
3.13 Public Health and Safety

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3.13 PUBLIC HEALTH AND SAFETY

PUBLIC HEALTH AND SAFETY SYNOPSIS

The United States Department of the Navy considered all potential stressors, and the following have been analyzed for public health and safety:

- Underwater energy
- In-air energy
- Physical interactions
- Secondary

Preferred Alternative (Alternative 1)

- Because of the Navy's standard operating procedures, impacts on public health and safety would be unlikely.

3.13.1 INTRODUCTION AND METHODS

3.13.1.1 Introduction

This section analyzes potential impacts on public health and safety within the Mariana Islands Training and Testing (MITT) Study Area (Study Area). Unlike military training and testing activities conducted within the boundaries of a fenced land installation, public access to ocean areas or to the overlying airspace cannot be physically controlled. The United States (U.S.) Department of the Navy (Navy) coordinates use of these areas through the scheduling of activities, and issues warnings and notices to the public prior to conducting potentially hazardous activities (Section 3.13.2.2, Safety and Inspection Procedures). Sensitivity to public health and safety concerns within the Study Area is heightened in areas where the public may be close to certain activities (e.g., pierside testing or littoral training).

Generally, the greatest potential for a proposed activity to affect the public is near the coast because that is where public activities are concentrated. These coastal areas could include dive sites or other recreational areas where the collective health and safety of groups of individuals that could be exposed to the hazards of training and testing would be of concern. Most commercial and recreational marine activities are close to the shore and are usually limited by the capabilities of the boat used. Commercial and recreational fishing may extend as far out as 100 nautical miles (nm) from shore but are concentrated near the coast.

3.13.1.2 Methods

Baseline public health and safety conditions were derived from the current training and testing activities. Existing procedures for ensuring public health and safety and other elements of the baseline (e.g., restricted areas) were derived from federal regulations, Department of Defense (DoD) directives, and Navy instructions for training and testing. The directives and instructions provide specifications for mission planning and execution that describe criteria for public health and safety considerations. These directives and instructions include criteria for public health and safety considerations for training and testing planning and execution.

The alternatives were evaluated based on two factors: the potential for a training or testing activity to impact public health and safety, and the degree to which those activities could have an impact. The

likelihood that the public would be near a training or testing activity determines the potential for exposure to the activity. If the potential for exposure exists, the degree of the potential impacts on public health and safety, including increased risk of injury or loss of life, is determined. If the potential for exposure were zero, then public health and safety would not be affected. Isolated incidents and other conditions that affect single individuals, although important for safety awareness, may not rise to the level of a public health or safety issue and are not considered in this assessment (e.g., airborne noise effects are not addressed in this section).

3.13.2 AFFECTED ENVIRONMENT

3.13.2.1 Overview

The area of interest for assessing potential impacts on public health and safety is the U.S. Territorial Waters of the island of Guam and the islands of the Commonwealth of the Northern Mariana Islands (CNMI) (seaward of the mean high water line to 12 nm). Military, commercial, institutional, and recreational activities take place simultaneously in the Study Area (Figure 3.13-1) and have coexisted safely for decades. These activities coexist because established rules and practices lead to safe use of the waterway and airspace. The following paragraphs briefly discuss the rules and practices for recreational, commercial, and military use in sea surface areas and airspace.



Figure 3.13-1: Simultaneous Activities within the Mariana Islands Training and Testing Study Area

3.13.2.1.1 Sea Space

Most of the sea space in the Study Area is accessible to recreational and commercial activities. However, some activities are prohibited or restricted in certain areas (e.g., danger zones and restricted areas) in accordance with Title 33 Code of Federal Regulations (C.F.R.) Part 334 (Danger Zone and Restricted Area Regulations). These restrictions can be permanent or temporary. Nautical charts issued by the National Oceanic and Atmospheric Administration include these federally designated zones and areas. Operators of recreational and commercial vessels have a duty to abide by maritime regulations administered by the U.S. Coast Guard.

In accordance with Title 33 C.F.R. 72 (Aids to Navigation), the U.S. Coast Guard and the Department of Homeland Security inform private and commercial vessels about temporary closures via Notices to Mariners (NOTMARS). These notices provide information about durations and locations of closures because of activities that are hazardous to surface vessels. Broadcast notices on maritime frequency radio, weekly publications by the appropriate U.S. Coast Guard Navigation Center, and global positioning system navigation charts disseminate these navigational warnings.

3.13.2.1.2 Airspace

Most of the airspace in the Study Area is accessible to general aviation (recreational, private, corporate) and commercial aircraft. Like waterways, however, some areas are temporarily off limits to civilian and commercial use. The Federal Aviation Administration (FAA) has established Special Use Airspace—airspace of defined dimensions wherein activities must be confined because of their nature or wherein limitations may be imposed upon aircraft operations that are not part of those activities (U.S. Department of Transportation Federal Aviation Administration 2013). Additional discussion on airspace is provided in Section 3.12 (Socioeconomic Resources). Special Use Airspace in the Study Area includes:

- **Restricted Airspace:** Areas where aircraft are restricted because of unusual (often invisible) hazards to aircraft (e.g., release of ordnance). Some areas are under strict control of the DoD, and some are shared with nonmilitary agencies.
- **Warning Areas:** Areas of defined dimensions, beyond 3 nm from the coast of the United States, which warn nonparticipating aircraft of potential danger.
- **Air Traffic Controlled Assigned Airspace:** Airspace that is defined by the FAA and is not over an existing operating area. This airspace is used to contain specified activities, such as military flight training, that are segregated from other instrument flight rules air traffic. Air traffic controlled assigned airspace is not classified as special use airspace in accordance with FAA definition and airspace classification.

Notices to Airmen (NOTAMs) are created and transmitted by government agencies and airport operators to alert aircraft pilots of any hazards en route to or at a specific location. The FAA issues NOTAMs to disseminate information on upcoming or ongoing military exercises with airspace restrictions. Civilian aircraft are responsible for being aware of restricted airspace and any NOTAMs that are in effect. Pilots have a duty to abide by aviation rules as administered by the FAA.

