3 General Approach to Analysis

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3 GENERAL APPROACH TO ANALYSIS

3.0 INTRODUCTION

This chapter outlines the United States (U.S.) Department of the Navy's (Navy's) rational for resource analysis in the Gulf of Alaska (GOA) Navy Training Activities Supplemental Environmental Impact Statement (EIS)/Overseas EIS (Supplemental EIS/OEIS).

In accordance with 40 Code of Federal Regulations (C.F.R.) §1502.9(c), Agencies:

> (1) Shall prepare supplements to either draft or final environmental impact statements if:
>
> > (i) The agency makes substantial changes in the proposed action that are relevant to environmental concerns; or
> >
> > (ii) There are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts.
>
> (2) May also prepare supplements when the agency determines that the purposes of the Act will be furthered by doing so.
>
> (3) Shall adopt procedures for introducing a supplement into its formal administrative record, if such a record exists.
>
> (4) Shall prepare, circulate, and file a supplement to a statement in the same fashion (exclusive of scoping) as a draft and final statement unless alternative procedures are approved by the Council.

In March 2011, the Navy released the GOA Navy Training Activities Final EIS/OEIS (U.S. Department of the Navy 2011), hereafter referred to as the 2011 GOA Final EIS/OEIS, for which a Record of Decision (ROD) was received (*Record of Decision for Final Environmental Impact Statement/Overseas Environmental Impact Statement for the Gulf of Alaska Navy Training Activities* [U.S. Department of the Navy 2011]) pursuant to the guidance of 40 C.F.R. §1502.9(c). However, subsequent to completion of the 2011 GOA Final EIS/OEIS, the Navy, in coordination with the National Marine Fisheries Service (NMFS), developed a new acoustic impact model (the Navy Acoustics Effects Model [NAEMO]), that reflects a more complex modeling approach along with the integration of new impact criteria and marine mammal density data. Additional details on this new modeling approach (NAEMO) are available in the Marine Mammal Modeling Team Technical Report (*in progress*, 2014).

This chapter describes existing environmental conditions in the Study Area (the Temporary Maritime Activities Area [TMAA]) as well as the analysis of resources potentially impacted by the Proposed Action described in Chapter 2 (Description of Proposed Action and Alternatives). The Study Area is described in Section 2.1.1 (Gulf of Alaska Temporary Maritime Activities Area) and depicted in Figure 2.2-1.

Section 3.0.1 (Approach to Analysis) identifies the methodology used in this Supplemental EIS/OEIS to assess resource impacts associated with the Proposed Action. Section 3.0.2 (Regulatory Framework) presents the regulatory framework on which this Supplemental EIS/OEIS is based. It identifies applicable laws, regulations, executive orders (EOs), and directives used to develop the analyses. Section 3.0.3 (Data Sources and Best Available Data) lists the sources of data used in the analysis. Section 3.0.4 (Resources and Issues Considered for Re-Evaluation in This Document) describes a general approach to the analysis. It identifies the resources that were analyzed in the 2011 GOA Final EIS/OEIS, as well as those resources eliminated from further consideration in this Supplemental EIS/OEIS.

The Navy's approach to environmental analysis has evolved from a resource-based activities analysis to a stressors-based analysis. As such, Section 3.0.5.2 (Stressors) introduces the stressors-based approach,

and Section 3.0.5.2.1 (Identification of Acoustic Sources for Analysis) presents a detailed description of each acoustic stressor category.

