

## „NS MIRCEA” COMPARTMENTS CLASSIFICATION AND NOISE ANALYSIS OF THE MARINE ENVIRONMENT BY ACOUSTIC EMISSIONS

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**Abstract:** This paper presents experimental conditions, equipment, and methods used to determine emissions measurements recorded sound (noise) produced by the technique and equipment on board „NS Mircea” held during march 2014 and the noise level recorded in the coastal marine environment. The results obtained allowed the classification of the vessel compartments after recorded and reported emissions standards in the field of noise and noise analysis for the coastal marine environment from different sources.

**Keywords:** noise level; noise analysis; noise emissions

### INTRODUCTION

In the early nineteenth century, the famous German Robert Koch Bacteriological mention the following statement on the fight against noise visionary "One day fight against noise will go with the same rigor as in past centuries plague and cholera fight." From specialized studies, it appears that exposure to noise can result in a reaction manifested primary form of stress. If this exposure is short, human body typically returns to normal in a few minutes or to the previous noise exposure. Problems started when exposure are significant long or repetitive aspect that can generate definitive deterioration of neuro-sensitive systems, digestive, endocrine and circulator. In Romania, based on data reported by the National Statistics Institute [1] The proportion of households who consider that the population suffers from noise exceeds 25% (Figure 1).

In general, noise decreases direct labor capacity by reducing the possibility of intellectual concentration; decreased accuracy and efficiency of movement; decreased or distraction; increase energy expenditure required to perform a given physical effort; difficulty collecting verbal information (orders, commands); Voice and brain overload.

According to the legal provisions in force, employee health and safety by implementing a noise management must include:

- Identifying the sources generating noise;
- The measurements of noise to see between what limits fall;
- Monitoring the health of workers;
- Appropriate signs jobs;
- Technical measures to reduce noise;
- Training of employees on the risks posed by not suitable protecting equipment in workplaces with a high noise level; [2].

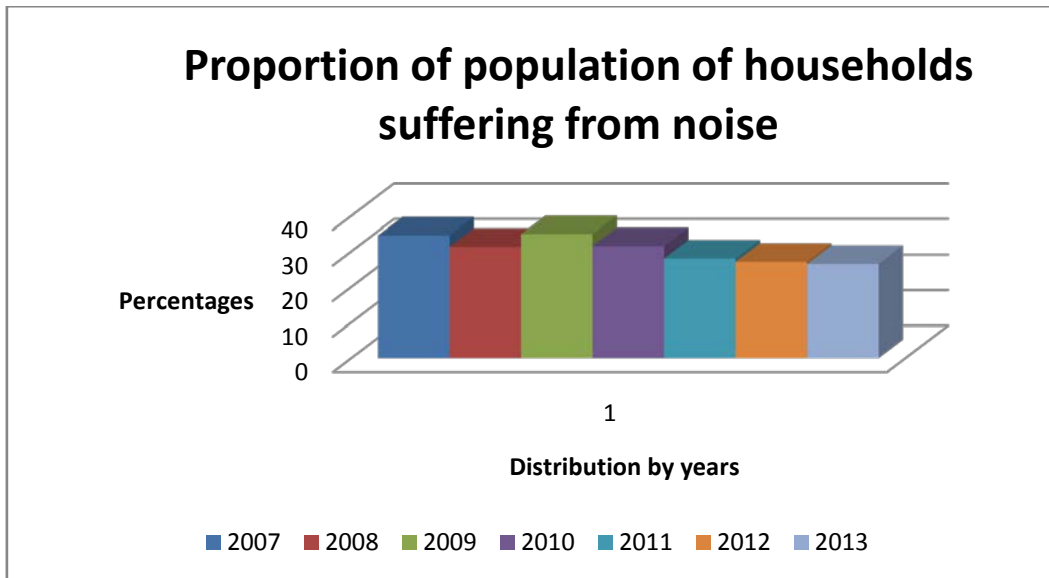


Figure1. The percentage of the population suffering from noise

In interpreting the results obtained from measurements made with the meter is taken into account, in particular, two clear situations:

A. The maximum permissible limit of noise (sound stage) to request jobs normal neuropsychological and psychosensorial is 87 dB (A) level of personal daily noise exposure.