Weather conditions dictate whether aircraft (general aviation, commercial, or military) can fly under visual flight rules or whether instrument flight rules are required. Under visual flight rules, the weather is favorable and the pilot is required to remain clear of clouds by specified distances to ensure separation from other aircraft under the concept of see and avoid. Pilots flying under visual flight rules must be able to see outside of the cockpit, control the aircraft's altitude, navigate, and avoid obstacles and other aircraft based on visual cues. Pilots flying under visual flight rules assume responsibility for their separation from all other aircraft, and are generally not assigned routes or altitudes by air traffic control.

During unfavorable weather, pilots must follow instrument flight rules. Factors such as visibility, cloud distance, cloud ceilings, and weather phenomena cause visual conditions to drop below the minimums required to operate by visual flight referencing. Instrument flight rules are the regulations and restrictions a pilot must comply with when flying in weather conditions that restrict visibility. Pilots can

fly under instrument flight rules in visual flight rules weather conditions; however, pilots cannot fly under visual flight rules in instrument flight rules weather conditions.

3.13.2.2 Safety and Inspection Procedures

During training and testing, the military services have policies in place to ensure the safety and health of personnel and the general public. The military services achieve these conditions by considering location when planning activities, scheduling and notifying potential users of an area, and ensuring that an area is clear of nonparticipants. The military services also have a proactive and comprehensive program of compliance with applicable standards and implementation of safety management systems.

As previously stated, the greatest potential for a training or testing activity to affect the public is in coastal areas because of the concentration of public activities. When planning a training or testing activity, the military services consider proximity of the activity to public areas in choosing a location. Important factors considered include the ability to control access to an area; schedule (time of day, day of week); frequency, duration, and intensity of activities; range safety procedures; operational control of activities or events; and safety history.

The Navy's Fleet Area Control and Surveillance Facilities actively manage assigned airspace, operating areas, ranges, and training and testing resources to enhance combat readiness of U.S. Pacific Fleet units. The Navy schedules activities through the Fleet Area Control and Surveillance Facilities, which coordinate air and surface use of the training areas with the FAA and the U.S. Coast Guard, which issue NOTAMs and NOTMARs, respectively.

During training and testing activities in the Study Area, the military services ensure that the appropriate safety zone is clear of nonparticipants before engaging in certain activities, such as firing weapons. Inability to obtain a "clear range" could cause an event to be delayed, cancelled, or relocated. Military procedures ensure public safety during military activities that otherwise could harm nonparticipants. Military practices employ the use of sensors and other devices (e.g., radar) to ensure public health and safety while conducting training and testing activities. The following subsections outline the current requirements and practices for human safety as they pertain to range safety procedures, range inspection procedures, exercise planning, and scheduling and coordinating procedures for the military services.

Active management of assigned airspace, operating areas, ranges, and training and testing resources to enhance combat readiness of U.S. military service units in all warfare areas in the Study Area are provided by the Mariana Islands Range Complex (MIRC) Operations, in coordination with the FAA, Naval Base Guam Security or 36th Wing Operations Group (Andersen Air Force Base). Training participants comply with published safety procedures in the Joint Region Marianas Instruction 3500.4A (Marianas Training Manual) (U.S. Department of the Navy 2011a) for training and testing activities in the Study Area. These guidelines apply to range users as follows:

- Military personnel are responsible for ensuring that impact areas and targets are clear before commencing hazardous activities.
- The use of underwater ordnance must be coordinated with submarine operational authorities. The coordination also applies to towed sound navigation and ranging (sonar) arrays and torpedo decoys.
- Aircraft or vessels expending ordnance shall not commence firing without permission of the Range Safety Officer for their specific range area.

- Firing units and targets must remain in their assigned areas, and units must fire in accordance with current safety instructions.
- Aircraft carrying ordnance to or from ranges shall avoid populated areas to the maximum extent possible.
- Strict on-scene procedures include the use of ship sensors, visual surveillance of the range from aircraft and range safety boats, and radar and acoustic data to confirm the firing range and target area are clear of civilian vessels, aircraft, or other nonparticipants.

Testing activities have their own comprehensive safety planning instructions (U.S. Department of the Navy 2011a). These instructions provide guidance on how to identify the hazards, assess the potential risk, analyze risk control measures, and review safety procedures. They apply to all testing activities, including ground, waterborne, and airborne testing activities involving personnel, aircraft, inert minefields, equipment, and airspace. The guidance applies to system program managers, program engineers, test engineers, test directors, and aircrews that are responsible for incorporating safety planning and review when conducting test programs.

The following safety and inspection procedures are implemented for training activities. Each commanding officer is responsible for implementing safety and inspection procedures for activities inside and outside established ranges. In the absence of specific guidance on matters of safety, the military follows the most prudent course of action. The following contains information on the military's program of compliance with applicable standards and implementation of safety management systems.

3.13.2.2.1 Aviation Safety

Navy procedures on planning and managing Special Use Airspace are provided in the Chief of Naval Operations Instruction 3770.2K, *Airspace Procedures and Planning Manual* (U.S. Department of the Navy 2007). Navy and Air Force aircraft operating over the high seas comply with DoD Directive 4540.1, *Use of Airspace by U.S. Military Aircraft and Firings Over the High Seas*, and Chief of Naval Operations Instruction 3770.4A, *Use of Airspace by U.S. Military Aircraft and Firing Over the High Seas*, which specify procedures for conducting aircraft maneuvers and for firing missiles and projectiles. The missile and projectile firing areas are to be selected "so that trajectories are clear of established oceanic air routes or areas of known surface or air activity" (U.S. Department of Defense 1981).

Aircrews involved in a training or testing exercise must be aware that nonparticipating aircraft and ships are not precluded from entering the area and may not comply with NOTAMs or NOTMARs. Aircrews are required to maintain a continuous lookout for nonparticipating aircraft while operating in warning areas under visual flight rules. In general, aircraft carrying ordnance are not allowed to fly over surface vessels.