3.0.1 APPROACH TO ANALYSIS

The methods used in this Supplemental EIS/OEIS to assess resource impacts associated with the Proposed Action include the procedural steps outlined below:

- Review of the existing GOA ROD
- Review of the existing 2011 GOA Final EIS/OEIS
- Review of existing federal and state regulations and standards relevant to resource-specific management and/or protection.
- Review of new literature, to include new surveys, new information on habitat, new information on how resources could be affected by stressors, as well as new literature, laws, regulations, and publications pertaining to the resources identified in the 2011 GOA Final EIS/OEIS
- Description of any changes to existing resource conditions from the 2011 GOA Final EIS/OEIS and ROD.
    - Determine if an existing activity needs to be re-analyzed based upon a change in the activity
    - Determine if the affected environment has changed
    - Determine if there is a new method of analysis for the existing activity
- Identification of resource sections for re-analysis within this Supplemental EIS/OEIS
    - Resource-specific impacts analysis for individual stressors[1]
    - Examination of potential population-level impacts
- Cumulative impacts analysis
- Consideration of mitigations to reduce identified potential impacts

3.0.2 REGULATORY FRAMEWORK

In accordance with the Council on Environmental Quality (CEQ) regulations for implementing the requirements of the National Environmental Policy Act (NEPA), other planning and environmental review procedures are integrated to the fullest extent possible. This section identifies the primary applicable federal statutes and applicable executive orders (Section 3.0.2.1), and guidance (Section 3.0.2.2) that form the regulatory framework for the resource evaluations. Chapter 6 (Additional Regulatory Considerations) provides a summary listing and status of compliance with the applicable environmental laws, regulations, and executive orders that were considered in preparing this Supplemental EIS/OEIS (including those that may be secondary considerations in the resource evaluations).

3.0.2.1 Applicable Federal Statutes

Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) of 1972 (16 U.S. Code [U.S.C.] §1451) was discussed in the 2011 GOA Final EIS/OEIS in the Executive Summary (ES 1.3.3); Sections 1.5.5, 3.3, and 6.1.1; and Table 6-1.

[1] The term "stressor" is broadly used in this document to refer to an agent, condition, or other stimulus that causes stress to an organism or alters physical, socioeconomic, or cultural resources.

Since the March 2011 publication of the 2011 GOA Final EIS/OEIS, the Alaska Coastal Management Program (ACMP) ended on 14 May 2011, pursuant to the provisions of Alaska Statute (AS 44.66.030), when the Alaska Legislature adjourned their special legislative session without passing the legislation required to extend the ACMP past the "sunset clause" date contained within the ACMP when it was initially authorized in 1979. Therefore, Alaska currently does not have an approved Coastal Management Program (CMP), and the Navy has no requirements to prepare any sort of CZMA determination until such time another ACMP is implemented by the State of Alaska.

Endangered Species Act

The Endangered Species Act of 1973 (16 U.S.C. §1531 et seq.) was discussed in the 2011 GOA Final EIS/OEIS in Section 1.5.7, and Table 6-1.

Marine Mammal Protection Act

The Marine Mammal Protection Act of 1972 (16 U.S.C. §1361 et seq.) was discussed in the 2011 GOA Final EIS/OEIS in Section 1.5.6, and Table 6-1.

National Environmental Policy Act

The Navy prepared this EIS/OEIS in accordance with the President's CEQ regulations implementing NEPA (40 C.F.R. §§1500–1508 et seq.). NEPA was discussed in the 2011 GOA Final EIS/OEIS in the Executive Summary (ES 1.3.1), Section 1.5.1, and Table 6-1.

Executive Order 12114, *Environmental Effects Abroad of Major Federal Actions*

This Supplemental OEIS has been prepared in accordance with EO 12114, *Environmental Effects Abroad of Major Federal Actions* (44 Federal Register [FR] 1957), and Navy implementing regulations in 32 C.F.R. Part 187. EO 12114 was discussed in the 2011 GOA Final EIS/OEIS in the Executive Summary (ES 1.3.2), Section 1.5.2, and Table 6-1.

