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NOISE CONTROL FOR A BETTER ENVIRONMENT

NEPTUNES Measurement protocol and Noise Label

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ABSTRACT

The NEPTUNES (Noise Exploration Program To Understand Noise Emitted by Seagoing ships) project is about mitigating noise impact from moored ships around sea ports. This project is a combined effort from eleven ports around the world. Next to legislation and information, this project aims to reduce the annoyance caused by ship noise by pricing noisy ships as an aspect of port fees. This requires a noise measurement protocol that specifies how, and which sources must be measured under representative circumstances. Furthermore, the results will be transformed into a noise label to give ports easy input on calculating port fees. This paper provides information on the background and the status of this measurement protocol, the first measurement results and the corresponding noise labels.

Keywords: Ship, Ports, Measurement protocol, Noise label
I-INCE Classification of Subject Number: 89, 81

1. INTRODUCTION

Complaints about noise from seagoing ships at berth are increasingly becoming an environmental issue. This is mainly due to the rising population in residential areas around ports, the increase in the number of residential areas being built closer to the port itself and changing expectations from people living in these residential areas. The intensification of shipping and expansion of ports and ships also play an important role. There are several challenges to be overcome to reduce noise pollution from seagoing ships.

There is currently little recorded information or standardised data relating to noise and nuisance in and around ports or from seagoing ships and there has been no real attempt to design quieter seagoing ships that go further than protect seafarers from noise. To achieve sustainable port developments and operations, there is a desire to overcome these challenges and study what causes the characteristic noise generated by moored ships and how it can be mitigated.

Furthermore, no rules on sound production of ships is given in most countries, and surely not for sea going vessels sailing under foreign flags. An incentive for the design of more silent ships is not present.

2. THE NEPTUNES PROJECT

Because this problem involves ships calling at various international ports, the NEPTUNES (Noise Exploration Program To Understand Noise Emitted by Seagoing ships) project was launched by eleven ports in Europe, Australia and Canada.

The objectives of project NEPTUNES are:

• Structured insight into the scope, nature and cause of noise pollution from ship-generated noise and a brief description of effective noise mitigation measures that have already been implemented (or are already being implemented in industry fields).

• The presentation of a brief overview of laws and regulations related to noise pollution from ship-generated airborne noise.

• The development of a universal measurement protocol to measure ship-generated airborne noise.

• The development of guidelines for the classification of a ship based on its noise performance.

• The development of a best practice guide including noise reduction measures and noise awareness methods to be employed.

This paper looks at the measurement protocol and the noise label.

3. MEASUREMENT PROTOCOL

This chapter is almost a direct copy of the NEPTUNES Good Practice Guide [1].

The measurements will preferably be performed on board the ship concerned. The noise emission measurements on board the ship will be performed to determine the sound power level of the most dominant noise sources. The total sound power level of the ship will then be calculated from the sound power levels of the individual sound sources. Only in exceptional cases, such as proven denied access to the ship, complementary sound pressure measurements at a certain distance from the ship can be performed to determine the total sound power level of the ship (provided that the requirements for measurements at a certain distance can be met, e.g. low residual noise and accessibility).

Besides the broadband total sound power level, the total sound power level for 1/3 octave bands ≤ 160 Hz will be calculated (low frequency total sound power level). Guidance for how to calculate the sound power levels from the performed measurements is given in the measurement protocol.

The most dominant noise sources that are in operation in berth and that emit noise into the environment are expected to be:

- The funnel outlet(s) of the auxiliary engine(s)
- The opening(s) of engine room ventilation inlet and outlet
- The opening(s) of the cargo holds, ventilation and air conditioning inlet(s) and outlet(s)
- The opening(s) of the ventilation and air conditioning of passenger rooms, RoRo/RoPax and Cruise ships
- Further relevant ventilation openings (e.g. sanitary or galley exhaust)
- Pumps on deck (tankers)

The operation of cooled containers/reefers on container ships depends strongly on several indicators such as type of container, type and size of the ship, load on board the ship and port weather conditions. Therefore, the cooled containers/reefers are not considered for measurements or for the calculation of the total sound power level of the measured ship in the measurement protocol. Nevertheless, based on several measurements in the participating ports of NEPTUNES, an average sound power level of approx. L_{WA} = 91-93 dB(A) can be expected for one reefer in operation.

All seagoing ships have at least one main engine and two auxiliary engines. While the main engine(s) is/are used to drive the ship, the auxiliary engines are used to run electrical equipment on board (pumps, fans, reefers, lighting, etc. and many others). On

a moored ship, the main engine(s) is/are switched off, whereas the electrical equipment is usually driven by only one or two auxiliary engine(s). Most equipment is controlled by ship automation according to cargo handling requirements. The load of the auxiliary engine(s) can usually only be manually changed by the activation or deactivation of equipment. During cargo handling, this can only occur in a limited range.
The operating conditions thus strongly depend on many factors that cannot easily be controlled in the respect port conditions (e.g. current load of the ship, number of reefers, temperature, etc.).

During the measurements, the ship will therefore be operating in the characteristic/normal load of the ship at berth. The load condition during measurements must be chosen in such a way that the measured sound emissions are not exceeded at berth in any calling port (in most cases during high/maximum load conditions of the ship). It is important that the electrical load is kept as constant as possible during all measurements.

4. MEASUREMENT RESULTS

During the NEPTUNES project 29 measurements were performed on berthed ships. The first results for the container ships is given below in figure 1, as function of dead weight tonnage (DWT) a measure of the maximum load of a ship.