Part of aviation safety during training and testing activities is the implementation of the Bird/Animal Aircraft Strike Hazard program. The Bird Aircraft Strike Hazard program manages risk by addressing specific aviation safety hazards associated with wildlife near airfields through coordination among all the entities supporting the aviation mission (U.S. Department of Defense 2012). The Bird Aircraft Strike Hazard program strives to effectively minimize secondary consequences of strikes, such as damage to aircraft, environmental cleanup due to aircraft crashes, and impairment of training (U.S. Department of Defense 2012), at the same time precluding potential impacts to public health and safety. The Bird Aircraft Strike Hazard program is defined in the Navy Bird/Animal Aircraft Strike Hazard Program Implementing Guidance (Commander, Navy Installations Command Instruction 3700) (U.S. Department of Defense 2012) and the Bird/Animal Aircraft Strike Hazard Manual (U.S. Department of the Navy 2010).

The Bird Aircraft Strike Hazard program consists of, among other things, identifying the bird/animal species involved and the location of the strikes to understand why the species is attracted to a particular area of the airfield or training route. By knowing the species involved, managers can understand the habitat and food habits of the species. A Wildlife Hazard Assessment identifies the areas of the airfield that are attractive to the wildlife and provides recommendations to remove or modify the attractive feature. Recommendations may include the removal of unused airfield equipment to eliminate perch sites, placement of anti-perching devices, wiring of streams and ponds, removal of brush/trees, use of pyrotechnics, and modification of the grass mowing program (U.S. Department of Defense 2012).

3.13.2.2.2 Submarine Navigation Safety

Submarine crews use various methods to avoid collisions while they are surfaced, including visual and radar scanning, acoustic depth finders, and state-of-the-art satellite navigational systems. When transiting submerged, submarines use all available ocean navigation tools, including inertial navigational charts that calculate position based on the submerged movements of the submarine. Areas with surface vessels can then be avoided to protect both the submarines and surface vessels.

3.13.2.2.3 Surface Vessel Navigational Safety

The Navy practices the fundamentals of safe navigation. While in transit, Navy surface vessel operators are alert at all times, use extreme caution, use state-of-the-art satellite navigational systems, and are trained to take proper action if there is risk. Surface vessels are also equipped with trained and qualified Navy lookouts. Individuals trained as lookouts have the necessary skills to detect objects or activity in the water that could potentially be a risk for the vessel.

For specific testing activities, like unmanned surface vehicle testing, a support boat would be used near the testing to ensure safe navigation. Before firing or launching a weapon or radiating a non-eyesafe laser, Navy surface vessels are required to determine that all safety criteria have been satisfied. When applicable, the surface vessel would use aircraft and other boats to aid in navigation. In accordance with Navy instructions presented in this chapter, safety and inspection procedures ensure public health and safety.

3.13.2.2.4 Sound Navigation and Sounding (Sonar) Safety

Surface vessels and submarines may use active sonar in the pier-side locations listed in Chapter 2 (Description of Proposed Action and Alternatives) and during transit to the training or testing exercise location. To ensure safe and effective sonar use, the Navy applies the same safety procedures for pier-side sonar use as described in Section 3.13.2.2 (Safety and Inspection Procedures).

Naval Sea Systems Command Instruction 3150.2, Appendix 1A, *Safe Diving Distances from Transmitting Sonar*, is the Navy's governing document for protecting divers during active sonar use (U.S. Department of the Navy 2011b). This instruction provides procedures for calculating safe distances from active sonar. These procedures are derived from experimental and theoretical research conducted at the Naval Submarine Medical Research Laboratory and the Navy Experimental Diving Unit. Safety distances vary based on conditions that include diver attire, type of sonar, and duration of time in the water. Some safety procedures include onsite measurements during testing activities to identify an exclusion area for nonparticipating swimmers and divers.

3.13.2.2.5 Electromagnetic Energy Safety

All frequencies (or wavelengths) of electromagnetic energy are referred to as the electromagnetic spectrum, and they include electromagnetic radiation and radio frequency radiation. Communications and electronic devices such as radar, electronic warfare devices, navigational aids, two-way radios, cell phones, and other radio transmitters produce electromagnetic radiation. While such equipment emits electromagnetic energy, some of these systems are the same as, or similar to, civilian navigational aids and radars at local airports and television weather stations. Radio waves and microwaves emitted by transmitting antennas are a form of electromagnetic energy, collectively referred to as radio frequency radiation. Radio frequency energy includes frequencies ranging from 0 to 3,000 gigahertz. Exposure to radio frequency energy of sufficient intensity at frequencies between 3 kilohertz and 300 gigahertz can adversely affect people, ordnance, and fuel.

To avoid excessive exposures from electromagnetic energy, military aircraft are operated in accordance with standard operating procedures that establish minimum separation distances between electromagnetic energy emitters and people, ordnance, and fuels (U.S. Department of Defense 2009a). Thresholds for determining hazardous levels of electromagnetic energy to humans, ordnance, and fuel have been determined for electromagnetic energy sources based on frequency and power output, and current practices are in place to protect the public from electromagnetic radiation hazards (U.S. Department of Defense 2002, 2009a). These procedures include setting the heights and angles of electromagnetic energy transmissions to avoid direct exposure, posting warning signs, establishing safe operating levels, activating warning lights when radar systems are operational, and not operating some platforms that emit electromagnetic energy within 15 nm of shore. Safety planning instructions provide clearance procedures for nonparticipants in operational areas prior to conducting training and testing (U.S. Department of the Navy 2011a) activities that involve underwater electromagnetic energy (e.g., mine warfare).

Mine warfare devices are analyzed under other resources in this Environmental Impact Statement (EIS)/Overseas EIS (OEIS) because they emit electromagnetic energy. The electromagnetic impacts from mine warfare devices are very local, unlike radars and radios. Measures to avoid public interaction with mine warfare devices are effective in protecting the public from these impacts. As discussed in Section 3.0.5.3.3.2 (Kinetic Energy Weapon), electromagnetic fields generated by kinetic energy weapon testing would likely be shielded and contained on the vessel as to not affect other shipboard systems. Therefore, there will be no impacts to the public from testing of the kinetic energy weapon.

