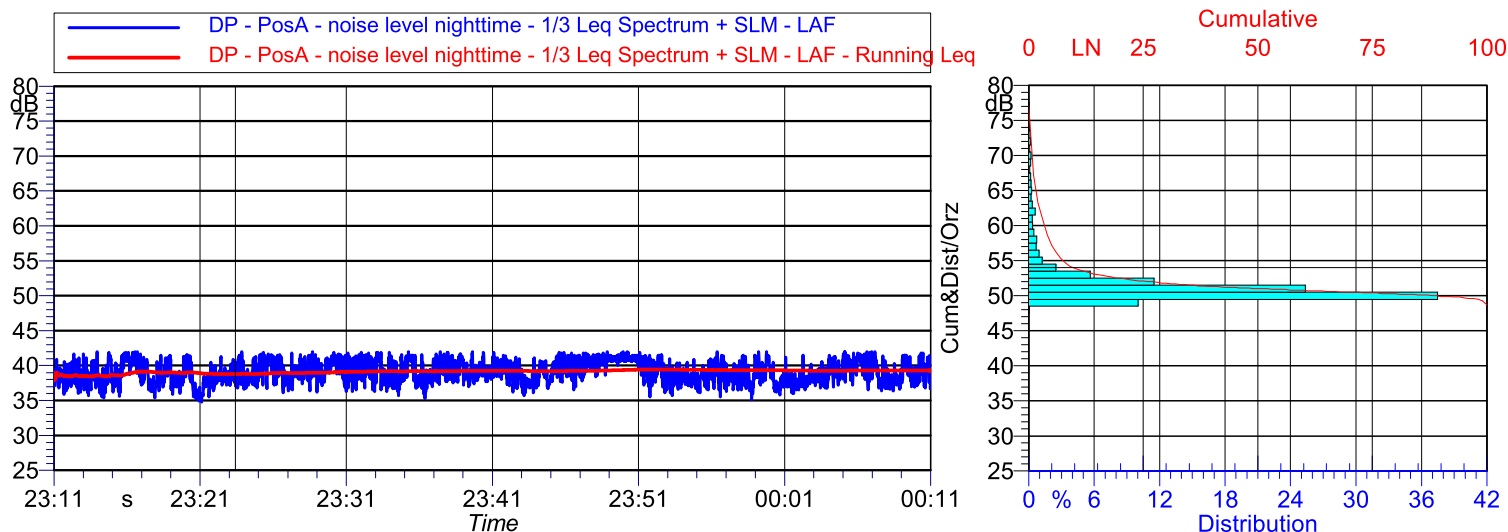
LeqA : 39.3 dB(A)

Statistic Index:

L10: 41.2 dB(A)

L50: 38.9 dB(A)

L90: 37.0 dB(A)

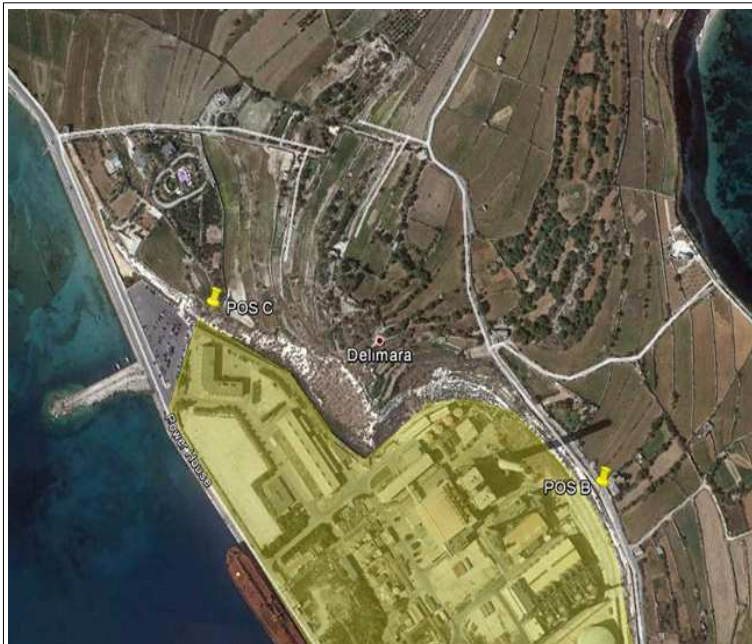


Notes : Plant in normal working condition. Nighttime

The sound level measurements and numerical calculations have been carried out in the following Technical Acoustics Environment:

