



Frequently Asked Questions About Offshore Wind Sonar and NMFS' Level B Harassment Threshold

Please explain why offshore wind (OSW) sonar activity happens.

OSW construction projects require marine characterization surveys to inform as to the conditions of the seabed where the turbines and other project infrastructure will be embedded. High resolution geophysical (HRG) equipment is used to generate strong, but quick bursts of sound that reflect off the seabed and produce an image of the bottom topography. Sub-bottom profilers penetrate below the seabed to assess subsurface conditions.

What is an incidental harassment authorization and why is it needed?

The Marine Mammal Protection Act (MMPA) exists to protect whales and other marine mammals from any act that “harasses, hunts, captures, kills, or attempts to harass, hunt, capture, or kill” them. These acts are called “takes” and are generally prohibited without a special permit, called an incidental harassment authorization (IHA) or incidental take permit.

Sonar-based survey equipment can produce sounds that are harmful to marine mammals. For this reason, NMFS requires OSW developers to secure IHAs. An IHA grants developers conditional permission for sonar surveys to proceed, as long as the areas around the offending sonar equipment are monitored and actions are taken to ensure marine mammals do not encounter harmful noise levels. An IHA can only be requested if “there is no potential for serious injury or mortality, or the potential for serious injury or mortality can be negated through mitigation requirements” ([NOAA, 2013](#)). If an applicant cannot meet these conditions, then they must request a 5-year letter of authorization (LOA).

IHAs permit two levels of harassment, Level A and Level B ([NOAA, 2022](#)), as follows:

- Level A harassment means any act of pursuit, torment, or annoyance that has the potential to injure, but not seriously injure marine mammal or marine mammal stock in the wild. Level A harassment could result in permanent threshold shift (PTS) of some degree or lung or gastrointestinal (g.i.) tract injury. PTS is a form of permanent hearing impairment.
- Level B harassment refers to acts that have the potential to disturb (but not injure) a marine mammal or marine mammal stock in the wild by disrupting behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering. Level B harassment could also result in temporary threshold shift (TTS) which is hearing impairment that is not permanent.

Exposure to noise above the permitted level is deemed a “take” under the IHA.

The IHAs issued for OSW sonar also include exclusion or shut down zones where all activity must be halted if an animal comes within a pre-set distance of the active sonar. This distance varies by species, but it is typically 500 meters for the critically endangered North Atlantic right whale and other species listed under the Endangered Species Act, and 100 meters for other marine mammals including the Atlantic humpback whale.

How many IHAs have NMFS issued for OSW activity?

Since 2016 NMFS has issued over fifty 1-year conditional IHAs for the purposes of surveying and constructing wind energy facilities along the U.S. coast from Massachusetts to the southern tip of North Carolina. By mid-July 2023, fifteen IHAs remained active with another fourteen new applications for IHAs and Letters of Authorization (5-year permits) under review by NMFS.

In the aggregate, the active and pending applications, according to NMFS's own calculations, authorize nearly 600,000 instances of take, corresponding to more than 20,000 individual whales, 477,000 dolphins, and over 101,000 seals, including over 292,000 of a single species (common dolphin). For the critically endangered North Atlantic right whale, active and pending applications permit just over 1,000 incidences of Level B take (Green Oceans, 2023). In most cases, the authorizations allow Level B harassment, however, pending applications before NMFS seek Level A takes of 450 individual whales including the endangered blue, fin, sei, and sperm whales.

Under the MMPA, NMFS is only allowed to authorize 'small' numbers of mammals although 'small' is not defined in regulation. NMFS will "typically look at whether the total taking will be small relative to the estimated pop size" ([NOAA, 2017](#)).

Does NMFS have established limits in decibels on noise to protect marine mammals from harassment?

Yes. NMFS defines two separate limits when regulating anthropogenic noise depending on the characteristic of the noise. For noise that is continuous, NMFS has defined a Level B harassment threshold of 120 decibel (dB). For impulsive noise, which is characterized as having a high peak sound pressure with rapid rise time and rapid decay, the Level B threshold is 160 dB.