3.13.2.2.6 Laser Safety

Lasers produce light energy. The military uses tactical lasers for precision range finding, as target designation and illumination devices for engagement with laser-guided weapons, and for mine detection and mine countermeasures. Laser safety procedures for aircraft require an initial pass over the target prior to laser activation to ensure that target areas are clear. The military observes strict precautions, and has written instructions in place for laser users to ensure that nonparticipants are not exposed to intense light energy. During actual laser use, aircraft run-in headings are restricted to avoid unintentional contact with personnel or nonparticipants. Personnel participating in laser training activities are required to complete a laser safety course (U.S. Department of the Navy 2008).

3.13.2.2.7 High-Explosive Ordnance Detonation Safety

Pressure waves from underwater detonations can pose a physical hazard in surrounding waters. Before conducting an underwater training or testing activity, Navy personnel establish an appropriately sized

exclusion zone to avoid exposure of nonparticipants to the harmful intensities of pressure. Naval Sea Systems Command Instruction 3150.2, Chapter 2, *Safe Diving Distances from Transmitting Sonar*, provides procedures for determining safe distances from underwater explosions (U.S. Department of the Navy 2011b). In accordance with training and testing procedures for safety planning related to detonations (Section 3.13.2.2.8, Weapons Firing and Ordnance Expenditure Safety), the Navy uses the following general and underwater detonation procedures:

- Navy personnel are responsible for ensuring that impact areas and targets are clear before commencing hazardous activities.
- The use of underwater ordnance must be coordinated with submarine operational authorities.
- Aircraft or vessels expending ordnance shall not commence firing without permission of the Range Safety Officer or Test Safety Officer for their specific range area.
- Firing units and targets must remain in their assigned areas, and units must fire in accordance with current safety instructions.
- Detonation activities will be conducted during daylight hours.

3.13.2.2.8 Weapons Firing and Ordnance Expenditure Safety

In accordance with safety and inspection procedures (U.S. Department of the Navy 2011a), any unit firing or expending ordnance shall ensure that all possible safety precautions are taken to prevent accidental injury or property damage. The officer conducting the exercise shall permit firing or jettisoning of aerial targets only when the area is confirmed to be clear of nonparticipating units, both civilian and military.

Safety is a primary consideration for all training and testing activities. The range must be able to safely contain the hazard area of the weapons and equipment employed. The hazard area is based on the size and net explosive weight of the weapon. The type of activity determines the size of the buffer zone. For activities with a large hazard area, special sea and air surveillance measures are implemented to make sure that the area is clear before activities commence. Before aircraft can drop ordnance, they are required to make a preliminary pass over the intended target area to ensure that it is clear of boats, divers, or other nonparticipants. Aircraft carrying ordnance are not allowed to fly over surface vessels.

Training and testing activities are delayed, moved, or cancelled if there is any question about the safety of the public. Target areas must be clear of nonparticipants before conducting training and testing. When using ordnance with flight termination systems (which terminate the flight of airborne missiles or launch vehicles when they veer from their targeted path), the military is required to follow standard operating procedures to ensure public health and safety. In those cases where a weapons system does not have a flight termination system, the size of the target area that needs to be clear of nonparticipants is based on the flight distance of the weapon plus an additional distance beyond the system's performance capability.

3.13.3 ENVIRONMENTAL CONSEQUENCES

This section evaluates how and to what degree the activities described in Chapter 2 (Description of Proposed Action and Alternatives) could impact public health and safety. In this section, each public health and safety stressor is introduced, analyzed by alternative, and analyzed for training activities and testing activities. Tables 2.8-1 through 2.8-4 present the baseline and proposed training and testing activity locations for each alternative (including the number of events and ordnance expended). The

stressors vary in intensity, frequency, duration, and location within the Study Area. The stressors applicable to public health and safety and analyzed below include the following:

- Underwater energy
- In-air energy
- Physical interactions
- Secondary

Alternatives 1 and 2 include the expansion of the Study Area boundary to the west and north of the existing MIRC to encompass the Marianas Trench Marine National Monument (to include both the Islands and Trench Units) and the Transit Corridor from the MIRC to Hawaii. While Alternatives 1 and 2 would adjust locations and tempo of training and testing activities, including the establishment of danger zones around existing training areas, existing safety procedures and standard operating procedures would be employed such that no new or additional impacts to public health and safety would occur. In addition, the establishment of danger zones that would result in the exclusion of the public from these training areas on a full-time or intermittent basis would be a beneficial impact in terms of public health and safety. Therefore, expansion of the Study Area boundary and establishment of danger zones will not be addressed further in the analysis below.

Potential public health and safety impacts were evaluated assuming continued implementation of the military's current safety procedures for each training and testing activity or group of similar activities. Generally, the greatest potential for the proposed activities to be co-located with public activities would be in coastal areas because most commercial and recreational activities occur close to the shore.

Training and testing activities in the Study Area are conducted in accordance with the Marianas Training Manual (U.S. Department of the Navy 2011a). The Marianas Training Manual provides operational and safety procedures for all normal range activities. The Manual also provides information to range users that is necessary to operate safely and avoid affecting non-military activities, such as shipping, recreational boating, diving, and commercial or recreational fishing. Ranges are managed in accordance with standard operating procedures that ensure public health and safety. Current requirements and practices (e.g., standard operating procedures) designed to prevent public health and safety impacts are identified in Chapter 5 (Standard Operating Procedures, Mitigation, and Monitoring).

As part of its continuing improvement of training, the U.S. military services generate an After Action Report (as required in the Marianas Training Manual) at the end of a training or testing activity primarily to track ordnance and training area usage, and at the same time identify problems encountered, provide solutions to the problem, and solicit suggestions for improvement.