So in these jobs for professional risk is particularly inner ear hearing loss and can cause deafness and professional.

B. maximum permissible limits of the soundstage (professional noise) to request neuropsychological jobs and enhancing psychosensorial particular are those referred to art.595 and Table no.15 of NGPM / 2002. [3]

For seafarers, currently existing studies based on IMO statistics (Figure 2), studied in the category of ships, revealed the following values of noise on different sections:

## Noise levels onboard ships

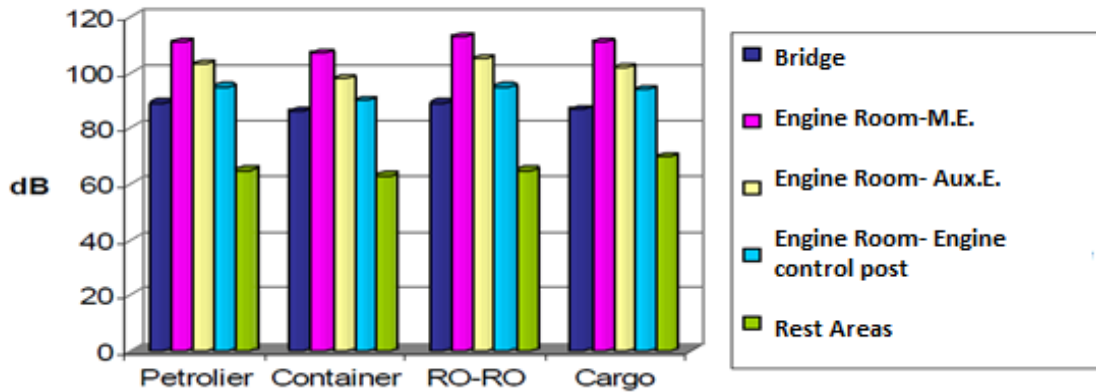


Figure 2 The global values of noise levels in different compartments of the vessel after IMO statistics

### EXPERIMENTAL METHODS AND PROCEDURES WORK

The experimental conditions, equipment and methods used to determine acoustic emissions (noise) produced by the

technique and equipment on board the ship "Mircea NS" in the period 23.04 - 04.24.2014

The equipment of the vessel main .Characteristicile play a role in the production of acoustic emission, are presented in Table 1.

Table 1. The main equipment of the vessel with a role in producing the acoustic emissions

TYPE OF VESSEL	VESSEL CHARACTERISTICS	
N.S. Mircea Shipyard: Blohm&Voss, Hamburg, Germania Building year: 1939 First operation year: 1939	Main engine (nr.xtip, putere)	1 x 6M451 AK, 1.100 CP
	Diesel generator (nr.xtip)	3 x MAN-STAMFORD, 132 kVA, 50 Hz, 400 V
	Emergency diesel generator (nr.xtip)	1 x Mazda-Westberbeke, 25 kVA, 50 Hz, 220 V
	Proppeler (buc./tip/nr. pale)	1 / variable pitch propeller, 3 blades

Conditions for making measurements

- > The period of execution  
23.04-24.04.2014
- > Measuring points

The measurements were performed with the ship underway and at anchor compartments agreed with the crew.

Compartments and conditions under which measurements were made are:

Nr. crt.	TYPE OF VESSEL	MEASUREMENT POINTS
1.	NS "Mircea"	Cab officer Camera rudder Barrack no. three Barrack no. February Above the tunnel axial line DG load Mouth ventilation bridge Main engine idling Main engine at full load pilot house Tunnel Idle axial line Tunnel axial line at full load Bridge center - with siren / None Lest 1.2 3

### EQUIPMENT USED

When choosing measuring points was envisaged location measuring equipment in accordance with the laws in force.

Measurements N.S. Mircea were made at 1.2 m above the floor (deck). Microphone positions were chosen at not less than 0.75 m from the surface reflection (bulkheads, etc.) to the exhaust openings (discharge) and to the person who performed the measurement, in order to minimize the effects of reflection and flow fluids.