Level A sound limits are defined by NMFS as the point where a marine mammal will be exposed to noise that could inflict injury such as permanent hearing impairment. Under NMFS' scheme, Level A limits vary according to the hearing frequency range of the different marine mammals and the duration in which the animal is exposed to the loud sound. The focus of this FAQ is Level B harassment.

Distance is the only true mitigation for loud noise. The noise level in dB when measured at the sonar device registers its highest levels, but as the noise travels through water and away from the source it loses energy and ultimately dissipates. Under the NMFS standard, mammals must stay a sufficient distance away from the sonar so that the animal does not encounter levels above 120 dB for continuous noise and 160 dB for impulsive noise.

These noise levels are measured in "decibel root mean square" (dB,rms) referenced to 1 micropascal (μPa). In simple terms, this unit expresses an averaging of the peak sound levels emitted from a source over a period.

I was following until you mentioned 1 microPascal and dB,rms? What are those and why do they matter?

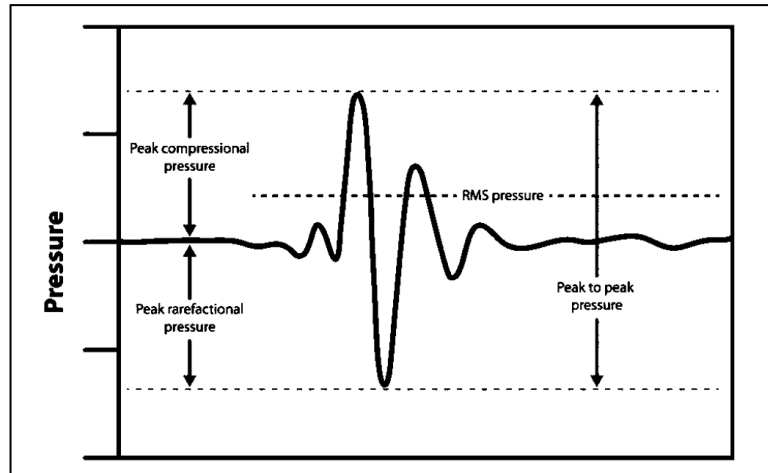
Acoustics is a complex topic, but it is important to generally understand the metrics NMFS uses to regulate noise. We address both questions below.

- a) **What is 1 microPascal (μPa)?** A micropascal is a unit of pressure. Sound waves move differently depending on the medium in which they exist. Noise travels in water at a different rate than in air. Given that difference, decibel levels measured in water cannot be compared directly to decibel levels in air. Decibels in water are referenced at 1 μPa versus air at 20 μPa . For the purposes of this FAQ, the NMFS' 120 dB and 160 dB limits in water translate roughly to 58 dB and 98 dB in air, or a difference of 62 dB between water and air. All decibel values in this FAQ are referenced to 1 micropascal (μPa).

b) What is dB,rms? The rms metric applies averaging to the sound levels when they are reported. Expressing sound levels as an average can be useful when an impulsive sound comprised of rapid successive peaks include levels that can change from peak to peak. The figure on this page graphically represents this condition. You can see in the graph that there are multiple different peaks within the wave. The rms sound pressure level is represented by the middle dashed line.

A consequence of utilizing the rms standard for regulating harmful impulsive noise is that the peak levels are averaged out. For this example, the tallest peak in the graph could be 170 dB,peak while the rms line could represent NMFS' limit of 160 dB,rms. An RMS metric could result in under-estimating the risk of acoustic harm to animals (or humans). In practice, even if a whale stays away from the 160 dB,rms setback distance, the animal could still encounter peak noise levels that exceed the 160 dB,rms limit.

Averaging eliminates the rapidly changing peaks on paper, but it does not eliminate peak noise levels experienced by mammals in the ocean. There is an ongoing debate over whether averaging peak values is appropriate for noise control. Nonetheless, this is the metric NMFS applies.



What is meant by source level (SL) sound in decibels?

The source level or SL is the sound in decibels when measured 1 meter from the device. Generally, as noise moves away from the source, it loses energy, and its level in decibels drops.

