DRAFT TANZANIA STANDARD

ACOUSTIC- GENERAL TOLERANCE LIMITS FOR UNDERWATER NOISE

0. Foreword

Sound in the aquatic environment is generated by a broad range of sources, both natural and human (anthropogenic), for intentional use or as the unintended consequence of activity in the aquatic environment. In natural environment, sounds are originated by: waves, rain, wind, and seismic events which contribute to ambient or background noise. Living organisms, such as certain species of whales, seals, fishes, and shrimp, also produce sounds that can be detected underwater. In fact, the presence of sounds originated naturally in the marine environment are tolerable with marine organisms. The introduction of extra sound/ noise into the marine environment has increasingly caused concern over possible effects upon animal life. These extra sounds referred as "**Underwater noise**" affect marine mammals which depend upon sound for navigation, hunting, reproduction and communication.

Anthropogenic underwater noises are generated by a variety of activities, including commercial shipping (with sound emissions greatest in the main shipping routes, coastal and port areas); oil drilling and production, dredging and construction, sonar systems, oceanographic research and geophysical surveys. Some underwater noise can be generated intentionally or unintentionally. Intentional noise in marine environment are produced for an explicit purpose, such as seismic surveying to find new fossil fuel reservoirs (increasingly in deep water, but with emphasis on the continental shelf) while unintentional sounds are generated as a byproduct of some other activity, such as noise radiated by a ship's machinery as it crosses the ocean.

Anthropogenic underwater noise sounds may be of short duration (impulsive) or long lasting (continuous). The impulsive underwater noise include sounds from explosions, air-guns, pile drivers, and sonars. These sources produce impulsive noises which may be repeated at intervals (duty cycle). The repetition noises may become diffuse with distance and reverberation and become indistinguishable from continuous noise. On other hand, noise from a fixed, ongoing source like an operating drillship, an aircraft or a ship is continuous. Depending on its frequencies, underwater noise with higher frequency transmit less well in the marine environment whereas lower frequency noise can travel far. Anthropogenic underwater sources have a hierarchy of effects on marine animals, which depend critically on the distance from the sound source, the sound frequency and intensity, and on the hearing, vocalization, and other biological characteristics of the organism. For a given source, the effects diminish with range depending on sound attenuation and the organism's sensitivity.

Underwater noises due to anthropogenic can affect behaviors and have an impact upon organisms in other ways as well. For example, masking (the drowning out of certain sounds by other sounds) can reduce the effective communication distance among conspecific organisms. These noises can also cause physiological impacts, such as temporary or permanent threshold shifts (temporary or permanent hearing loss and tissue damage).

In drafting this underwater standard assistance were driven from, Ocean noise and Mammals, under national research council (2003) and International regulation of underwater sound, establishing rules and standards to address ocean noise standards by Elena Mc Carthy (2004)

1. Scope

The standard sets out general tolerance limits for underwater noise as a results of human activities (Anthropogenic). The standard identify and categorize all the sources of underwater noise into main three groups

a) Low and mid-frequency Impulse
b) High frequency Impulse anthropogenic activities
c) Low frequency continuous sounds.

2. Normative References

For the purpose of this draft Tanzania Standard the following references shall apply:

EMDC 5 (6024)/ISO 18405: 2017 (Ed 1) Underwater acoustics- Terminology

EMDC 5 (5841)/ISO 18406: 2017 (Ed 1) Underwater acoustics: measurements of radiated underwater sound from percussive pile driving.

EMDC 5 (5858)/ISO 17208-1:2016 (Ed 1) Underwater acoustics – Quantities and procedures for description and measurement of underwater noise from ships- Part 1: Requirements for precision measurements in deep water used for comparison purposes.

3. Terminology

For the purpose of this draft Tanzania Standard, the following definitions shall apply:

3.1 civilian sonar

uses of sonar for other purpose rather than military

3.2 continuous wave or continuous waveform (CW)

an electromagnetic wave of constant amplitude and frequency, almost always a sine wave, that for mathematical analysis is of infinite duration.

3.3 decibel

a logarithmic measure of the relative amplitude of two quantities. The two quantities being compared must have the same units so that their ratio is unitless. In underwater acoustics, the standard unit of acoustic pressure is the micro Pascal (μPa), or one-millionth of a Pascal.

3.4 impulsive sound

specific sounds that are often transient, and which are characterised by a rapid rise time and high peak pressures

3.5 merchant vessels

ships that are primarily used either for carrying cargo or passengers. Basically, the ships that are engaged in active commercial transportation fall in this category. The navy ships or pleasure craft that don't charge passengers are excluded from the category of merchant vessels.

3.6 ocean Noise

the underwater sound from all types of noise sources, including noise from specific identified sources as well as ambient noise. For the purposes of evaluating the potential effects of underwater sound on the marine environment, both ambient noise and the noise from identified sources must be considered

3.7 permanent threshold shifts

Prolonged exposure to noise causing permanent hearing damage

3.8 sonar

technique that uses sound propagation (usually underwater, as in submarine navigation) to navigate, communicate with or detect objects on or under the surface of the water, such as other vessels

3.9 temporary threshold shifts

temporary hearing loss and tissue damage

4 Requirements

TABLES -The tolerance/required sound level limits for underwater activities.