3.13.3.1 Underwater Energy

Underwater energy can come from acoustic sources or electromagnetic devices. Active sonar, underwater explosions, airguns, and vessel movements all produce underwater acoustic energy. Sound will travel from air to water during aircraft overflights. Electromagnetic energy can enter the water from mine warfare training devices and unmanned underwater systems. The potential for the public to be exposed to these stressors would be limited to individuals, such as recreational swimmers or self-contained underwater breathing apparatus (SCUBA) divers, who are underwater and within unsafe proximity of a training or testing activity.

Many of the proposed activities generate underwater acoustic energy; however, not all sources rise to the level of consideration in this EIS/OEIS. Swimmers or divers might intermittently hear ship noise or underwater acoustic energy from aircraft overflights if they are near a training or testing event, but public health and safety would not be affected because these events would be infrequent and short in duration. Pierside integrated swimmer defenses are tested with underwater airguns during swimmer defense and diver deterrent training and testing activities; public health and safety would be ensured for these localized activities because access to pierside locations by nonparticipants is controlled for safety and security reasons. Because of the infrequency and short duration of the events, underwater acoustic energy from vessel movements, aircraft overflights, and airguns is not analyzed in further detail. Active sonar and underwater explosions are the only sources of underwater acoustic energy evaluated for potential impacts on public health and safety.

The proposed activities that would result in underwater acoustic energy include activities such as amphibious warfare, anti-surface warfare, anti-submarine warfare, mine warfare, surface warfare testing, and sonar maintenance. A limited amount of active sonar would be used during transit between range complexes and training and testing locations.

The effect of active sonar on humans varies with the sonar frequency. Of the four types of sonar (very high-, high-, mid-, and low-frequency), mid-frequency and low-frequency sonar have the greatest potential to impact humans due to the range of human hearing. Underwater explosives cause a physical shock front that compresses the explosive material, and the pressure wave then passes into the surrounding water. Generally, the pressure wave would be the primary cause of injury. The effects of an underwater explosion depend on several factors, including the size, type, and depth of the explosive charge and where it is in the water column.

Systems like the Organic Airborne and Surface Influence Sweep emit an electromagnetic field and sound to simulate the presence of a ship. Unmanned underwater vehicles, some unmanned surface vehicles, and towed devices use electromagnetic energy. Electronic warfare activities involve aircraft, surface ship, and submarine crews attempting to control portions of the electromagnetic spectrum to degrade or deny the enemy's ability to take defensive actions. An electromagnetic signal dissipates quickly with increasing distance from its source. The literature lacks evidence to conclude that any adverse health effects result from exposure to electromagnetic energy, which is why no federal standards have been set for occupational exposures to this type of energy. Because standard operating procedures require an exercise area to be clear of participants, the public would not be exposed to electromagnetic energy the way a worker could experience long-term, occupational exposures. In the unlikely event that the public was exposed, the level of electromagnetic energy associated with the Proposed Action would not be enough to pose a health or safety risk.

As previously stated, the potential for the public to be exposed to these stressors would be limited to divers within unsafe proximity of an event. SCUBA diving is a popular recreational activity that is typically concentrated around known dive attractions such as reefs and shipwrecks. In general, recreational divers should not exceed 130 feet (40 meters) (Professional Association of Diving Instructors 2011). This depth limit typically limits this activity's distance from shore. Therefore, training and testing activities closest to shore have the greatest potential to co-occur with the public.

Swimmers and recreational SCUBA divers are not expected to be near Navy pierside locations because access to these areas is controlled for safety and security reasons. Locations of popular offshore diving spots are well documented, and dive boats (typically well marked) and diver-down flags would be visible

from the ships conducting the training and testing. Therefore, co-occurrence of recreational divers and Navy activities is unlikely. Swimmers and recreational divers are not expected to be near training and testing locations where active sonar, underwater explosions, and electromagnetic activities would occur because of the strict procedures for clearance of nonparticipants before conducting activities.

The U.S. Navy Dive Manual (U.S. Department of the Navy 2011b) prescribes safe distances from active sonar sources and underwater explosions. Safety precautions for use of electromagnetic energy are specified in DoD Instruction 6055.11, *Protecting Personnel from Electromagnetic Fields* (U.S. Department of Defense 2002, 2009b) and Military Standard 464A, *Electromagnetic Environmental Effects: Requirements for Systems* (U.S. Department of Defense 2002). These distances would be used as the standard safety buffers for underwater energy to protect public health and safety. If unauthorized personnel are detected within the exercise area, the activity would be temporarily halted until the area was again cleared and secured. Therefore, the public is unlikely to be exposed to underwater energy at Navy pierside locations, in training or testing areas, or in ports.

3.13.3.1.1 No Action Alternative

3.13.3.1.1.1 Training Activities

Under the No Action Alternative, active sonar training activities such as anti-submarine warfare, mine warfare, and sonar maintenance would continue at current levels and at current locations. Navy training exercises would be confined within the Study Area in offshore areas and within Naval Base Guam Apra Harbor. See Figure 2.1-5 for locations of training areas and facilities associated with Naval Base Guam Apra Harbor. Most Navy training activities involving active sonar under the No Action Alternative would be conducted well out to sea, however, while most civilian activities are conducted within a few miles of the coast of Guam, the islands of the CNMI, and other island nations close to the Study Area.

Activities involving underwater explosions, such as anti-surface warfare and mine warfare, would also continue at current levels and at current locations. Target areas would be cleared of nonparticipants prior to conducting training, so the only public health and safety concern would be on the rare occasion when an activity exceeds the safety area boundaries. Safety hazard areas would be determined prior to conducting training, and the public would not be allowed into the safety training areas. Standard operating procedures would be followed at all times. This separation decreases the potential for conflicts of military and civilian activities, and reduces the potential for incidents from underwater energy that could threaten the safety of civilians.

The Navy would continue to temporarily limit public access to areas where training activities involving underwater explosions would occur and would issue NOTMARs. Public safety would continue to be enhanced by providing the public with information that would let them take an active role in avoiding interactions with Navy training involving sonar and underwater explosives and ensuring their own safety.