Executive Order 13547, *Stewardship of the Ocean, Our Coasts, and the Great Lakes*

EO 13547, *Stewardship of the Ocean, Our Coasts, and the Great Lakes* (75 FR 43023), was issued in 2010. It is a comprehensive national policy for the stewardship of the ocean, our coasts, and the Great Lakes. This order adopts the recommendations of the Interagency Ocean Policy Task Force and directs executive agencies to implement the recommendations under the guidance of a National Ocean Council. This order establishes a national policy to:

- ensure the protection, maintenance, and restoration of the health of ocean, coastal, and Great Lakes ecosystems and resources;
- enhance the sustainability of ocean and coastal economies, preserve our maritime heritage;
- support sustainable uses and access;
- provide for adaptive management to enhance our understanding of and capacity to respond to climate change and ocean acidification; and
- coordinate with our national security and foreign policy interests.

3.0.2.2 Guidance

Department of Defense and Navy Directives and Instructions

Several military communications are included in this Supplemental EIS/OEIS that establish policy or a plan to govern an action, conduct, or procedure. For example, DoD Directive 4540.1, *Use of Airspace by U.S. Military Aircraft and Firings over the High Seas*, specifies procedures for conducting aircraft

maneuvers and for firing missiles and projectiles. Each range complex has its own manual; however, many of the components are similar.

3.0.3 DATA SOURCES AND BEST AVAILABLE DATA

The Navy used the best available scientific data and information to compile the environmental baseline and environmental consequences evaluated in Chapter 3. In accordance with NEPA, the Administrative Procedure Act of 1946 (5 U.S.C. §§551–559), and EO 12114, best available data accepted by the appropriate regulatory and scientific communities were used in the analyses of potential impacts on resources.

Literature searches of journals, books, periodicals, bulletins, and other technical reports were conducted in preparation of this Supplemental EIS/OEIS. Searches included general queries in the resource areas evaluated to document the environmental baseline, and specific queries support analysis of environmental consequences. A wide range of primary literature was used in preparing this Supplemental EIS/OEIS from federal agencies such as NMFS, the U.S. Environmental Protection Agency (USEPA), international organizations, state agencies, and nonprofit and nongovernment organizations. Internet searches were conducted, and websites were evaluated for credibility of the source, quality of the information, and relevance of the content to ensure use of the best available information in this document.

3.0.4 RESOURCES AND ISSUES CONSIDERED FOR RE-EVALUATION IN THIS DOCUMENT

In the 2011 GOA Final EIS/OEIS, the resources analyzed were identified and the expected geographic scope of potential impacts for each resource, known as the resource's Region of Influence, was defined. Physical resources and issues that were considered for re-evaluation in this Supplemental EIS/OEIS are those that were analyzed in the 2011 GOA Final EIS/OEIS and include air quality, expended materials, water resources, and acoustic environment (airborne). Biological resources (including threatened and endangered species) considered include marine plants and invertebrates, fish, sea turtles, marine mammals, and birds. Human resources and issues considered in this Supplemental EIS/OEIS include cultural resources, transportation and circulation, socioeconomics, environmental justice and protection of children, public safety, and cumulative impacts. However, this Supplemental EIS/OEIS is being conducted because there is new information and analytical methods to analyze acoustic impacts to marine mammals. In the process of preparing this Supplemental EIS/OEIS, the Navy has also taken into account new research, literature, laws, and regulations that have emerged since the publication of the 2011 GOA Final EIS/OEIS that may affect other resource areas. Subsequently, the Navy used this information to identify and evaluate all the resource areas to determine which ones required alternatives re-analysis in this Supplemental EIS/OEIS (Table 3.0-1). As illustrated in Table 3.0-1, it was determined that the majority of the resource areas do not warrant alternatives re-analysis.

