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Emitted noise in harbors – Effect of shore power

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The presentation will summarize and discuss the noise reduction from ships and offshore rigs in ports, due to the use of shore power. Comparisons of the measured noise reduction with theoretical calculations done in earlier international project will be presented. Noise measurements have been done on both passenger ship and offshore rigs in Kristiansand port, prior to and after connection of shore power. The measurements for passenger ship show marginal reduction of the total A-weighted noise level, but good effect in the lower frequencies. For offshore-rigs noise level on a port building has been continously registered, prior to and after connection to shore power. These measurements show reductions of the noise level from 12-16 dB, depending on type of rig and the emission level of the rig without shore power.

1 Introduction

The presentation will summarize:

- Theoretical calculations concerning noise reduction with shore power from earlier international project
- Noise reduction due to shore power for passenger ship (SuperSpeed)
- Noise reduction due to shore power for offshore rigs (Kristiansand port)

2 Effect of shore power – noise reduction

2.1 Theoretical calculations – international project

An earlier international project where DGMR was involved, showed the following calculated noise reduction due to use of shore power:

- Offshore-rigs 5-16 dB noise reduction of total A-weighted level
- Passenger ship 0-1 dB noise reduction of total A-weighted level

The effect of shore power is related to the different kinds of noise sources on ships and rigs. Shore power does not give significant noise reduction on ships where ventilation and fans are dominating noise sources.

2.2 Measurements for passenger ship (SuperSpeed)

Fig. 1 – Photograph showing the passenger ship SuperSpeed 1

There has been done noise measurements for passenger ship SuperSpeed in Kristiansand, both in November 2010 (without shore power) and in December 2016. The speed of the fans should be for same conditions in the two measurements, since both measurements are done at the same time of the year. The shore power system was with high voltage. Measurements of noise were done at a distance in measurement points with low background noise. The sound power level is calculated as for hemispherical source, and shows good match with typical L_w for passenger ships. The results are as following:

Table 1: SuperSpeed – emitted noise level, sound power level (L_w)

Frequency	Without Shore power (measured 2010)	With shore power (measured 2016)	Noise reduction
63 Hz	119 dB	113 dB	6 dB
125 Hz	112 dB	106 dB	6 dB
250 Hz	106 dB	102 dB	4 dB
500 Hz	105 dB	106 dB	-1 dB
1000 Hz	102 dB	103 dB	-1 dB
2000 Hz	96 dB	97 dB	-1 dB
4000 Hz	88 dB	83 dB	5 dB
8000 Hz	89 dB	74 dB	15 dB
Total level	107 dBA	107 dBA	

Fig. 2 – Photograph showing the shore power connection for passenger ship

The measurements show that the effect of shore power on the total A-weighted level is marginal, as the noise reduction in the lower frequencies and C-weighted level is significant. The noise reduction in the lower frequencies (below 250 Hz) is 4-6 dB. The uncertainty in the noise calculation is 1-2 dB. The effect of shore power on the passenger ship is limited by noise sources on the ship like ventilation, fans and kettles.

2.3 Measurements for offshore rigs

There has been done measurements for two offshore-rigs before and after connection to shore power. Measurements have been done as a long-time registration (2-3 years) on a port building. Shore power connection for the rigs were established some days after the rigs arrived the port. Therefore registrations of noise level in the nights with and without shore power connection have been done. The noise measurements show the relative difference in the same measurement point (at a distance from rig of 100 m), prior to and after connection to shore power. The measured noise reduction of shore power should therefore be very reliable. The power systems were low voltage:

- 1200 kVA, 60 Hz, voltage 440, 480 or 690 (supplier: Processkontrol Elektriska AB)
- 1400 kVA, 60 Hz, voltage 440-690 (supplier: PowerCon)

Fig. 3 – Photograph showing the shore power connection for offshore ri

The noise level has been continuously registered on a harbor building. The results are as follows:

1. COSL RIGMAR
    - Without shore power in the night: L_w 100 dB
    - With shore power in the night: L_w 87-93 dB

Fig. 4 – Photograph showing the rig COSL RIGMAR

2. COSL RIVAL
    - Without shore power in the night: L_w 110-112 dB
    - With shore power in the night: L_w 94-96 dB

Fig. 5 – Photograph showing the rig COSL RIVAL

The measurements are affected by background noise, for instance wind and rain on the steel plates (of the building) several nights. Investigation show good match between "lower effect of shore power" and nights with heavy rain. From the measurements referred above, shore power reduces the noise level from rig with at least 12-16 dB. The sound power level for the rigs are estimated with hemispherical modeling of the noise source calibrated against measured noise level at distances of 250 and 400 m. The calculated L_w for rigs show very good match with other noise data for such installations.

2.4 Summary

Noise measurements done in Kristiansand port give valuable information about the noise reduction due to shore power for both passenger ship and offshore rigs. The measurements show very good match with theoretical calculations from earlier international project.