

Final
Range Condition Assessment
Marianas Land-Based Operational
Range Complex
Decision Point 1 Recommendations
Report
GUAM AND COMMONWEALTH NORTHERN MARIANA
ISLANDS

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EXECUTIVE SUMMARY

INTRODUCTION

This Decision Point 1 Recommendations Report provides the findings of the Marianas Land-Based Operational Range Complex Range Condition Assessment (RCA). This Operational Range Complex consists of the 1) Farallon de Medinilla (FDM) Range, Commonwealth Northern Mariana Islands (CNMI); and 2) Emergency Detonation Range (EDR), COMNAVMARIANAS (Commander, Naval Forces Marianas) Ordnance Annex, Guam. RCA's are part of the U.S. Navy's Range Sustainability Environmental Program Assessment (RSEPA), which satisfies the requirements of Department of Defense Instruction (DoDI) 4715.14, Operational Range Assessments. All RCA activities were performed according to the Navy Performance Work Statement (Naval Facilities Engineering Command [NAVFAC], 2004), RSEPA Guidance Manual (Chief of Naval Operations (CNO), 2006), and the RCA Notification Package (ECC, 2005). The purpose of RSEPA is to support the sustainment of Navy ranges by assessing and managing the present environmental condition of each U.S. Navy land-based operational range where munitions-related activities have occurred. The findings and recommendations in this report will support range managers in making informed decisions that ensure range compliance with environmental laws and regulations and protection of public health and the environment.

The RCA consists of three phases: Range Selection (Phase I), Pre-Site Visit Information Collection (Phase II), and On-Site Visit Information Collection (Phase III). Phase III entails the majority of the RCA process, including an on-site visit and assessment of range environmental programs, the Operational Range Site Model (ORSM) and Predictive Modeling for munitions-related testing and training activities and the conclusions and recommendations that support RSEPA Decision Point 1. Figure 1-1 provides an overview of the RSEPA process. The latest RSEPA Guidance Manual distinguishes small arms ranges from other land-based ranges in that they are assessed separately. Accordingly, the small arms ranges were removed from the Marianas RCA for assessment under a separate program. These small arms ranges include: 1) Naval Computer Telecommunications Station (NCTS) Finegayan Small Arms Range (Rifle / Pistol), Guam; 2) KD Small Arms Range, Orote Peninsula; and 3) Pistol Range, Orote Peninsula, Guam.

BACKGROUND

The U.S. Pacific Command (USPACOM), headquartered in Pearl Harbor, Hawaii, is responsible for maintaining national security for the Asia-Pacific region. COMNAVMARIANAS acts as USPACOM Representative Guam and has responsibilities for Guam, CNMI, Federated States of Micronesia, and the Republic of Palau. COMNAVMARIANAS supports operations, logistics, and critical sustainment training for forward deployed U.S. West Coast (Army, Army Reserves, Navy, Marine Corps, Air Force) units and other units (Allied, Guam National Guard) deploying to the Western Pacific, Far East and Middle East.

The Marianas Land-Based Operational Range Complex is comprised of land assets, supporting military facilities, and restricted military airspace. The range complex consists of the FDM Range, CNMI, and EDR, COMNAVMARIANAS Ordnance Annex, Guam.

FDM is a land-based operational range of the Marianas Range Complex. FDM, shown below in Figure 4-2, is an uninhabited island that is approximately 1.7 miles long and 0.3 miles wide (approximately 206 acres). The island is part of the CNMI and is leased for use by the U.S. Government. The island is located at latitude 16°-01'N and longitude 143°-03'E, approximately 50 miles north-northeast of Saipan and approximately 150 north of Guam in the Commonwealth Northern Mariana Islands, and is bounded by the Pacific Ocean on the east and the Philippine Sea on the west. FDM's operational training activities generally consist of aerial bombardment, naval surface fire support, and raiding craft fire.

EDR Site is part of the COMNAVMARIANAS Ordnance Annex located east and uphill of the Apra Harbor Complex along the west-central coast of Guam. The EDR Site (estimated less than 2.0 acres) is very small part of the COMNAVMARIANAS Ordnance Annex (approximately 8,840 acres), and is bounded by undeveloped property and Fena Reservoir to the east (see Figures 4-9 and 4-10). COMNAVMARIANAS Ordnance Annex consists of mostly undeveloped land surrounding ordnance storage magazines with restricted public and military access. The central magazine area of the Ordnance Annex is not available for training. Explosive storage and munitions handling limits the areas that can be used for field training and live-fire range training. EDR Site consists of a level graded earthen demolition pit with steep, grass-covered up-hill slopes bounding the site on south and west. The north and east site perimeters are grass / tree covered, down-hill slopes that drain to the Fena Reservoir, located <1.0 mile east of the demolition pit. This area is reportedly underlain by a relatively thin soil layer and moderate-highly weathered volcanic bedrock.