The apparatus used

For the measurement, recording and processing of data concerning noise using a measuring chain, consisting of:

- > Hardware:
  - Bruel & Kjaer Sound Level Meter Portable model 2250-1 pcs .;
  - Microphone ½ inch free field 4189-1 pcs .;
  - Bruel & Kjaer type microphones Calibrator 4231-1 pcs
  - Noise Dosimeter Bruel & Kjaer type 4445-1 pcs .;

Instrumentation is as under:

- IEC 651: 1979 - level meter
- IEC 804: 1985 - integrating sound level meters

and allowing sound pressure measurements in the band 31.5 - 16000 Hz.

For measurements were used only instruments and sensors that meet the requirements of the International Electrotechnical Commission - IEC (International Electrotechnical Commission) publication 651 (device for precise measurement of the sound level) on measurement accuracy.

Before the measurements, measuring chain was calibrated with a standard secure (certified), at least one frequency (1000 Hz).

The noise level was measured in decibel scale A (reference level  $2 \times 10^{-5}$  Pa). Noise spectrum was recorded by measuring sound pressure levels in 1/3 octave bands with frequencies between 31.5 and average 16,000 Hz.

**MEASUREMENTS RECORDED ACOUSTIC EMISSION LEVELS (NOISE) PRODUCED BY THE TECHNIQUE AND EQUIPMENT ON BOARD THE SHIP "MIRCEA NS"**

Table No. 2. Noise measurement results in tabular form LAeq [dB]

Nr crt	Data measurement and general conditions	Section							
		Central Bridge	Engine room	Petty officer dining room	Cab 2	Axial line	Lest 1	Lest 2	Lest3
1	23.04.2014 The ship started marching MP, DG ON, Mist	With the use of siren: 120	104,6	69	71,8	96	60	60,1	60,5
2	24.04.2014 The ship at anchor DG III - bow started	Without the use of siren: 62	95	67	50	80	60	60	63
3	24.04.2014 The ship anchor DG I - stern started	63	99,6	72	50	78	53	56	58

**ANALYSIS OF ACOUSTIC EMISSION LEVELS RECORDED INSIDE THE NS "MIRCEA"**

Acoustic emissions recorded for analysis, reporting is required STANAG 4293 standard, which specifies the acoustical environment of surface ships of the Navy composition, in terms of maximum noise level (MNL) and noise characteristic curve (NRC) and levels disruption of sounds the human voice (SIL). Maintaining a proper acoustic environment is necessary to prevent:

- impaired hearing loss and other health personnel;

- disruption of communication in operational and working spaces;
- reducing crew efficiency;
- disruption of recovery and recreation conditions in living quarters.

MNL is normally acceptable noise level in a room or compartment, originated from permanent equipment mounted indoors or outdoors, working in specific regimes. MNL levels are given in decibel scale A, the baseline is  $2 \times 10^{-5}$  Pa (N / m<sup>2</sup>), and are presented in the Table. 3.

Table nr. 3

Compartment / Compartment Type	Ship's position	
	At anchor, the onboard energy	
	dB(A)	NRC
Medical facilities (nursing)	50	45
Bedrooms	50	45
Squares, dining rooms	50	45
Offices, libraries	65	60
Kitchen, office, gym, laundry, lockers	70	65
Machinery and plant compartments that have permanent staff, control points (observation) in rooms	90	85
Compartments machinery and plant personnel temporarily employed with supervisory tasks, control points (observation) outside	110	105
ME control compartment, control compartment damage		
Workshops less specific workshops with electronic	80	75
Electronic specific workshops	70	65
Ammunition compartment	75	70
Wheelhouse, chartroom drawing room controls, central leadership of the struggle and related departments occupied by personnel, control compartment sonar, electronic countermeasures section	60	55