Table 3.0-1: Resource Area Re-Evaluation in the Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement

Resource Area	New or Changes to Laws or Regulations	Changes to Existing Resource Conditions	New Research/ Information	Impacts Can Be Measured by NAEMO	Requires Alternatives Re-analysis
Air Quality	No	No	Yes	No	**No**
Expended Materials	Yes	No	Yes	No	**No**
Water Resources	Yes	No	No	No	**No**
Acoustic Environment (Airborne)	No	No	No	No	**No**
Marine Plants and Invertebrates	No	No	Yes	No	**No**
Fish	No	No	Yes	No	**No**
Sea Turtles	No	No	Yes	No	**No**
Marine Mammals	Yes	Yes	Yes	Yes	**Yes**
Birds	No	No	Yes	No	**No**
Cultural Resources	No	No	No	No	**No**
Transportation and Circulation	No	No	No	No	**No**
Socioeconomics	No	No	Yes	No	**No**
Environmental Justice and Protection of Children	No	No	No	No	**No**
Public Safety	No	No	No	No	**No**

Notes: EIS/OEIS = Environmental Impact Statement/Overseas Environmental Impact Statement, NAEMO = Navy Acoustic Effects Model, NMFS = National Marine Fisheries Service

3.0.4.1 Resources Carried Forward for Alternatives Re-Analysis

As illustrated in Table 3.0-1, a "yes" entry in a particular column indicates changes to that resource area since the 2011 GOA Final EIS/OEIS. These resource areas were then evaluated as to whether the change affected the analysis contained in the 2011 GOA Final EIS/OEIS. The change was also assessed based upon whether the impacts could be measured by NAEMO. Finally, a determination was made as to whether the resource area required alternatives re-analysis. As shown in Table 3.0-1, marine mammals is the only resource area meeting all the criteria and is being carried forward for alternatives re-analysis in this Supplemental EIS/OEIS. The sections following Section 3.0 briefly discuss and explain why each of the additional resource areas was not carried forward for alternatives re-analysis.

3.0.5 STRESSORS-BASED ANALYSIS

As mentioned above, the Navy's approach to environmental analysis has evolved from a resource/activities-based analysis to a stressors-based analysis since the publication of the 2011 GOA Final EIS/OEIS. As such, the following sections introduce the stressors-based approach and present a detailed description of each acoustic stressor category.

3.0.5.1 Introduction to Acoustics

To fully understand the stressors to marine mammals (underwater acoustic stressors), one must understand the transmission of sound through different media. However, the transmission of sound in air and in water can be a complex topic and may be difficult to understand. Appendix G (Acoustic Primer) provides a technical introduction to acoustics including the various sources of underwater sound, including physical, biological and anthropogenic sounds. The acoustic primer also explains the transmission of sound in the ocean, defines acoustic terms, abbreviations, and units of measurement used in the analysis, as well as frequencies produced during Navy training activities. Please refer to Appendix G (Acoustic Primer) for information regarding sound transmission in the ocean environment and air.

3.0.5.2 Stressors

The term stressor is broadly used in this document to refer to an agent, condition, or other stimulus that causes stress to an organism or alters physical, socioeconomic or cultural resources. For the Supplemental EIS/OEIS, acoustic sound is being analyzed as an acoustic stressor. Other information that was evaluated to identify and analyze stressors included public and agency scoping comments, previous environmental analyses, agency consultations, resource-specific information, and applicable laws, regulations, and executive orders. This process was used to focus the information presented and analyzed in the affected environment and environmental consequences sections of this Supplemental EIS/OEIS.

As previously mentioned, this Supplemental EIS/OEIS is analyzing the same warfare areas and activities that produce underwater sound as was analyzed in the 2011 GOA Final EIS/OEIS. However, in the Supplemental EIS/OEIS, the analysis is using NAEMO, new threshold criteria, and updated marine mammal density data as compared to the 2011 GOA Final EIS/OEIS. Table 3.0-2 identifies the acoustic stressors that will be quantified by NAEMO for the analysis of marine mammal impacts.

3.0.5.2.1 Identification of Acoustic Sources for Analysis

In order to make the transition from an activities-based analysis to a stressor-based analysis, the same training activities that were analyzed in the 2011 GOA Final EIS/OEIS were re-evaluated to identify specific components that could act as acoustic stressors (Table 3.0-2) by having direct or indirect impacts on marine mammals and which were applicable and quantifiable by NAEMO. This evaluation included identification of the spatial variation of the identified acoustic stressors. The following subsections describe the acoustic stressors in more detail.