RCA PHASE I: RANGE SELECTION

In accordance with the 2006 RSEPA Policy Implementation Manual, during RCA Phase I, Navy ranges are selected for assessment if they are land-based, not closed, and have a history of testing or training using munitions. Other considerations are the range's role to the overall Navy mission, known environmental condition and interest to the public. Based upon these considerations, the Chief of Naval Operations (OPNAV) N45, Range Assessments Division, in conjunction with the Marinas Range Complex RCA Management Team determined that FDM Range, CNMI and EDR, COMNAVMARIANAS Ordnance Annex, Guam would be assessed in this RCA. They are the only designated land-based operational range areas within the Marianas Range Complex that have either conducted or currently do conduct munitions-related operations.

FDM RANGE

FDM is the only U.S.-controlled live air-to-ground range in the western Pacific. The range is under the control of COMNAVMARIANAS, and is utilized by Navy, Air Force (USAF), and Marine Corps forces. FDM supports live-fire and inert engagements such as surface-to-ground and air-to-ground gunnery exercise (GUNEX), air-to-ground bombing exercise (BOMBEX), air-to-ground missile exercise (MISSILEX), Fire Support, and Precision Weapons (including laser seeking). Naval Special Warfare Unit ONE (NSWU-1) uses FDM for small arms, grenades, and crew served weapons in direct action against targets on the island. Ocean surfaces are not targeted nor fired upon.

FDM is an uncontrolled and un-instrumented, laser certified range with fixed targets, which includes CONEX boxes and other prefabricated targets in various configurations within the live-fire zones, and anti-aircraft missile and gun shape targets within the inert only zone. The targets present only a visual simulation of actual targets and do not provide real-time electronic scoring. Munitions deployment is restricted to specific impact areas to prevent damage to the island and migratory bird species present.

EDR SITE

EDR is also a land-based operational range of the Marianas Range Complex. EDR Site is part of the COMNAVMARIANAS Ordnance Annex located east and uphill of the Apra Harbor Complex along the west-central coast of Guam. The EDR Site (estimated less than 2.0 acres) is very small part of the COMNAVMARIANAS Ordnance Annex (approximately 8,840 acres), and is bounded by undeveloped property and Fena Reservoir to the east (see Figures 4-9 and 4-10). EDR consists of a demolition pit west of Fena Reservoir that is primarily used by EODMU-5 Detachment Marianas for disposing of WWII Unexploded Ordnance (UXO) munitions by open detonation (certified up to 3,000-lbs Net Explosive Weight [NEW]) that are periodically discovered in Guam. The detonation of ordnance at EDR is reportedly conducted only on an emergency basis.

RCA PHASE II: DOCUMENT COLLECTION AND ON-SITE VISIT PREPARATION

The purpose of RCA Phase II, “Pre-Site Visit Information Collection”, is to gather relevant environmental and range/operational documents that will assist RCA Technical Team members in assessing range and environmental program management practices, and the environmental condition of the Marianas Range Complex. The Marianas Range Complex RCA Phase II occurred from June – July 2005.

All range, installation and environmental program stakeholders at FDM and EDR Guam were notified of the start of the RCA and provided information describing the Marianas Range Complex RCA process. A Range Management In-brief was held with range management, and the NAVFAC Pacific and COMNAVMARIANAS were also initially contacted to determine what staff members will need to be interviewed, and inform them of the types of documents and information that the Technical Team will need to review. All interviewees were provided a “read-ahead” Notification Package in advance of the scheduled Technical Team site visit in RCA Phase III.

RCA PHASE III: ON-SITE VISIT ASSESSMENT

The RCA Technical Team, comprised of on-site support contractors, and staff members from COMNAVMARIANAS and COMPACFLT conducted the RCA Phase III “On-Site Visit Information Collection and Review”, during the week of 2 August 2005.