Eng. Marco ANGELONI
Eng. Andrea BATTISTINI

Planimetric and photographic individuation



Noise measurement

Monitoring point : Delimara Plant - pos B - noise level daytime

Data : 21/05/2014
Time : 12:27:30
Duration time: 60 min

Instrument : L&D 831
Serial: 2490

Weather : Clean Sky

Values:

Const. time (Time History): Fast

LMin: 48.7 dB(A)

LMax: 77.1 dB(A)

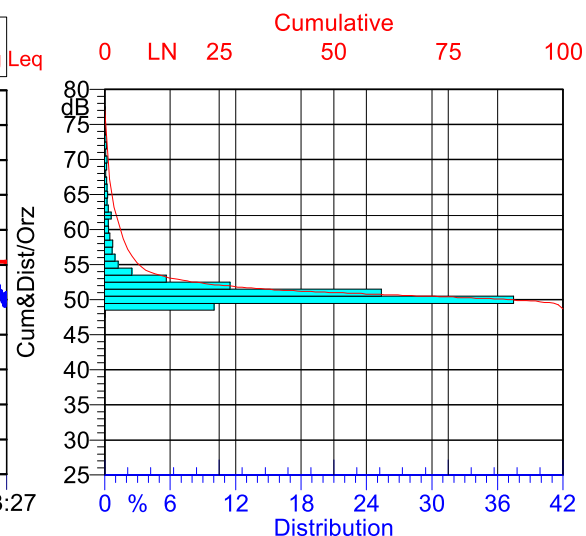
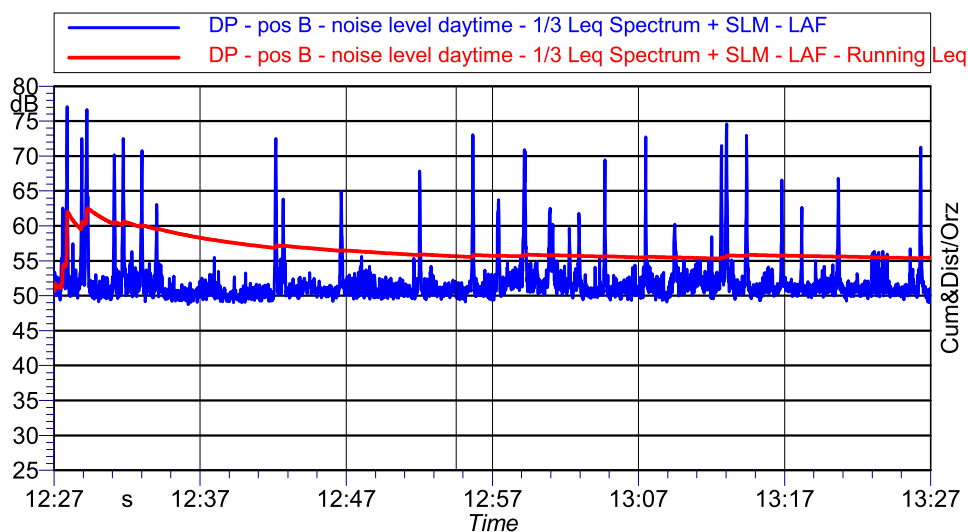
LeqA : 55.4 dB(A)

Statistic Index:

L10: 53.9 dB(A)

L50: 51.0 dB(A)

L90: 49.9 dB(A)



Notes : Plant in normal working condition. Daytime

The sound level measurements and numerical calculations have been carried out in the following Technical Acoustics Environment:

Eng. Marco ANGELONI
Eng. Andrea BATTISTINI

Planimetric and photographic individuation



Noise measurement

Monitoring point : Delimara Plant - pos B - noise level nighttime

Data : 21/05/2014
Time : 22:45:33
Duration time: 60 min

Instrument : L&D 831
Serial: 2490

Weather : Clean Sky

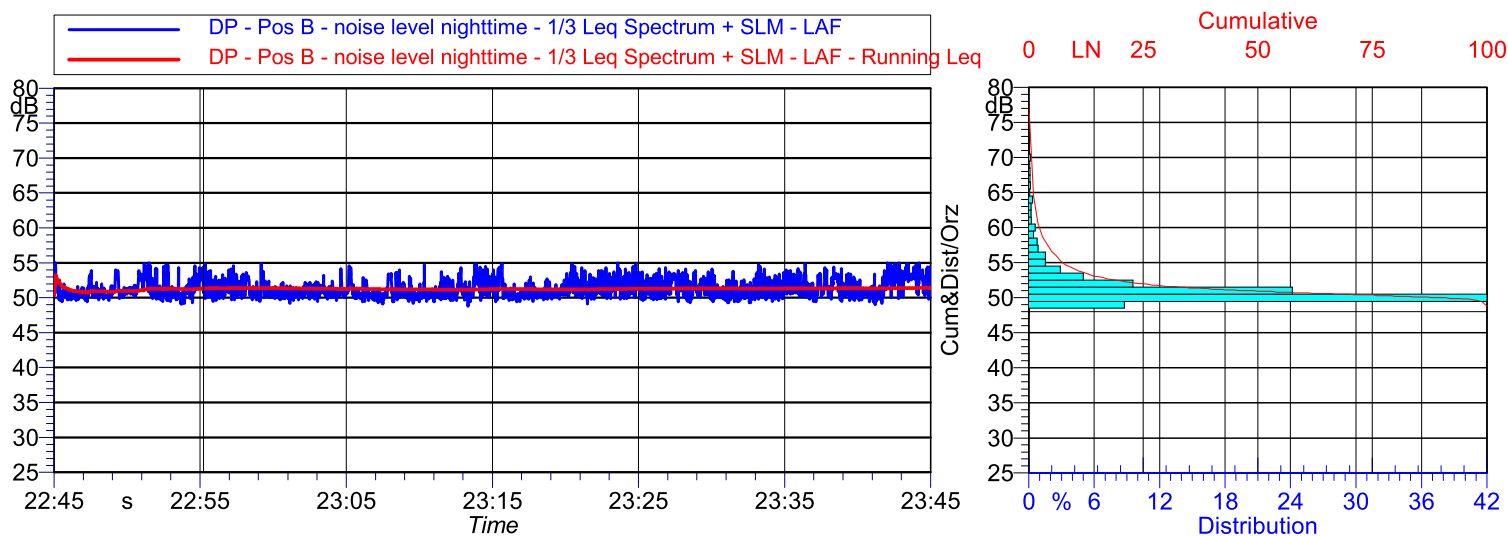
Values:

Const. time (Time History): Fast
LMin: 48.8 dB(A)
LMax: 55.0 dB(A)

LeqA : 51.4 dB(A)

Statistic Index:

L10: 53.1 dB(A)
L50: 50.9 dB(A)
L90: 50.0 dB(A)



Notes : Plant in normal working condition. Nighttime

The sound level measurements and numerical calculations have been carried out in the following Technical Acoustics Environment:

Eng. Marco ANGELONI
Eng. Andrea BATTISTINI

Planimetric and photographic individuation



Noise measurement

Monitoring point : Delimara Plant - pos C - noise level daytime

Data : 21/05/2014
Time : 13:47:19
Duration time: 60 min

Instrument : L&D 831
Serial: 2490

Weather : Clean Sky

Values:

Const. time (Time History): Fast

LMin: 45.1 dB(A)

LMax: 65.1 dB(A)