3.0.5.2.1.1 Acoustic Stressors

This section describes the characteristics of sounds produced during naval training activities and the relative magnitude of these sound-producing activities. This provides the basis for analysis of acoustic and explosive impacts to marine mammals in the remainder of Chapter 3. For additional details on the properties of sound and explosives, see Appendix G (Acoustic Primer).

Table 3.0-2: Acoustic Stressors Associated with Training Activities

Warfare Area and Activities that Occurred and Were Analyzed in the 2011 GOA Final EIS/OEIS and Will Occur under the Supplemental EIS/OEIS	Acoustic Stressors Analyzed in This Supplemental EIS/OEIS		Requires NAEMO Re-analysis
Warfare Area and Activity	**Sonar/Other Active Acoustic Sources**	**Explosives**	
AAW			
Aircraft Combat Maneuvers			
Air Defense Exercise			
Surface-to-Air Missile Exercise			
Surface-to-Air Gunnery Exercise			
Air-to-Air Missile Exercise			
ASUW			
Visit, Board, Search, and Seizure			
Air-to-Surface Missile Exercise		✓	✓
Air-to-Surface Bombing Exercise		✓	✓
Air-to-Surface Gunnery Exercise		✓	✓
Surface-to-Surface Gunnery Exercise		✓	✓
Maritime Interdiction Exercise			
Sea Surface Control			
Sinking Exercise	✓	✓	✓
ASW*			
ASW Tracking Exercise – Helicopter	✓	✓	✓
ASW Tracking Exercise – Maritime Patrol Aircraft	✓	✓	✓
ASW Tracking Exercise – Extended Echo Ranging (EER) (Includes IEER and MAC)	✓	✓	✓
ASW Tracking Exercise – Surface Ship	✓		✓
ASW Tracking Exercise – Submarine	✓		✓
EC			
Electronic Combat Exercises			
Chaff Exercises			
Counter Targeting Exercises			
NSW			
Special Warfare Operations			
STW			
Air-to-Ground Bombing Exercise			
Personnel Recovery			
Support Operations			
Deck Landing Qualifications			

* ASW Warfare sensors used include MF1, MF3, MF4, MF5, MF6, MF11, HF1, HF6, ASW2, ASW3, ASW4, and E4 (Extended Echo Ranging and Improved Extended Echo Ranging sonobuoys).

Notes: (1) For this Supplemental EIS/OEIS, listing the ASW activity in the same format that was used in the 2011 GOA Final EIS/OEIS does not accurately reflect how modeling was conducted. For this Supplemental EIS/OEIS, ASW activity was not modeled as individual unit level training events (as was done in the 2011 GOA Final EIS/OEIS) but instead was modeled using the NAEMO model, which models all non-impulsive (e.g., sonar) sources together over the course of three 7-day exercises using the amount of sonar sources authorized in the Gulf of Alaska Temporary Maritime Activities Area Federal Register and Letter of Authorization evenly divided between these three periods of exercises. (2) Explosive events are modeled separately from sonar events within NAEMO (different models within NAEMO). (3) AAW = Anti-Air Warfare, ASUW = Anti-Surface Warfare, ASW = Anti-Submarine Warfare, EC = Electronic Combat, EER = Extended Echo Ranging, EIS/OEIS = Environmental Impact Statement/Overseas Environmental Impact Statement, IEER = Improved Extended Echo Ranging, NAEMO = Navy Acoustics Effects Model, NSW = Naval Special Warfare, STW = Strike Warfare

Sonar and Other Active Acoustic Sources

Sonar and other non-impulsive sound sources emit sound waves into the water to detect objects, safely navigate, and communicate. Most systems operate within specific frequencies (although some harmonic frequencies may be emitted at lower sound pressure levels). Sonar use associated with anti-submarine warfare (ASW) would emit the most underwater non-impulsive sound during training activities. General categories of sonar systems are described in Section 2.2.1 (Classification of Non-Impulse and Impulse Sources). Table 3.0-3 presents the hours of operation proposed for the source classes that are being quantitatively analyzed for impacts.