During the site visit, the Technical Team interviewed key range managers and COMNAVMARIANAS environmental program managers. Additional range, operational, and environmental records were collected at this time. Interview forms from the RSEPA Policy Implementation Manual (RSEPA Forms 6 through 16) were used to acquire and record the information needed to assess the environmental regulatory compliance of the ranges. Interview forms are tailored to address range compliance with the following U.S. Navy Environmental Program areas:

- Air Quality
- Water/Wastewater
- Military Munitions/Solid Waste/Hazardous Materials/Hazardous Waste
- Cultural Resources
- Natural Resources
- Emergency Planning and Community Right to Know Act (EPCRA)
- Environmental Planning
- Range Environmental and Explosives Safety Management
- Installation Restoration (IR)
- Storage Tank and Petroleum, Oil, and Lubricants (POL) Management
- Safe Drinking Water

The COMNAVMARIANAS environmental programs that oversee the environmental management of the Marianas Range Complex area were determined to be in compliance with applicable U.S. Navy environmental program requirements. Technical Team members did develop some recommendations that could improve upon range management, which are provided in the Decision Point 1 section below. A brief summary for each range is provided below which gives an explanation of the rationale used in making the range management improvement recommendations.

Recommendations for range management improvements at FDM were based on: 1) isolated, uninhabited island; 2) limited, controlled site access due in part to steep topography; 3) current site use and environmental conditions for Zones 1 and 3 (south and mid-sections of island); 4) current use of live or inert ordnance; and 5) no MC (munitions constituents) related pathway / receptor interactions associated with the range.

For EDR site, recommendations for range management improvements were based on: 1) current facilities with security measures / protocols; 2) site use for current 0.75-acres “EOD Blowhole”; 3) current approved 3,000-pounds NEW for non-fragmentation and 600-pounds NEW for fragmentation explosives; 4) environmental conditions include a drinking water reservoir located downgradient of the site; and 5) low probability of exposure to human receptors to MC’s in significant concentrations.

Technical Team members’ assessments of environmental programs’ compliance with respect to management of the FDM and EDR Guam range areas are also provided in detail within the report. Assessments are based upon the information gained during interviews and from supporting documents. Environmental Program Managers answered questions only with respect to their knowledge of their individual programs. Records review provided additional information beyond the scope of program managers’ personal experience or knowledge.

OPERATIONAL RANGE SITE MODEL (ORSM)

ORSMs are used in RSEPA to characterize land-based ranges for the purpose of determining possible sources of MCs, pathways of movement of MCs, and possible human and ecological receptors. ORSMs are also used to determine where predictive modeling is needed to assess the risk of off-range releases of MCs.

FDM

The FDM ORSM summarized in this section supports the Technical Team’s assessment that munitions-related activities conducted at the range did not warrant further analyses due to its uninhabited remote location posing no risk of exposure to human receptors. Based upon the types and quantities of live ordnance that were recorded to have been dropped on FDM, the estimated source loading of residual MCs at the range was conducted and reported in Section 4.1.3.2.10 of this report.

Operational

Aerial and shore bombardment activities have been conducted at FDM since October 1971. According to the Environmental Impact Statement (EIS) completed for FDM in 1975, the quantity of ordnance delivered on FDM was approximately 22 tons per month during the peak of training operations during the Vietnam War. These munitions consisted primarily of air-delivered 500- and 750-pound bombs, but also included approximately 60 three-inch Naval projectiles fired per month during shore bombardment exercises. Assuming this rate of munitions usage for a period of 42 months (October 1971 through March 1975), approximately 1,019 standard tons (2,037,070 pounds) of air and surface delivered ordnance was dropped on FDM. The 1975 EIS indicated that training operations at FDM following the Vietnam War effort were likely to reduce loading to 40 tons of aerial munitions delivered per year, with similar shore bombardment totals and the use of four to five air-to-surface “bullpup” missiles per year. The entire land portion of FDM was utilized for aerial and shore bombardment until 1999. An EIS completed in 1999 for the island subsequently identified four specific impact areas (Figures 4-5 and 4-6) that limit the portions of the island in which bombardment can be conducted.

FDM is currently utilized for scheduled bombing and ship bombardment training operations. The island is also used in the Tandem Thrust Exercise (now part of Exercise Talisman Saber), a biennial joint

exercise event. In the 1999 EIS, the Navy provided estimates of the quantities of explosives to be expended on an annual basis at FDM. The estimates included munitions delivered during training operations for strategic bombing, air-to-surface gunnery, naval gunfire, and raiding craft fire. The following descriptions of training exercises conducted at FDM are provided in the 1999 EIS and the 2000 Marianas Training Handbook. The allowable expenditures at FDM are also listed, based on data provided in COMNAVMARIANAS INST 3502.1. The following is a description of the munition items listed in the available expenditure records.

Strategic Bombing

- USAF ACC B-52, B-1, and B-2 jet aircraft conduct high-, medium- and low-altitude bombing runs dropping conventional and precision-guided munitions, and mines.
- Navy SEALs (Sea, Air, and Land) support the precision-guided bombing through Tactical Air Control Party support in the special-use area on the northern end of the island (Zone 4).
- Estimates indicate between 5 and 612 live and/or inert bombs are delivered per month.