The analysis indicates that no impact on public health and safety would result from training activities using underwater energy, based on the Navy's implementation of strict operating procedures that protect public health and safety. These operating procedures include ensuring clearance of the area before commencing training activities involving underwater energy. Because of the Navy's safety procedures, the potential for training activities using underwater energy to impact public health and safety under the No Action Alternative would be unlikely.

3.13.3.1.1.2 Testing Activities

Under the No Action Alternative, the Navy would continue conducting deep water sound propagation and temperature-sound velocity profiles of the water column in the Study Area (refer to Table 2.4-4 for a complete description). Research vessels, acoustic test sources, side scan sonars, ocean gliders, existing moored acoustic topographic array and distributed vertical line array, and other oceanographic data collection equipment are used to collect information. Under the No Action Alternative, this activity would continue within the Study Area. Because of the Navy's safety procedures, the potential for this testing activity using underwater energy to impact public health and safety would be unlikely.

3.13.3.1.2 Alternative 1

3.13.3.1.2.1 Training Activities

Active sonar training activities would continue to occur at current locations under Alternative 1; however, the potential areas for these activities are expanded under Alternative 1. While Alternative 1 would adjust the locations and tempo of active sonar training activities, the Navy would continue to implement standard operating and safety procedures; therefore, an increased potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely.

Activities involving underwater explosions, such as anti-surface warfare and mine warfare, would also continue within established ranges and training locations, as described under the No Action Alternative. While Alternative 1 would adjust locations and tempos of underwater explosives training activities to include the expanded area of the Study Area and the designation of danger zones around underwater detonation sites, the Navy would continue to implement standard operating and safety procedures; therefore, an increased potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely. Public health and safety would be enhanced by the designation of danger zones around underwater detonation zones and associated restrictions on public access.

Mine warfare activities using electromagnetic energy include airborne mine countermeasures (e.g., Mine Countermeasure Exercise—Towed Sonar). While Alternative 1 would adjust locations and tempos of training activities with electromagnetic energy, the Navy would continue to implement standard operating and safety procedures; therefore, an increased potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely.

The Navy's safety procedures would ensure that the potential for training activities to impact public health and safety under Alternative 1 would be unlikely.

3.13.3.1.2.2 Testing Activities

Under Alternative 1, the Navy would continue conducting deep water sound propagation and temperature-sound velocity profiles of the water column in the Study Area and include other testing activities. The proposed testing activities include testing of anti-surface warfare and anti-submarine warfare systems. They would also include swimmer defense testing and testing of mission packages (anti-surface warfare, anti-submarine warfare, and mine countermeasure) associated with new ship construction (Tables 2.8-2 and 2.8-3). These proposed testing activities would occur within Navy-controlled and established ranges and locations. The Navy would implement standard operating and safety procedures similar to those used during training activities; therefore, an increased potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely. Public health and safety would be enhanced by the designation of danger zones around underwater detonation zones and associated restrictions on public access.

Because of the Navy's safety procedures, the potential for testing activities to impact public health and safety under Alternative 1 would be unlikely.

3.13.3.1.3 Alternative 2

3.13.3.1.3.1 Training Activities

Alternative 2 is similar to Alternative 1 in the increase in active sonar, underwater explosions, and electromagnetic activities over the No Action Alternative. Alternative 2 is identical to Alternative 1 in the proposed locations for these activities. As concluded under Alternative 1, because of the Navy's safety procedures, an increased potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely.

3.13.3.1.3.2 Testing Activities

Under Alternative 2, the same testing activities identified in Alternative 1 would be conducted. The Navy would continue conducting deep water sound propagation and temperature-sound velocity profiles of the water column in the Study Area. The proposed testing activities identified under Alternative 1 would increase slightly under Alternative 2 (Tables 2.8-2 and 2.8-3). These testing activities would occur within Navy-controlled and established ranges and locations and would not impact public health and safety. The Navy would implement the standard operating and safety procedures similar to those used during training activities; therefore, an increased potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely. Public health and safety would be enhanced by the designation of danger zones around underwater detonation zones and associated restrictions on public access. Because of the Navy's safety procedures, the potential for underwater testing activities to impact public health and safety under Alternative 2 would be negligible.

3.13.3.2 In-Air Energy

In-air energy stressors include sources of electromagnetic energy and lasers. The sources of electromagnetic energy include radar, navigational aids, and electronic warfare systems. These systems operate similarly to other navigational aids and radars at local airports and television weather stations throughout the U.S. Electronic warfare systems emit electromagnetic energy similar to that from cell phones, hand-held radios, commercial radio stations, and television stations. Current practices are in place to protect military personnel and the public from electromagnetic energy hazards. These procedures include setting the heights and angles of electromagnetic energy transmissions to avoid direct human exposure, posting warning signs, establishing safe operating levels, and activating warning lights when radar systems are operational. Procedures also are in place to limit public and participant exposure from electromagnetic energy emitted by military aircraft. As stated in Section 3.13.3.1 (Underwater Energy), the level of electromagnetic energy associated with the Proposed Action would not be enough to pose a health or safety risk to the public.

A comprehensive safety program exists for the use of lasers. Current DoD and Navy practices protect individuals from the hazard of severe eye injury caused by laser energy. Laser safety requires pilots to verify that target areas are clear before commencing an exercise. In addition, during actual laser use, the aircraft run-in headings are restricted to preclude inadvertent lasing of areas where the public may be present.

Training and testing activities involving electromagnetic energy include electronic warfare activities that use airborne and surface electronic jamming devices to defeat tracking and communications systems. Training activities involving low-energy lasers include anti-surface warfare, mine warfare, and Homeland

Security/Anti-Terrorism Force Protection with Unmanned Aerial Vehicles. Proposed testing activities that involve low-energy lasers include mine countermeasure mission package testing.

3.13.3.2.1 No Action Alternative

3.13.3.2.1.1 Training Activities

Under the No Action Alternative, electronic warfare training activities involving electromagnetic energy sources would continue at current levels and current locations within the MIRC. Laser targeting activities and mine detection activities using lasers also would continue at current levels and within established ranges and training locations within the MIRC.