How does NMFS use dB,rms levels to determine safe distances from sonar noise?

NMFS has developed a spreadsheet model that calculates noise propagation in water. By inputting the source sound level in dB,rms and threshold limit (120 dB,rms or 160 dB,rms) into the model along with several other parameters the NMFS model will report the distance in meters at which the sonar sound should dissipate down to the NMFS protective limit. The expectation is that a marine mammal that stays outside the distance is deemed safe. If the marine mammal strays closer to the sonar, it will be counted as a 'take' of animal.

How do OSW developers apply this model?

The best way to demonstrate this is to show the results of the model by using one of the popular sparker sonar devices for OSW sonar applications. This would be the Geo-Marine Geo-Source 400 tip, 800 joule sparker sonar. According to the Geo-source manufacturer, the device has a typical peak source level of 226 dB,peak when measured 1-meter away. Since the manufacturer does not readily provide the corresponding dB,rms for the device, NMFS recommends developers follow its 2020 *Interim Recommendation for Sound Source Level and Propagation Analysis for High Resolution Geophysical Sources (NMFS 2020)* which says to subtract 7 dB from the peak to arrive at the dB,rms for sparker device. Doing so shows the rms is 219 dB,rms (226 dB – 7 dB).

The resulting Level B harassment distance for an impulsive noise (160 dB,rms) pops up at 890 meters.

INPUT VALUES (LEVEL B)		COMPUTED VALUES (LEVEL B)	DO NOT CHANGE
Threshold Level	160	alpha (dB/km)	0.00882342
Source Level (dBrms)	219	TL coefficient	20
Frequency (kHz)	1	Slant distance of threshold (m)	890
Beamwidth (degree)	180	Vertical depth of threshold (m)	5.45191E-14
Water depth (m)	60	Horizontal Threshold Range (m)	890

If the developer enters the lower 203 dB,rms level which is the case for many of the IHA applications that NMFS reviewed and approved, the resulting distance is much shorter at 141 meters.

INPUT VALUES (LEVEL B)		COMPUTED VALUES (LEVEL B)	DO NOT CHANGE
Threshold Level	160	alpha (dB/km)	0.00882342
Source Level (dBrms)	203	TL coefficient	20
Frequency (kHz)	1	Slant distance of threshold (m)	141
Beamwidth (degree)	180	Vertical depth of threshold (m)	8.6373E-15
Water depth (m)	60	Horizontal Threshold Range (m)	141

Can you summarize this issue in simple terms?

The MMPA specifies that no one is allowed to harm or harass (“take”) marine mammals without a special permit and even then, the statute authorizes the taking of only small numbers of animals. Offshore wind developers need these permits because they use loud bursts of sonar to map the ocean floor, and these loud sounds can harm whales’ hearing if they get too close. Anyone who “takes” a mammal, even with a permit, must report it.

Since 2016, NMFS has issued many of these permits to OSW developers. NMFS developed a complex sound propagation model to determine how far impulsive sonar sound travels before it dissipates down to a level that is considered safe for marine mammals. By entering the source level measured in dB,rms into NMFS’ model, the model will report the safe distance in meters. To mitigate harmful noise levels, NMFS requires Protected Species Observers (PSOs) to watch for whales that might cross over the safe distance mark and risk encountering unsafe sound levels that exceed NMFS’ limits.

If a developer inputs a dB,rms level for the sonar device that is lower than the level reported by the manufacturer and NMFS, the distance out to which PSOs search for marine mammals will be much shorter. In the example above, the PSOs would look out just 141 meters when the correct distance from the model should be 890 meters. In other words, under the current NMFS mitigations whales and other mammals would encounter harmful noise levels beyond the short distance (141 meters) but those encounters would not be recognized or reported. Any exposure to sound above the permitted level is a take. This means more whales would likely be experiencing takes that OSW developers are not reporting.

There is another important factor to consider. The number of marine mammal takes that NMFS has approved for each IHA is calculated based on the Level B threshold distance. Using a shortened distance of 141 meters would result in grossly undercounting the number of animals that would be taken. In many cases the level of take is an order of magnitude lower.