Air-to-Surface Gunnery

- Navy and Marine Corps fighter / attack jet aircraft operating from transiting aircraft carriers practice interdiction, strike, and Close Air Support in delivering 500-pound bombs, air-to-ground missiles, and 20-millimeter (mm) canon fire to the impact areas within Zone 1.
- Fixed-wing AV-8B Harriers and AH-1W Super Cobra helicopters also conduct gunnery training with machine gun, cannon, and missile fire.
- USAF AC-130 gunships also fire 20 mm cannon and 105mm howitzer at FDM. Average 7.62mm round contains 0.268 oz (0.0167 lbs) of lead
- Munitions expenditures may be up to 80 air-to-surface missiles, 840 air-to-surface rockets (2.75-inch and 5-inch), and 4,020 conventional and high explosive (HE) bombs (1,400 250- to 500-pound bombs, 1,240 1,000- to 2,000-pound bombs, and 1,380 inert bombs).

Naval Gunfire

- Ships of the Seventh Fleet fire deck-mounted guns at the western cliffline using HE, point-detonating rounds with mechanical and variable time-fuzed rounds.
- 76-mm OTO Melara guns are also used by small combatants, hydrofoils and US Coast Guard (USCG) patrol craft. Practice munition does not contain an explosive filler.
- Illumination rounds may be used to light up the impact area so strikes may be observed.
- Munitions expenditures may reach 1,040 5-inch shells and 400 76-mm shells per year.

Raiding Craft Fire

- NSWU-1 utilizes rigid hull, inflatable boats to deploy from Guam to fire AT-4 anti-tank missiles, 40mm grenades, 7.62mm rifles, and .50 caliber machine guns at the same cliff impact areas designated for Naval gunfire.
- The AT-4 has been replaced by the Carl Gustav shoulder-launched M3 missile, which has greater range and a variety of shells, including a training projectile.

- Munitions expenditures may reach 40 AT-4 anti-tank missiles, 2,600 40-mm grenades, 50,000 rounds from 7.62-mm rifles, and 600 rounds from .50 caliber machine guns.

Air-to-surface gunnery activity at FDM is expected to increase as both Navy and USAF operations are expected to increase. USAF expansion on Guam may include more frequent or additional bomber wing deployments and stationing of a permanent FA-22 or F-15 squadron on Guam. Activities from Navy strike forces stationed in Japan may increase as ranges in Okinawa and Japan continue to be encroached upon. Activities from Navy strike forces out of Hawaii or Guam may increase with forward stationing of a Carrier in either port.

Naval gunfire requirements at FDM are anticipated to remain the same or slightly increase. The primary users of FDM for shore bombardment are Guided Missile Destroyers (DDG) and Guided Missile Cruisers (CG) stationed in Yokosuka, Japan. These ships currently utilize Okino Daito Jima in Okinawa for naval gunfire qualification. It is anticipated that FDM will remain an alternate destination for naval gunfire as an event occurring within the context of expeditionary or carrier strike group sustainment operations.

Future munitions use at the FDM range may also include additional five-inch ordnance items, including a HE Projectile (HE-ET), a Kinetic Energy Projectile (KE-ET) and the EX-171 RGM projectile, a rocket-assisted projectile is capable of carrying a 4-caliber submunition.

Land Use

FDM is utilized solely as an aerial and shore bombardment training range. COMNAVMARIANAS controls the island, which is under lease to the U.S. Government from the CNMI. FDM is listed as part of CNMI under a joint-territorial covenant to the US with a 50-year leasehold to DON. Thus FDM should be considered a US territory under the CNMI joint-territorial covenant. Land use is not expected to change at this time. On 6 January 1983, a 50-year lease agreement for FDM was signed and the Navy assumed control and possession. The lease agreement contains a renewable provision for another 50 years of use of the island. Under the terms of the lease agreement, none of the leased lands may be privately owned, nor are any CNMI residents allowed to live or develop there. Any non-military uses within the leased areas must be approved by the Navy. Article 9, Improvements; Restoration of the lease agreement provides specifically to FDM, "...upon identification by the Lessees of a project for use of a specific area and notification to the United States of such intended use, the United States shall, to the extent practicable, remove all unexploded ordnance and exploded ordnance fragments from that area."

There are no land uses for the public at FDM. Access to the island is restricted to authorized military personnel (EOD and SEALs) only.