4.1: Shipping							
Source	Temporal Variability			Source Characteristics		Permissible values (dB re 1 µPa at 1 m)	Method of Test
	Large scale (Wks-Mos)	Mild Scale (hrs –days)	Small scale (ses-Mins)	Signal structure	Spectral content		
Mecharnt	Constant presences			Occasional transient due to operations activity on vessel		160-220	Calibrated Hydrophones
Utility	On site for works	Down-hrs		Numerous transients due to the nature of operations	For all shipping broadband energy from 10Hz to >1KHz with spectral lines rising above B/B due to propulsion, blades, turbine, generators	160-200	
Military		On site (hrs to days)		General level up and down with exercise		160-220	

				/War fighting requirement			
Scientific	On site for Days	Down to mins			Stop and start behavior driven by data collection schedule	160-200	
Recreation/ Others	Wks				Highly variable	160-190	

4.2: Sonars (Apply in the Military)							
Source	Temporal Variability			Source Characteristics		Permissible values (dB re 1 µPa at 1 m)	Method of Test
	Large scale (Wks-Mos)	Mild Scale (hrs – days)	Small scale (ses-Mins)	Signal structure	Spectral content		
Surveillance	On site for weeks	Down to days		Pulsed tones	<1 kHz	>230	Calibrated Hydrophones
Tactical		Onsite for hrs	Down to Min	Pulsed tones	>1kHz to <10kHz	200 to 230	
Weapon/Counter Weapon		Hrs – appro. To day	Down to min	Pulsed tone	>0kHz to >100kHz	190-220	

4.3: Sonars (Apply in the Civilian)							
Source	Temporal Variability			Source Characteristics		Permissible values (dB re 1 µPa at 1 m)	Method of Test
	Large scale (Wks-Mos)	Mild Scale (hrs – days)	Small scale (ses-Mins)	Signal structure	Spectral content		
Communication		hrs	To min(s) tones	CW/Pulsed	Low kHz to >10kHz	180-210	Calibrated Hydrophones
Navigation		Hrs/days	Min(s)	CW/Pulsed	Low kHz to >10kHz	180-220	
Hi-resolution			Min(s)	Pulsed tones	>10kHz to >100kHz	160-220	
Acoustic				Series of pulse 10-500 mses w/interpulse	5-30 kHz typically	130-150	

4.4: Underwater Research							
Source	Temporal Variability			Source Characteristics		Permissible values (dB re 1 µPa at 1 m)	Method of Test
	Large scale (Wks-Mos)	Mild Scale (hrs – days)	Small scale (ses-Mins)	Signal structure	Spectral content		
Research activities		Down to days/hrs				160-220	Calibrated Hydrophones

4.5: Explosions							
Source	Temporal Variability			Source Characteristics		Permissible values (dB re 1 µPa at 1 m)	Method of Test
	Large scale (Wks-Mos)	Mild Scale (hrs – days)	Small scale (ses-Mins)	Signal structure	Spectral content		
All atcivities invloving explosion such as extraction of oil, gases			secs	Impulsive	Broadband	<240	Calibrated Hydrophones

4.6: Seismic exploration							
Source	Temporal Variability			Source Characteristics		Permissible values (dB re 1 µPa at 1 m)	Method of Test
	Large scale (Wks-Mos)	Mild Scale (hrs – days)	Small scale (ses-Mins)	Signal structure	Spectral content		
All atcivities invloving Seismic exploration		One sites for days		Impulsive	Broadband	<240	Calibrated Hydrophones

4.7: Indutrial Activity							
Source	**Temporal Variability**			**Source Characteristics**		Permissible values (dB re 1 µPa at 1 m)	Method of Test
	Large scale (Wks-Mos)	Mild Scale (hrs – days)	Small scale (ses-Mins)	Signal structure	Spectral content		
Constructions	Weeks to months	Down to days		Broadband and tones/CW	<10Hz to 1kHz	< 120	Calibrated Hydrophones
Dredging	Weeks to Month	Down to days		Broadband and Tones	<10Hz to 10KHz	160 -180	
Power Plants	Constant process			CW and some transients		120 - 150	
Factories	Constant process			CW and significant transients	<100 to several 100Hz	120 - 150	
Transportation	Constant process			Same as shipping		170 - 210	
4.8: Drilling							
Semisubmersible drilling vessel	Weeks to months			Broadband and tones/CW	10-4000	120-170	Calibrated Hydrophones
Drillship	Weeks to months				20-1000	170-190	
Bottom-founded oil drilling				Broadband and tones/CW	4-40	120-130	

4.9: Miscellaneous							
Source	Temporal Variability			Source Characteristics		Permissible values (dB re 1 µPa at 1 m)	Method of Test
	Large scale (Wks-Mos)	Mild Scale (hrs – days)	Small scale (sec-Mins)	Signal structure	Spectral content		
Aircraft/ Overflight	Constant process			Both CW and broadband	200 Hz to 1KHz	<100	Calibrated Hydrophones
Military activity nonsonar		hrs	Down to Sec	Impulsive and broadband	5 to 160 kHz	185 – 195	

Note:

Mos -months
Hrs - hours
Sec- seconds

Mins – minutes
Down-minimum value from the higher scale to the maximum value of the next scale of the temporal variability