The public would not likely be exposed to electromagnetic energy sources or lasers under the No Action Alternative. Based on the military's strict safety procedures for use of lasers and electronic warfare, these activities would not likely be conducted close enough to the public to pose an increased risk. Because of the military's safety procedures, the potential for these training activities to impact public health and safety under the No Action Alternative would be negligible.

3.13.3.2.1.2 Testing Activities

Under the No Action Alternative, the Navy would continue conducting the North Pacific Acoustic Lab Philippine Sea Experiment in deep water in the Study Area (refer to Table 2.4-4 for a complete description). This testing activity does not involve any in-air energy source; therefore, there would be no impact on public health and safety from in-air energy sources.

3.13.3.2.2 Alternative 1

3.13.3.2.2.1 Training Activities

Under Alternative 1, the number of training activities that use electromagnetic energy would increase (Table 2.8-1) and would continue to occur within established ranges and training locations, as described under the No Action Alternative. Laser targeting activities and mine detection activities using lasers would increase but would also occur within established ranges and training locations.

While Alternative 1 would increase locations and tempo of training activities involving electromagnetic energy and lasers, the military would continue to implement standard operating and safety procedures. Therefore, the potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely to increase.

3.13.3.2.2.2 Testing Activities

Under Alternative 1, proposed testing activities that use electromagnetic energy and lasers would occur within established ranges and testing locations. Locations proposed under this alternative include ocean areas of the MIRC and to the west and north of the MIRC.

The Navy would implement standard operating and safety procedures similar to those used during training activities; therefore, the potential for impacts on public health and safety from testing activities under Alternative 1 would be unlikely.

3.13.3.2.3 Alternative 2

3.13.3.2.3.1 Training Activities

Alternative 2 is similar to Alternative 1 in the increase in electromagnetic energy and laser training activities over the No Action Alternative. Alternative 2 is identical to Alternative 1 in the proposed

locations for these activities. As concluded under Alternative 1, impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely.

While Alternative 2 would adjust locations and tempo of training activities involving electromagnetic energy and lasers, the military would continue implementation of standard operating and safety procedures; therefore, the potential for impacts on public health and safety beyond those identified under the No Action Alternative would be unlikely to increase.

3.13.3.2.3.2 Testing Activities

Similar to the analysis under Alternative 1, Alternative 2 would involve an increase in testing activities that use electromagnetic energy and lasers. Electromagnetic energy would occur in established location and ranges in the Study Area. Changes in the locations and tempo of testing activities that use electromagnetic energy and lasers would not impact public health and safety because safety procedures would be in place.

While Alternative 2 would adjust locations and tempo of testing activities involving electromagnetic energy and lasers, the military would implement standard operating and safety procedures similar to those used during training activities; therefore, the potential for impacts on public health and safety from testing activities under Alternative 2 would be unlikely to increase.

3.13.3.3 Physical Interactions

Public health and safety could be impacted by direct physical interactions with military training and testing activities. Military aircraft, vessels, targets, munitions, towed devices, seafloor devices, and other training and testing expended materials could have a direct physical encounter with recreational, commercial, institutional, and governmental aircraft, vessels, and users such as swimmers, divers, and anglers, as well as wildlife.

Both military and public aircraft operate under visual flight rules requiring them to observe and avoid other aircraft. In addition, NOTAMs advise pilots about when and where Navy and Air Force training and testing activities are scheduled. Finally, Navy and Air Force personnel are required to verify that the range is clear of nonparticipants before initiating any potentially hazardous activity. Together, these procedures would minimize the potential for adverse interactions between Navy, Air Force, and nonparticipant aircraft. Standard operating procedures of the Navy and the Air Force ensure that private and commercial aircraft traversing the Study Area during training or testing activities do not interact with Navy and Air Force aircraft, ordnance, and aerial targets.

Wildlife in the area is also subject to interactions with Navy and Air Force aircraft during training and testing activities. The military installations in the Study Area have an ongoing comprehensive Bird Aircraft Strike Hazard program to discourage wildlife from occupying areas of the airfield and adjacent areas. The program would minimize the occurrence of adverse interactions between military aircraft and wildlife, particularly bird/animal aircraft strikes.

Both Navy and public vessels operate under maritime navigational rules requiring them to observe and avoid other vessels. In addition, NOTMARs advise vessel operators about when and where Navy training and testing activities are scheduled. Finally, Navy personnel are required to verify that the range is clear of nonparticipants before initiating any potentially hazardous activity. Similar knowledge and avoidance of popular fishing areas, such as the Galvez and Santa Rosa banks, would minimize interactions between Navy training and testing activities and recreational and commercial fishing. Together, these procedures

would minimize the potential for adverse interactions between Navy and nonparticipant vessels. The Navy's standard operating procedures ensure that private and commercial vessels traversing the Study Area during training or testing activities do not interact with Navy vessels, ordnance, or surface targets.

Recreational diving within the Study Area takes place primarily at known diving sites such as shipwrecks and reefs. The locations of these popular dive sites are well documented, dive boats are typically well marked, and diver-down flags are visible from a distance. As a result, ships conducting training or testing activities would easily avoid dive sites. Interactions between training and testing activities and recreational divers thus would be minimized, reducing the potential for collisions or ship strikes. Similar knowledge and avoidance of popular fishing areas would minimize interactions between training and testing activities and recreational fishing.

Commercial and recreational fishing activities could encounter military expended materials that could entangle fishing gear and pose a safety risk. The Navy would continue to recover targets at or near the surface that were used during training or testing to ensure they would not pose a collision risk. Unrecoverable pieces of military expended materials are typically small (such as sonobuoys), constructed of soft materials (such as target cardboard boxes or tethered target balloons), or intended to sink to the bottom after their useful function was completed, so they would not be a collision risk to civilian vessels or equipment. Thus, these targets do not pose a safety risk to individuals using the area for recreation because the public would not likely be exposed to these items before they sank to the seafloor.