Environmental

FDM is a long, narrow island (approximately 187 acres) comprised of a hilly plateau with steep cliffs (up to 320 feet) that drop to the ocean on all sides (see Figure 4-4). No beaches are present along the shoreline. A narrow submerged shelf with limited coral communities surrounds the island. The top surface of FDM in the middle and northern sections of the island consists of gently rolling topography. Craters created by aerially-delivered ordnance are concentrated in the central portion of the island and can measure six feet deep and 20 feet in diameter. Steep cliffsides, descending directly to the ocean from as high as 330 feet, are present on all sides of the island. The southern portion of the island is steep with mostly exposed limestone and limited vegetation.

Current vegetation on FDM consists of low-lying shrubby and herbaceous littoral vegetation up to six feet in height. Vegetation is impacted by the use of live ordnance on the range; the communities are not

homogenous and lack clear boundaries, likely caused by cratering from ordnance impacts. The low-lying vegetation could provide suitable habitat for some bird species for nesting, foraging, and sheltering, particularly on the northern end of the island. Vegetation is comparatively sparse on the southern end of the island.

Surface water is not present on FDM. The presence of a subsurface freshwater aquifer is not known; however, due to the small size, sloping topography, and limestone composition of the island, it is unlikely that a significant groundwater resource is present at FDM.

Three ecosystems, none of which are considered sensitive, have been identified on FDM, including coastal, cliffline, and inland mesic terrace ecosystems. Management objectives have been established for these ecosystems to protect coastal resources, protect avifauna populations, enhance vegetative growth, and to monitor changes in the physical condition of the island (topography, vegetation). Wetlands or critical habitats for threatened or endangered species are not present on FDM.

There are no known threatened and endangered plant species on FDM. Avifauna surveys completed in 1975, 1996, and 1997 indicate that up to 24 bird species may be present on FDM. Species consists of seabirds, migratory birds, and resident land birds. Of these, only the Micronesian Megapode (*Megapodius laperous*) is listed as an endangered species and it is estimated that no more than 21 pairs inhabit the island (Scott Vogt, 2007). The megapode is found in the more densely vegetated areas of the island and is known to be present in the southern and eastern sides of the island in Zone 3 plateau. The Mariana fruit bat (*Pteropus marianus marianus*) is listed as a federally threatened species (Federal Register / Vol. 70, No. 4 / January 6, 2005) and has also been observed on the island (see Figure 4-7). Military training in this zone is restricted to impact areas established west and north of the known nesting locations to minimize impacts on megapode nesting sites and megapode and Mariana fruit bat juveniles. Surveys of Threatened and Endangered (T&E) species that may have been injured or killed as a result of training activities are conducted and reported on an annual basis.

In addition, several bird species such as the Great Frigate Bird and Red-footed Booby (see Figure 4-8), which not endangered or threatened, are protected under the Migratory Bird Treaty Act (MBTA) of 1918, which limits “taking” of migratory birds. In 1996, the Navy applied to the US Fish & Wildlife Service (USFWS) for a permit pursuant to MBTA regulations that would allow the incidental taking of migratory birds on FDM as a result of training exercises. The permit request was rejected, though the USFWS continued to elect to not exercise enforcement action of the MBTA at FDM. In 2002, a civil case brought against the Navy and DoD for violating the MBTA resulted in the issuance of an injunction that prevented live-fire training at FDM. Several months later, the 2003 National Defense Authorization Act issued by Congress included a provision for a one-year exemption for the Armed Forces for the incidental taking of migratory birds during military readiness activities. Since that time, the USFWS has issued a proposed rule allowing for incidental taking of migratory birds during training activities by the DoD.

As part of a biological opinion issued by the USFWS in 1998 and in an effort to minimize impacts to the bird populations on FDM, monthly aerial surveys of the island are conducted. These surveys are via helicopter and personnel from NAVFAC Pacific conduct biological seabird counts for trend analysis. The biologists also survey surrounding waters for sea turtles and marine mammals. Sea turtles have not been commonly observed near FDM and the island is unsuitable as a nesting area. They also take photographs of the island for long-term comparisons of physical changes.

NAVFAC Pacific with support from COMNAVMARIANAS also conducts an annual underwater marine survey of FDM. This survey, in cooperation with National Oceanic and Atmospheric Administration (NOAA) Fisheries, USFWS, and CNMI Division of Fish and Wildlife, evaluates the nearshore waters. In addition, EOD units occasionally survey FDM to monitor the condition of coral around the island and to

detect the presence and monitor concentrations of UXO. To protect coral communities, no detonations of UXO are conducted in the ocean.

The Brown Treesnake (BTS) is not present on FDM. Measures are taken to accordance with the BTS Control and Interdiction Plan (COMNAVMARIANAS INST 5090.10A, February 2005) to prevent contamination of the island with this invasive species. This includes inspection and quarantine of targets to be placed on the island for training purposes.