Underwater sound propagation is highly dependent upon environmental characteristics such as bathymetry, bottom type, water depth, temperature, and salinity. The sound received at a particular location will be different than near the source due to the interaction of many factors, including propagation loss; how the sound is reflected, refracted, or scattered; the potential for reverberation; and interference due to multi-path propagation (see Appendix G, Acoustic Primer).

Table 3.0-3: Sonar and Other Active Acoustic Sources Quantitatively Analyzed in the Gulf of Alaska Navy Training Activities Study Area

For Annual Training Activities				
Source Class Category	**Source Bins**	**Units**	**Annual Training from the Proposed Action**	**Requires NAEMO Re-analysis**
Mid-Frequency (MF) Tactical and non-tactical sources that produce signals from 1 to 10 kHz	MF1	Hours	541	Yes
	MF3	Hours	48	Yes
	MF4	Hours	53	Yes
	MF5	Items	25	Yes
	MF6	Items	0.15	Yes
	MF11	Hours	78	Yes
High-Frequency (HF) Tactical and non-tactical sources that produce signals greater than 10 kHz but less than 180 kHz	HF1	Hours	24	Yes
	HF6	Hours	80	Yes
Anti-Submarine Warfare (ASW) Tactical sources used during anti-submarine warfare training activities	ASW2	Hours	31	Yes
	ASW3	Hours	546	Yes
	ASW4	Items	4	Yes
Torpedoes (TORP) Source classes associated with active acoustic signals produced by torpedoes	TORP2	Items	5	Yes

Notes: kHz = kilohertz, NAEMO = Navy Acoustic Effects Model

Most use of active acoustic sources involves a single unit or several units (ship, submarine, aircraft, or other platform) employing a single active sonar source in addition to sound sources used for communication, navigation, and measuring oceanographic conditions. Anti-submarine warfare activities may also use an acoustic target or an acoustic decoy.

Anti-Submarine Warfare Sonar

Sonar used in ASW is deployed on many platforms and is operated in various ways. Anti-submarine warfare active sonar is usually mid-frequency (1–10 kHz) because mid-frequency sound balances sufficient resolution to identify targets and distance within which threats can be identified.

- Surface ship tactical hull-mounted sonar accounts for 43 percent (619 hours) of the overall non-impulse sound in the Study Area, all of which is conducted in the TMAA. Duty cycle can vary from about a ping per minute (for source bin MF1) to continuously active (for source bin MF11). Sonar can be wide-ranging in a search mode or highly directional in a track mode.
- A submarine's mission revolves around its stealth; therefore, a submarine's mid-frequency sonar is used infrequently because its use would also reveal a submarine's location.
- Aircraft-deployed, mid-frequency, ASW systems include omnidirectional dipping sonar (deployed by helicopters) and Directional Command Activated Sonobuoy System (MF5) sonobuoys (deployed from various aircraft), which have a typical duty cycle of several pings per minute.
- Acoustic countermeasures that continuously emulate broadband vessel sound or other vessel acoustic signatures may be deployed by ships and submarines during training.
- Torpedoes use directional high-frequency sonar when approaching and locking onto a target. Practice targets emulate the sound signatures of submarines or repeat received signals.

Anti-submarine warfare events in the Study Area would occur more than 12 nautical miles (nm) from shore. Additionally, most events usually occur over a limited area and are completed in less than 1 day, often within a few hours. Multi-day ASW events requiring coordination of movement and effort between multiple platforms with active sonar over a larger area occur less often, but constitute a large portion of the overall non-impulsive underwater noise that would be impacted by Navy activities. Such would be the case for Navy training activities in the Study Area, which would have periods of concentrated, near-continuous ASW sonar use by several platforms throughout the duration of the exercise.