As discussed in Section 3.1 (Sediments and Water Quality), a west coast study categorized types of marine debris collected by a trawler during a groundfish survey. Military expended materials were categorized as plastic, metal, fabric and fiber, and rubber comprising 7.4, 6.2, 13.2, and 4.7 percent of the total count of items collected, respectively. Military expended materials are items used during training and testing activities and may include non-explosive munitions and targets, and accessories related to the carriage or release of these items. They do not include military debris such as wreckage from World War II. The footprint of military expended materials in the Study Area is discussed in Section 3.3 (Marine Habitats). Given the small percentage of items in the survey that were military expended materials, it is unlikely the public would encounter military expended materials during recreational or commercial fishing activities in the Study Area.

Section 3.1 (Sediments and Water Quality) also discussed the low failure rates of munitions, which indicate that most munitions function as intended. While fishing activities may encounter undetonated ordnance lying on the ocean floor, such an encounter would be unlikely given the large size of the Study Area and because the density of munitions in the Study Area is low. The Army Corps of Engineers prescribes the following procedure if military munitions are encountered: recognize when you may have encountered a munition, retreat from the area without touching or disturbing the item, and report the item to local law enforcement by calling 911 or the U.S. Coast Guard.

The analysis focuses on the potential for a direct physical interaction with an aircraft, vessel, target, or expended training item. All proposed activities have some potential for a direct physical interaction that could pose a risk to public health or safety, so the following analysis is not activity specific. While some of the activities may not pose a potential for a direct physical interaction (like pierside activities), the platforms associated with the activity (aircraft, vessel, towed devices) could have a direct physical interaction that could pose a risk. The greatest potential for a physical interaction would be along the coast because of the high concentration there of public activities.

3.13.3.3.1 No Action Alternative

3.13.3.3.1.1 Training Activities

Under the No Action Alternative, training activities would continue at current levels and within current established locations. The potential for a direct physical interaction between the public and aircraft, vessels, targets, or expended materials would not change from existing conditions. The military implements strict operating procedures that protect public health and safety. These operating procedures include ensuring clearance of the area prior to commencing training activities.

The analysis indicates that public health and safety would not be affected by physical interactions with training activities, based on the military's implementation of strict operating procedures that protect public health and safety. These operating procedures include ensuring clearance of the area before commencing training activities involving physical interactions. Because of the military's safety procedures, the potential for training activities to impact public health and safety under the No Action Alternative would be negligible.

3.13.3.3.1.2 Testing Activities

Under the No Action Alternative, the Navy would continue conducting deep water sound propagation and temperature-sound velocity profiles of the water column in the Study Area (refer to Table 2.4-4 for a complete description). Research vessels, acoustic test sources, side scan sonars, ocean gliders, existing moored acoustic topographic array and distributed vertical line array, and other oceanographic data collection equipment are used to collect information. Under the No Action Alternative, this activity would continue within the Study Area. Because of the Navy's safety procedures and the relatively remote location of this testing activity, the potential for this testing activity to impact public health and safety from physical interactions would be negligible.

3.13.3.3.2 Alternative 1

3.13.3.3.2.1 Training Activities

Under Alternative 1, the number of training activities would increase but would continue within established locations. However, the increased number of aircraft and vessel movements or use of targets and expended materials would be conducted under the same safety and inspection procedures as under the No Action Alternative. While Alternative 1 would adjust locations and tempo of training activities, the military would continue to implement standard operating and safety procedures; therefore, the potential for impacts on public health and safety beyond those identified under the No Action Alternative would be negligible.

3.13.3.3.2.2 Testing Activities

Under Alternative 1, proposed testing activities involving aircraft and vessel movement or use of targets and expended materials would be conducted under the same safety and inspection procedures during training. Because the potential for a physical interaction is not activity-specific or location-specific, the analysis for the training activities above applies to testing activities under Alternative 1. As concluded above, because of the military's safety procedures, the potential for testing activities to impact public health and safety under Alternative 1 would be negligible.

3.13.3.3.3 Alternative 2

3.13.3.3.3.1 Training Activities

Under Alternative 2, the number of training activities would increase. The potential for a direct physical interaction between the public and aircraft, vessels, targets, or expended materials would also increase.

While Alternative 2 would adjust locations and tempo of training activities, the military would continue to implement standard operating and safety procedures; therefore, the potential for impacts on public health and safety beyond those identified under the No Action Alternative would be negligible.

3.13.3.3.2 Testing Activities

The potential for a physical interaction is not activity-specific or location-specific, so the analysis for the training activities above applies to testing activities under Alternative 2. As concluded above, because of the Navy's safety procedures, the potential for testing activities to impact public health and safety under Alternative 2 would be negligible.

3.13.3.4 Secondary Impacts

Public health and safety could be impacted if sediment or water quality were degraded. Section 3.1 (Sediments and Water Quality) considered the impacts on marine sediments and water quality of explosions and explosive byproducts, metals, chemicals other than explosives, and other materials (marine markers, flares, chaff, targets, and miscellaneous components of other materials). The analysis determined that no Guam, CNMI, or federal standards or guidelines would be violated by the No Action Alternative, Alternative 1, or Alternative 2. Because these standards and guidelines are structured to protect human health, and the proposed activities do not violate them, no secondary impacts on public health and safety would result from the training and testing activities proposed under the No Action Alternative, Alternative 1, or Alternative 2.

3.13.4 SUMMARY OF POTENTIAL IMPACTS (COMBINED IMPACTS OF ALL STRESSORS) ON PUBLIC HEALTH AND SAFETY

Activities described in this EIS/OEIS that could affect public health or safety include those that release underwater energy, in-air energy, or physical interactions, or that have indirect impacts from changes in sediment or water quality. Under the No Action Alternative, Alternative 1, or Alternative 2, these activities would be widely dispersed throughout the Study Area. Such activities also are dispersed temporally (i.e., few stressors would be present at the same time). For these reasons, no greater impacts from the combined operation of more than one stressor are expected. The aggregate impact on public health and safety would not observably differ.

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