An Integrated Cultural Resources Management Plan (ICRMP, 2003) for FDM has not been prepared since there are no significant cultural resources management issues for FDM. However, an Integrated Natural Resources Management Plan (INRMP, 2004) was completed for FDM and nearby Tinian Island in 2004. There are no IRP sites on FDM. The Military Munitions Rule does apply to activities at FDM, as the island is listed as US territory under a CNMI-US joint-territorial covenant with a 50-year leasehold to DON.

FDM ORSM: Assessment

Historical records and interviews indicate that live munitions used during strategic bombing, air-to-surface gunnery, naval gunfire, and raiding craft fire training would have been responsible for the deposition of the majority of residual explosives at FDM. Section 4.1.3.2.8 discusses the munitions expenditures and constituents profile data results for FDM and the quantities explosives used on annual basis on the range. No laboratory data exists to demonstrate transformation or transport of HMX, RDX, and TNT either on or off-site. Risk assessment indicates that human receptors are limited to range users and level of risk is acceptable for all range users.

Section 4.1.4 provides a summary of the ORSM results for the FDM range. The ORSM for FDM focuses only on off-range releases and exposures to human receptors (of which there were none). The RSEPA Manual does not provide any provisions for potential MC migration to marine environments. The manual states that “surface water and/or sediment modeling should not be conducted in marine environments (e.g., no modeling of fate and transport in ocean, bays),” indicating that the Navy does not consider these possible pathways and exposure routes (at least at this time).Based on the isolated location of the uninhabited island, quantities of explosives and used at the range on an annual basis, and the very low risk probability of exposure to human receptors to MCs, no further analysis is required to assess risk of off-range release of MCs at the FDM Range. This range will be re-evaluated when the RCA is repeated in five years.

EDR SITE

The Marianas Range Complex ORSM supports the Technical Team’s assessment that the live munitions-related activities conducted at the EDR site are not a significant source of MCs and have not posed an unacceptable risk to public health and the environment based upon surface water and soil sampling analytical results that rule out the presence of MCs. The quantity of MCs used at EDR and soil / water concentrations detected off-range served as data source points for the Predictive Model to the make recommendation for no further analyses. For these reasons and based upon RSEPA Policy Implementation Manual guidance (Rev. 1) (CNO, 2006) that Predictive Modeling is only necessary where live munitions are used, no further analyses was conducted for munitions-related testing in the EDR area.

Operational

The exact date the range was constructed and first used is unknown; however, a letter from the U.S. Naval Magazine to the Federal Aviation Administration (FAA) dated 26 May 1978 requesting that the airspace above the range be classified as restricted does provide some valuable information regarding the historic

use of the range. The letter states that the range has been used for “land detonation of hazardous WWII and current inventory ordnance” for more than twenty years. This dates the range back to at least 1958. However, it is likely that the range dates back to when the Naval Magazine was constructed due to contingency requirements to have an active demolition range available at an explosives magazine storage facility in case of emergency.

A review of the limited available historic records associated with the range indicates that a significant amount of WWII UXO, associated with the U.S. effort to recapture the island from the Japanese in 1944, has been disposed at the range. The 1978 letter referenced above indicates that in 1977, EOD technicians retrieved and disposed of 11.2 tons of UXO. The letter indicated that the planned frequency of use for the range was daily from December through May (dry season) and as often as weather permits during June through November (typhoon season). A 1977 memorandum from Commanding Officer, U.S. Naval Magazine Guam regarding the re-designation of the range from a Class B site to a Class A detonation site referenced 25,000 lbs of WWII ordnance being recovered on an average yearly basis. Based upon records from the early 1990s, it appears that the amount of WWII UXO recovered on the island has decreased on average. For example, documentation from the CNO exemption of the site from the requirement for a 500 foot radius cleared area prepared in the early 1990s indicated that on average 8,000 lbs per year of WWII UXO requiring detonation is recovered on Guam.

The range is used on average 2-3 times per month depending upon training needs and the frequency of UXO finds on Guam requiring disposal. Range use records were available for six years (1998 and 2001–2005). The number of records per year is provided below.

- 1998 – 25 records
- 2001 – 25 records
- 2002 – 21 records
- 2003 – 16 records
- 2004 – 29 records
- 2005 – 20 records (through July)

The records are summarized in the munitions section (see Section 4.2.5.6).

The Navy EODMU Five Detachment Marianas responds to calls associated with military UXO discoveries throughout Guam and the surrounding Mariana Islands. Much of the UXO from WWII recovered (approximately 8,000 lbs per year) is in advanced stages of deterioration. This UXO is disposed of on the range on an as needed basis. The range is also used for EOD training purposes including the use of demolition charges and EOD tools.