Other Active Acoustic Sources

Active sound sources used for navigation and obtaining oceanographic information (e.g., depth, bathymetry, and speed) are typically directional, have high duty cycles, and cover a wide range of frequencies, from mid-frequency to very high-frequency. These sources are similar to the navigation systems on standard large commercial and oceanographic vessels. These sound sources could be used by vessels during most activities and while transiting throughout the Study Area.

3.0.5.2.1.2 Explosives

Explosive detonations during training activities are associated with high-explosive ordnance, including bombs, missiles, and naval gun shells; torpedoes; and explosive buoys. Most explosive detonations during training involving the use of high-explosive ordnance, including bombs, missiles, and naval gun shells, would occur in the air or near the water's surface. Explosives associated with torpedoes and explosive sonobuoys would occur in the water column. Detonations would occur in waters greater than 200 feet (ft.) (61 meters [m]) in depth, and greater than 12 nm from shore.[2] Detonations associated with ASW would typically occur in waters greater than 600 ft. (183 m) depth, which is over 13 nm from the closest point of land (Cape Cleare, on Montague Island). The numbers of explosions in each explosive source class are shown in Table 3.0-4.

[2] As noted elsewhere, Cape Cleare on Montague Island is located approximately 12 nm from the northern point of the TMAA, and the nearest shoreline (Kenai Peninsula) is located approximately 24 nm north of the TMAA's northern boundary.

Explosive detonations occurring during a Sinking Exercise (SINKEX) would occur in accordance with a permit from the USEPA. The target,[3] typically a decommissioned combatant or merchant ship that has been made environmentally safe for sinking according to standards set by the USEPA, is placed in a specific location that is greater than 50 nm out to sea in water depths greater than 6,000 ft. (1,830 m) (40 C.F.R. §229.2).

Explosives in the water introduce loud, impulse, broadband sounds into the marine environment. Three source parameters influence the effect of an explosive: (1) the weight of the explosive warhead, (2) the type of explosive material, and (3) the detonation depth. The net explosive weight, the explosive power of a charge expressed as the equivalent weight of trinitrotoluene (TNT), accounts for the first two parameters. The properties of explosive detonations are discussed in Appendix G (Acoustic Primer). Table 3.0-4 shows the depths at which representative explosive source classes are assumed to detonate underwater for purposes of analysis.

Table 3.0-4: Explosive Sources Used during Training in the Gulf of Alaska Study Area

Explosives (Source Class and Net Explosive Weight) (lb.)	Number of Explosives with the Proposed Action	Requires NAEMO Re-analysis	Representative Underwater Detonation Depth[1]
E4 (> 2.6–6 lb. NEW)	80	Yes	10 m (33 ft.), 20 m (66 ft.)
E5 (> 6–10 lb. NEW)	112	Yes	1 m (3 ft.)
E6 (> 11–20 lb. NEW)	2	Yes	15 m (50 ft.)
E7 (> 20–60 lb. NEW) AGM-88 HARM	4	Yes	15 m (50 ft.)
E8 (> 61–100 lb. NEW)	6	Yes	1 m (3 ft.)
E9 (> 101–250 lb. NEW)	142	Yes	1 m (3 ft.)
E10 (> 251–500 lb. NEW)	32	Yes	6 m (20 ft.), 10 m (33 ft.)
E11 (> 501–650 lb. NEW) MK-48 Torpedo	2	Yes	6 m (20 ft.), 10 m (33 ft.)
E12 (> 651–1,000 lb. NEW) 2,000 lb. bomb	4	Yes	1 m (3 ft.)

[1] Underwater detonation depths listed are those assumed for purposes of acoustic impacts modeling. Detonations assumed to occur at a depth of 3.3 ft. (1 m) include detonations that would actually occur at or just above the water surface.