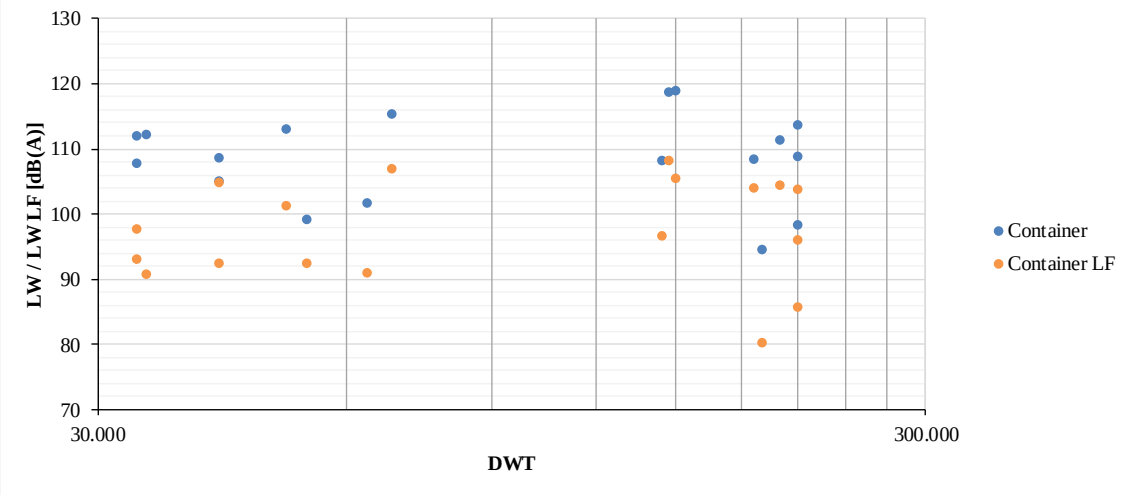

Figure 1: The sound power levels (total and Low Frequency) for container ships

No connection between sound power level and dead weight tonnage are clear as stated in earlier publications [2-4] for container ships. This may be caused by not considering the reefers.

5. NOISE LABEL

The noise label is developed in such a way that it can be used in all ports worldwide. Individual factors for different ports, such as environmental concerns, is not part of the noise label and where necessary may be considered in the classification system of each port. Details regarding the noise label are provided below. The label is based exclusively on the noise emission of ships at berth.

Other noise sources, such as noise from cargo handling, noise from reefers/cooling containers or manoeuvring, are not considered for labelling. The low frequency components are weighted twice as strong as the total sound power level, to accentuate the hindrance from low frequency components.

Table 1: calculation of scores

Part	Relevant parameter	Formula	Score range
1	Broadband sound power level	118-$L_{WA,total}$	≥ 0
2	Low frequency sound power level	2x[108-$L_{WA\ total \leq 160Hz}$]	≥ 0
3	Availability of a measurement report	Yes:20; no: 0.	0 or 20

The total score is maximized at 100 points.

The score for all measurements performed is given in figure 2.

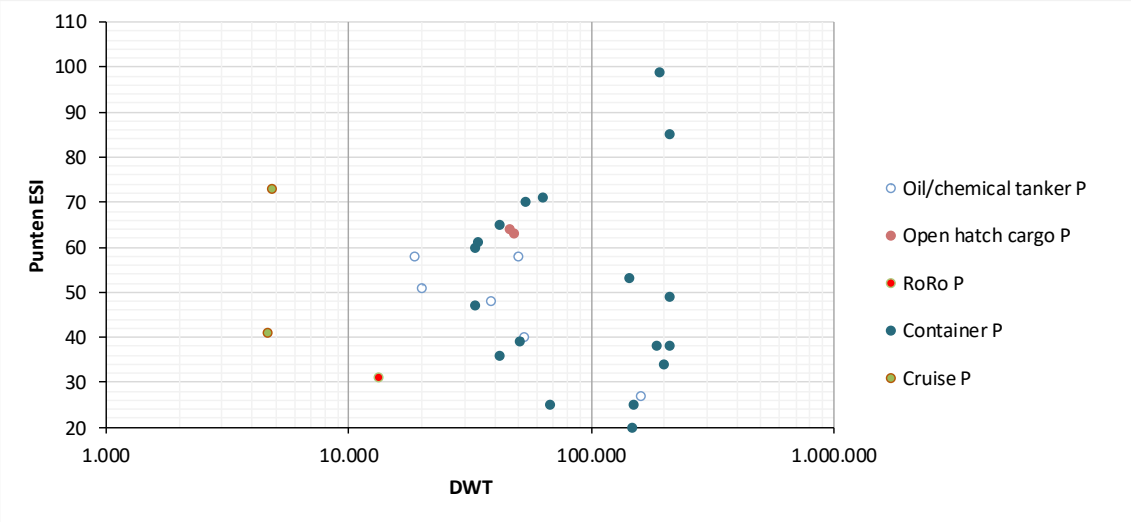

Figure 2: Points for the different measured ships

The chosen calculation format gives for these measurements a nice spread over the range. My fear that only cruise ships would get the highest number of points, is not confirmed (yet).

6. FUTURE

The ESI (Environmental Ship Index) that in similar ways consider the air pollution ships cause, is willing to incorporate noise in their index, as well as other parties. The next step is for ports to translate this noise label into reductions of port dues.

If many ports include noise labels, ship owners and designers will become more conscious of the sound production and will take measures. In time we may have to redefine the calculation of the scores to make sure that the incentive for building silent ships continues.

In the future also, the IMO (International Maritime Organisation) will be asked to formulate rules for the noise that ship makes to their surrounding areas.

7. CONCLUSIONS

With the measurement protocol, the noise label and the involvement of the ESI and the like, a step forward in reducing noise from sea going ships is established.

6. REFERENCES

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