EODMU Five Detachment Marianas has the overall responsibility for range clearance and maintenance operations conducted on the range. COMNAVMARIANAS INST 8027.1A (dated 22 September 2003) requires that all commands using the range provide a working party of no less than five personnel once per quarter, to facilitate range sweep and maintenance operations. In addition to the regular range clearance efforts, the EOD officer-in-charge (OIC) indicated that the facilities/public works office regrades the surface of the cleared area on a regular basis to smooth out the craters caused by the detonations to minimize the potential for free standing water at the site (see Figure 4-15).

There are no plans in the immediate future to change the use of the range. It is anticipated that the range will continue to be used at its current tempo with variations in use due to mission requirements and the number of UXO discovered on Guam that requires disposal.

Land Use

The EDR Site is considered an operational range. Land use surrounding the range is severely limited and is restricted to uninhabited land, as ESQD arcs from the explosives storage magazines and the range occupy approximately 70 percent of the installation.

Portions of the area surrounding the Ordnance Annex are privately held. The public does not have access to or use of the Ordnance Annex property. However, it should be noted that there reportedly has been encroachment (i.e., trespassing) from adjacent private lands onto the Guam Ordnance Annex primarily for poaching wildlife (i.e., deer, pigs, and carabao).

Environmental

The detonation site is located on a hillside west of the Fena Reservoir. The range has an open cleared area where the demolition and disposal charges are set up (approximately 0.75 acres). The north side of the cleared area is bounded by a steep hillside (approx 50' high) sloping sharply from west to east. The side of the hill facing the detonation site is nearly vertical (see Figure 4-13). On the extreme south side, the site is bounded by the Almagosa River gorge which is approximately 40 feet deep and 400 feet wide. At the widest point, the detonation site is an open area approximately 400 feet across sloping towards the reservoir (see Figure 4-14). An EOD crew blast shelter used for personnel protection purposes is located in the cleared portion of the range. The range has an explosives safety quantity distance (ESQD) safety radius of 5,000 feet. The range layout is shown in Figure 4-15.

The immediate area of the range is cleared of the majority of vegetation (approximately a 100 foot circle). The range OIC reported that the area is cleared and graded on a regular basis by facilities to minimize the potential for standing water to remain in detonation craters. Thick, undisturbed vegetation exists on the periphery of the range, particularly adjacent to the service road leading to the range.

The Guam INRMP lists the area that the Guam Ordnance Annex is located in as being within the vegetation coverage area generally classified as the Ravine Forest community. Within the Ravine Forest classification, the EDR Site is specifically classified as Savanna (mixed species) grasslands. These forests are generally located on volcanic soils or on argillaceous limestone soils, and are quite variable in floristic composition. This community is considered suitable habitat for threatened and endangered bird species on Guam. Sections of Savanna community are also present in areas peripheral to the range for which the EDR Site is classified. The EDR site and surrounding area are reportedly heavily used by feral ungulates (i.e., deer, pigs, and carabao) which can disturb and/or "rut" the surface soils, especially during the wet season.

The ravine forest (structurally complex with multiple layers) and disturbed ravine forest (usually dominated by non-native woody species with a more open canopy) plant communities are abundant in Ordnance Annex, occupying much of the south central portion of the Annex. Swamps, which are delineated as ravine communities, are often present on argillaceous limestone soils on bottomlands and also present in depressional areas. *Hibiscus tiliaceus* and *Pandanus* spp. are the most common woody plant associated with these communities. *Hibiscus tiliaceus* can form dense thickets along the edges of marshes and in bottomlands.

The EDR Site lies within the watershed of the Fena Reservoir, a source for potable water for Naval activities and approximately 30% of the water needed by the residents of Guam. The EDR Site lies just north approximately 2,400 feet uphill from the Fena Reservoir. Surface water drainage from the area enters the Almagosa River just upstream from its discharge into the reservoir. The Fena Reservoir is the largest freshwater body of water on Guam with a maximum storage capacity of about 7,500 acre-feet.

Fena Reservoir provides the majority of water to the Navy. Surplus water is sold to the Government of Guam for distribution to residents in southern Guam. The Fena Water Treatment Plant is owned by NAVFAC Marianas and has been in operation for over 40 years providing potable water at a rate of approximately 13.5 million gallons per day (mgd). Approximately 5 mgd are used for Naval activities and the remaining (approx 8.5 mgd) is sold to the Guam Waterworks Authority for public use.