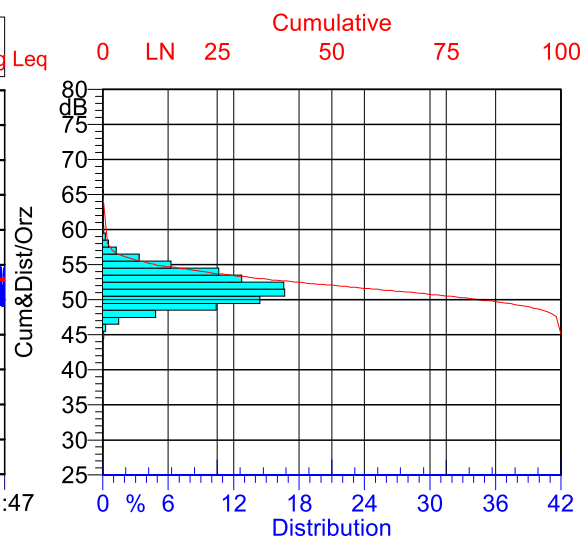
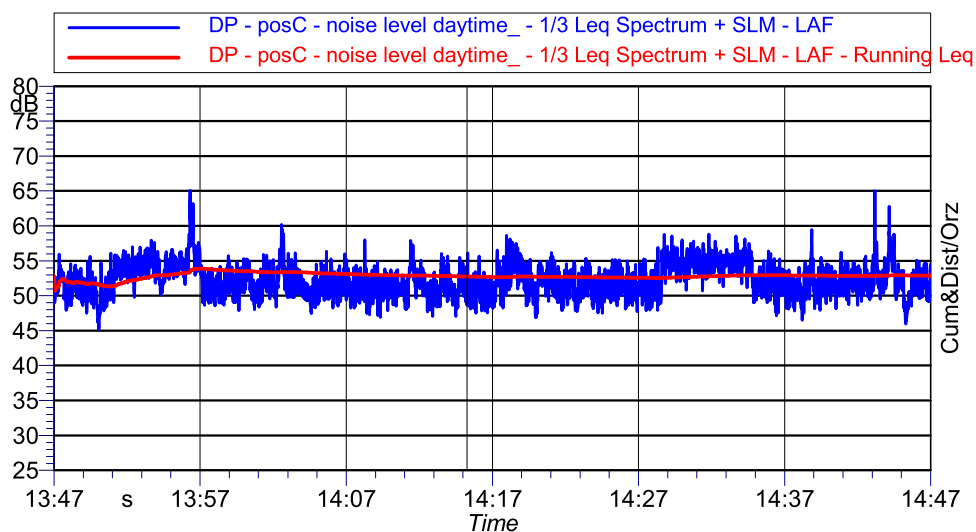
LeqA : 52.9 dB(A)

Statistic Index:

L10: 55.2 dB(A)

L50: 52.1 dB(A)

L90: 49.3 dB(A)



Notes : Plant in normal working condition. Daytime

The sound level measurements and numerical calculations have been carried out in the following Technical Acoustics Environment:

Eng. Marco ANGELONI
Eng. Andrea BATTISTINI

Planimetric and photographic individuation



Noise measurement

Monitoring point : Delimara Plant - pos C - noise level nighttime

Data : 22/05/2014
Time : 00:34:45
Duration time: 60 min

Instrument : L&D 831
Serial: 2490

Weather : Clean Sky

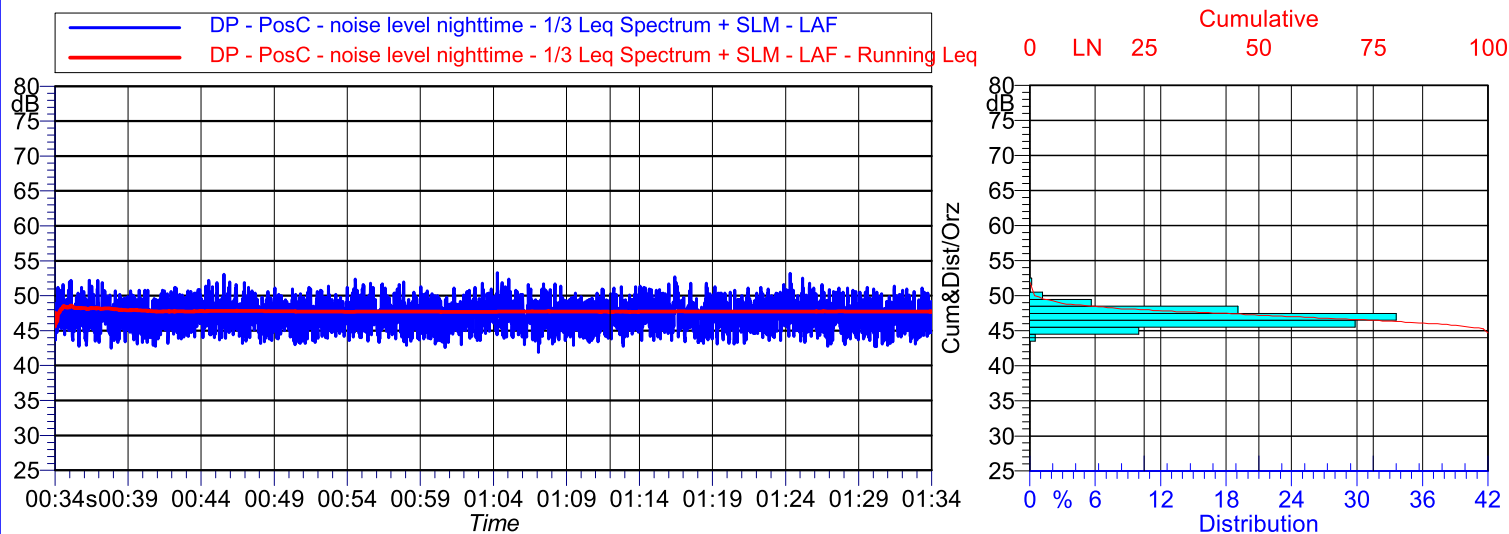
Values:

Const. time (Time History): Fast
LMin: 41.9 dB(A)
LMax: 53.3 dB(A)

LeqA : 47.7 dB(A)

Statistic Index:

L10: 49.9 dB(A)
L50: 47.3 dB(A)
L90: 44.5 dB(A)



Notes : Plant in normal working condition. Nighttime

The sound level measurements and numerical calculations have been carried out in the following Technical Acoustics Environment:

Eng. Marco ANGELONI
Eng. Andrea BATTISTINI

Planimetric and photographic individuation



Noise measurement

Monitoring point : Delimara Plant - pos D - noise level daytime

Data : 21/05/2014
Time : 17:13:32
Duration time: 60 min

Instrument : L&D 831
Serial: 2490

Weather : Clean Sky

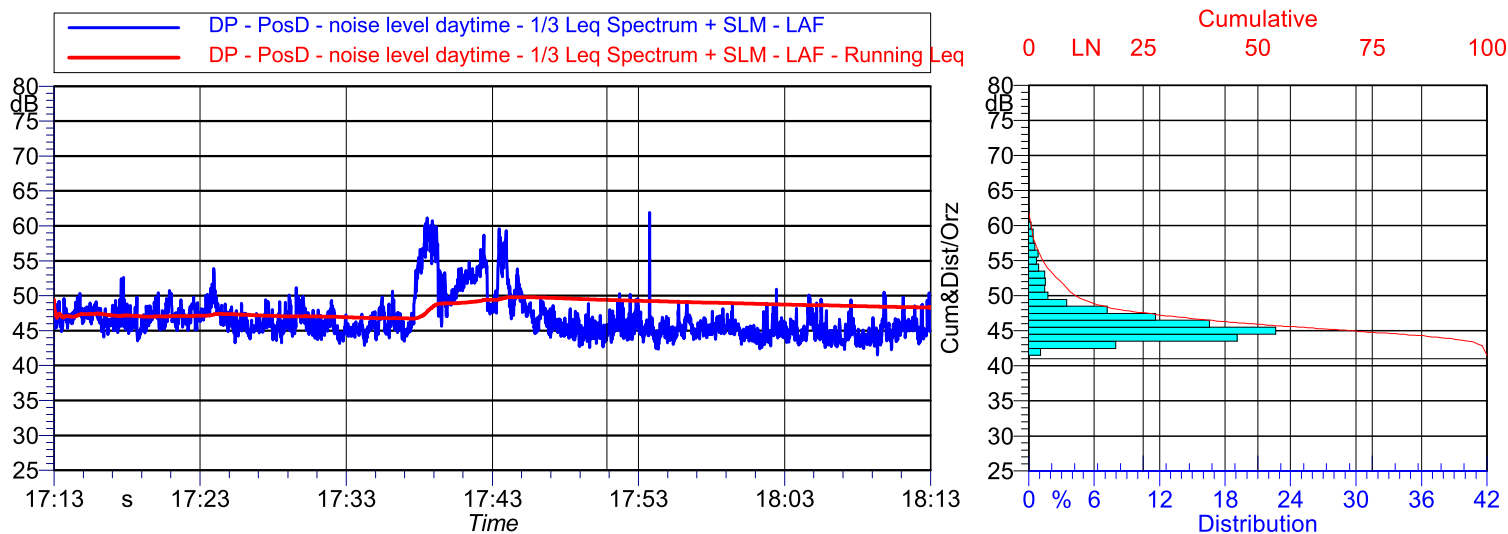
Values:

Const. time (Time History): Fast
LMin: 41.5 dB(A)
LMax: 61.9 dB(A)

LeqA : 48.3 dB(A)

Statistic Index:

L10: 50.1 dB(A)
L50: 45.9 dB(A)
L90: 44.0 dB(A)



Notes : Plant in normal working condition. Daytime

The sound level measurements and numerical calculations have been carried out in the following Technical Acoustics Environment:

Eng. Marco ANGELONI
Eng. Andrea BATTISTINI

Planimetric and photographic individuation



Noise measurement

Monitoring point : Delimara Plant - pos D - noise level nighttime

Data : 22/05/2014
Time : 00:01:26
Duration time: 60 min

Instrument : L&D 831
Serial: 2490

Weather : Clean Sky

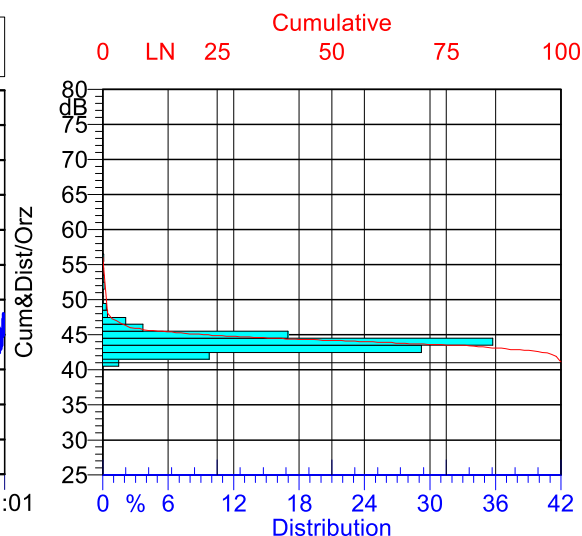
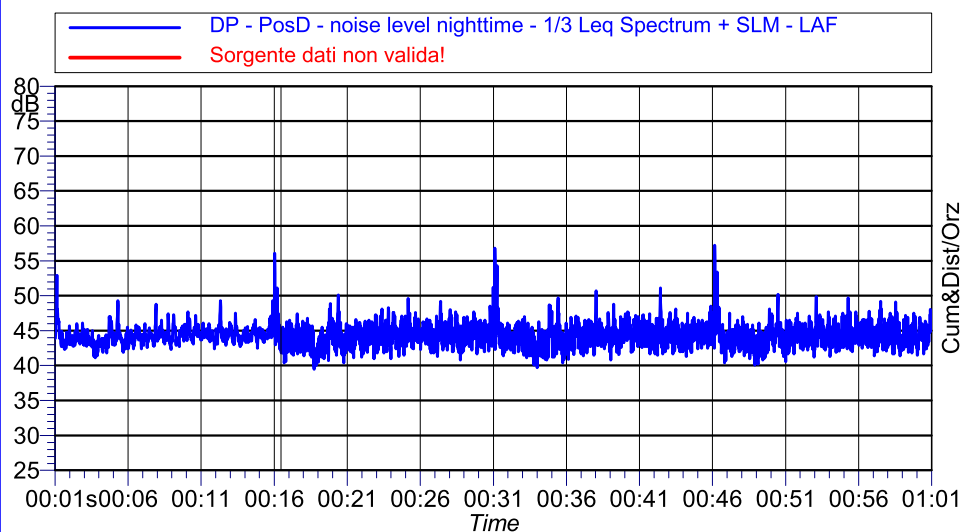
Values:

Const. time (Time History): Fast
LMin: 39.5 dB(A)
LMax: 57.2 dB(A)

LeqA : 44.7 dB(A)

Statistic Index:

L10: 46.3 dB(A)
L50: 44.2 dB(A)
L90: 42.3 dB(A)



Notes : Plant in normal working condition. Nighttime

The sound level measurements and numerical calculations have been carried out in the following Technical Acoustics Environment:

Eng. Marco ANGELONI
Eng. Andrea BATTISTINI