Notes: HARM = High Speed Anti-Radiation Missile, m = meters, NEW = Net Explosive Weight, ft. = feet, lb. = pounds, n/a = not applicable, NAEMO = Navy Acoustics Effects Model

In general, explosive events would consist of a single explosion or multiple explosions over a short period. During training, all high-explosive bombs would be detonated near the surface over deep water. Bombs with high-explosive ordnance would be fused to detonate on contact with the water. Other detonations would occur near but above the surface upon impact with a target; these detonations are conservatively assumed to occur at a depth of 3.3 ft. (1 m) for purposes of analysis. Detonations of projectiles during anti-air warfare would occur far above the water surface.

Since most explosive sources used in military activities are munitions that detonate essentially upon impact, the effective source depths are quite shallow and, therefore, the surface-image interference effect can be pronounced (see Appendix G, Acoustic Primer). This effect would reduce peak pressures and potential impacts near the water surface.

[3] Per a 24 January 2014 EPA/Navy agreement, "Navy agrees that SINKEX vessels will not likely, in the future, include aircraft carriers or submarines" (as the target vessel of a SINKEX).

3.0.5.3 Marine Mammal Resource-Specific Impacts Analysis for Acoustic Stressors

The direct and indirect impacts of each acoustic stressor carried forward for further analysis were analyzed for marine mammals in Section 3.8 (Marine Mammals). Quantitative and semi-quantitative methods were used to the extent possible, but inherent scientific limitations required the use of qualitative methods for acoustic stressor/marine mammal resource interactions. Resource-specific methods are described in Section 3.8 (Marine Mammals), where applicable. While specific methods used to analyze the impacts of individual stressors varied, the following generalized approach was used for all acoustic stressor/marine mammal resource interactions:

- The frequency, duration, and spatial extent of exposure to each acoustic stressor was analyzed for marine mammals. The frequency of exposure to each acoustic stressor or frequency of a proposed activity was characterized as intermittent or continuous, and was quantified in terms of number per unit of time when possible. Duration of exposure was expressed as short- or long-term and was quantified in units of time (e.g., seconds, minutes, and hours) when possible. The spatial extent of exposure was generally characterized as widespread or localized, and the acoustic stressor footprint or area (e.g., square feet, square nautical miles) was quantified when possible.
- An analysis was conducted to determine whether and how marine mammals are likely to respond to acoustic stressor exposure or be altered by acoustic stressor exposure based upon available scientific knowledge. This step included reviewing available scientific literature and empirical data. For many acoustic stressor/marine mammal interactions, a range of likely responses or endpoints was identified. For example, exposure of an organism to sound produced by an underwater explosion could result in no response, a physiological response such as increased heart rate, a behavioral response such as being startled, injury, or mortality.
- The information obtained was used to analyze the likely impacts of individual acoustic stressors on a marine mammal species and to characterize the type, duration, and intensity (severity) of impacts. The type of impact was generally defined as beneficial or adverse and was further defined as a specific endpoint (e.g., change in behavior, mortality, change in concentration, loss of habitat). When possible, the endpoint was quantified. The duration of an impact was generally characterized as short-term (e.g., minutes, days, weeks, months, depending on the resource), long-term (e.g., months, years, decades, depending on the resource), or permanent. The intensity of an impact was then determined. For marine mammals, the analysis started with individual organisms and their habitats, and then addressed populations, species, communities, and representative ecosystem characteristics, as appropriate.

3.0.5.4 Cumulative Impacts

A cumulative impact is the impact on the environment that results when the incremental impact of an action is added to other past, present, and reasonably foreseeable future actions. The cumulative impacts analysis (see Chapter 4, Cumulative Impacts) considers other actions regardless of what agency (federal or nonfederal) or person undertakes the actions. Cumulative impacts result when individual actions combine with similar actions taking place over a period of time to produce conditions that frequently alter the historical baseline (40 C.F.R. §1508.7). The goal of the analysis is to provide the decision makers with information relevant to reasonably foresee potentially significant impacts. See Chapter 4 (Cumulative Impacts) for the specific approach used for determining cumulative impacts.

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