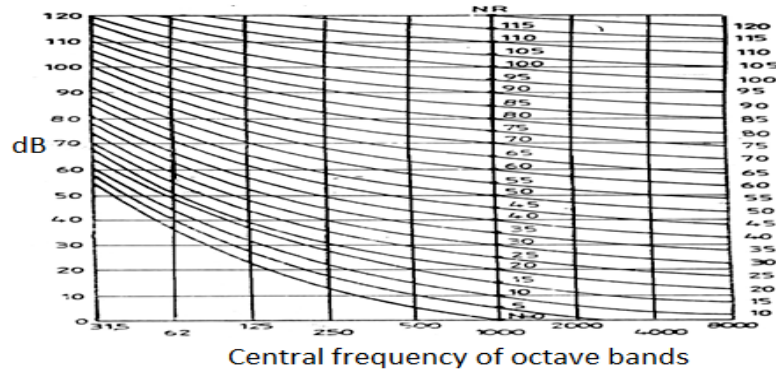


Figure 3. Central frequency of octave bands

Graphs NRC (R ISO 19961), shown in Figure 3 will be used when the levels exceed MNL. In these cases registrations are necessary in 1/1 octave bands between 31.5 Hz and 8000 Hz.


The level of disturbance emitted by the human voice sounds (SIL) is a table (index) for assessing the communication disturbance by noise. It represents an average

sound pressure levels in octave bands 1/1 frequency which centers 500, 1000, 2000 Hz.

In Table. 4 shows comparative analysis of the measures implemented in the different compartments with the values provided in specialized standards

Table 4 Comparative analysis table of measures implemented in compartments

Nr crt	Data measurement and general conditions	Compartment							
		Central Bridge	Engine room	Petty officer dining room	Cab 2	Tunnel axial line	Lest 1	Lest 2	Lest3
1	23.04.2014 The ship started marching MP, DG ON, Mist <b>LAeq [dB]</b>	Cu utilizarea sirenei: 120	104,6	69	71,8	96	60	60,1	60,5
	Limit values According to Table nr. 1 and Figure 1	LAeq [dB] = 110 <b>NRC [dB] =105</b>	LAeq [dB] = 90 <b>NRC [dB] =85</b>	LAeq [dB] = 50 <b>NRC [dB] = 45</b>	LAeq [dB] = 50 <b>NRC [dB] = 45</b>	LAeq [dB] = 110 <b>NRC [dB] =105</b>	LAeq [dB] = 60 <b>NRC [dB] =55</b>	LAeq [dB] = 60 <b>NRC [dB] =55</b>	LAeq [dB] = 60 <b>NRC [dB] =55</b>
2	24.04.2014 The ship at anchor DG III - bow started	Fară utilizarea sirenei: 62	95	67	50	80	60	60	63
	Limit values According to Table nr. 1 and Figure 1	LAeq [dB] = 110 <b>NRC [dB] =105</b>	LAeq [dB] = 90 <b>NRC [dB] =85</b>	LAeq [dB] = 50 <b>NRC [dB] = 45</b>	LAeq [dB] = 50 <b>NRC [dB] = 45</b>	LAeq [dB] = 110 <b>NRC [dB] =105</b>	LAeq [dB] = 60 <b>NRC [dB] =55</b>	LAeq [dB] = 60 <b>NRC [dB] =55</b>	LAeq [dB] = 60 <b>NRC [dB] =55</b>
3	24.04.2014 The ship anchor DG I - stern started	63	99,6	72	50	78	53	56	58
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Color legend:  

 Value admissible  
 Value to limit the admissibility  
 Value inadmissible

**CONCLUSIONS FOR THE PROTECTION OF PERSONNEL ACTION EMBARKED ACOUSTIC EMISSIONS**

From the above, it is found that the noise level in more than 50% of the measurements points on board ship Mircea march NS (MP started, DG ON) do not fall within the allowable limits exceeding the benchmarks of STANAG 4293

1. In all 3 different conditions measurements in engine room and Petty officer room were measured values over the admissible standards.

2. To have an overview of noise on board is necessary to make measurements with the ship in march / stationary at different speed regimes (according to STANAG 4293), using a large number of points;
3. It is necessary to monitor more closely the noise in ship compartments where the level of speech intelligibility is critical;
4. In order to limit conditions like hearing loss and other shortcomings of health personnel, in addition to the posters above, should be imposed rule of wearing earplugs;
5. Requires equipment with noise dosimeters to staff working in extremely noisy areas.

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- [4] \*\*\*Standardul de zgomot ISO R 19961
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