The COMNAVMARIANAS Environmental Division provided sampling data for water wells within the Navy water system over a 16 month period from 2002 to the end of 2003. The wells, including one labeled the “Fena Clearwell” were sampled for various chemical constituents, including perchlorate, nitrobenzene, 2,4-dinitrotoluene (DNT), and 2,6-DNT. None of the compounds were detected in any sample collected from the water production wells during this timeframe. The samples were analyzed for perchlorate using analytical procedure EPA Method 314.0. The locations of the wells were not provided with the analytical data. Environmental Division personnel were not aware of any sampling conducted within Fena Reservoir itself.

The EDR Site lies approximately 2,400 feet north and upgradient from the Fena Reservoir. Surface runoff from the range floor drains to the southeast along an unlined, earthen ditch. The earthen ditch discharges runoff to a culvert, which conveys the water down the steep topography of the ravine. Surface water drainage from the area enters the Almagosa River upstream from its discharge into the Fena reservoir (see Figure 4-16). No site-specific groundwater data was available to the Technical Team for the range; groundwater studies in the Southern Guam area were not available, and no groundwater monitoring wells are present in the immediate area of the range. The INRMP indicates that groundwater in this region generally flows laterally along the impervious layers of volcanic rock found beneath shallow soils. Groundwater eventually discharges to seeps, springs, stream, and/or wetlands. The majority of the annual precipitation likely runs off the range as surface drainage; little precipitation likely infiltrates through the clayey, shallow soil and into fractures in the volcanic rock. Any groundwater in this area likely discharges to the Almagosa River south of the range, or the Fena Reservoir to the east.

All of the Ordnance Annex lands are included in the Guam National Wildlife Refuge with the exception of administrative areas and the EDR site. The U.S. Navy, in cooperation with the U.S. Fish and Wildlife Service and the Government of Guam, Division of Aquatic and Wildlife Resources, manages these lands for federally listed threatened and endangered species.

Fena Reservoir serves as a source for potable water and important habitat for the federally listed endangered Mariana Common Moorhen. The largest population of Guam Swiftlet is known to exist within the terrestrial habitat the Ordnance Annex. Neither of these endangered species are believed to presently inhabit the EDR Site Range. Rare sightings of the threatened Mariana Fruit Bat have been reported over and around the Fena Reservoir. No other threatened or endangered species are believed to presently inhabit Navy lands at Ordnance Annex.

There are significant areas of cultural resources identified in the general vicinity of the EDR site. There are no IRP sites located within or associated with the range.

PREDICTIVE MODELING

Predictive modeling is used to estimate potential concentrations and the migration rates of MCs moving through the environment when the ORSM demonstrates that the environmental media are potentially impacted. In accordance with the RSEPA Policy Implementation Manual, Predictive Modeling was conducted with respect to estimating the mass loading of residual MCs at the EDR Site, as it is the only range area where live munitions-related activities occurred. A surface water (SW) screening level assessment was performed on the EDR Site to determine if the potential exists for RSEPA MCs of

concern (TNT, RDX, 2-4 DNT, HMX, and Perchlorate) to reach the Fena Reservoir (a potable water source) located approximately 2,400 feet downgrade.

The primary tool selected for modeling MC in SW is CalTOX, a spreadsheet-based multimedia total exposure model used for hazardous waste sites, developed by the California Department of Toxic Substances Control. The model consists of a multimedia transport and transformation model and exposure scenario models for conducting risk assessments. For the modeling of potential MC releases from the EOD Range, only the multimedia transport and transformation model of CalTOX was used because quantitative risk assessment is not an objective of this project. CalTOX was chosen as a screening model to simulate the release of MC to SW because of the model's overall capability of incorporating many of the transport mechanisms (erosion of particulate and adsorbed in soil, direct dissolution in runoff and leaching to the subsurface environment) that are likely to affect MC from their point of origin in surface soils to their release into streams.

The ORSM provided the basic information on the site-specific environmental conditions and the types and quantities of MEC disposed of at the range. A major input of CalTOX (and any screening level model) is the mass or concentrations of MC deposited on the range over time, referred to as MC loading. A general summary of the MC loading and the CalTOX model used in the assessment are provided below. This is followed by the screening level model results.

MASS LOADING

The SW screening analysis model requires the MC loading rate (kg/m^2). It is conservatively assumed that MCs not consumed by the detonation are all deposited directly on the range floor. Air releases by fugitive dust and other emissions are not considered to be significant contributors to potential off-range transport into the Fena Reservoir due to the prevailing wind direction (generally from the east and northeast) and occurrence of heavy rainfall (holds dust down). The area of range is calculated estimated as 49,060 ft^2 (125 foot radius circular area). Calculating the MC loading and converting to metric units (1 lbs/ft^2 equals 4.87 kg/m^2) the following average per year MC loading rates are presented in Table 2-3.

These MC loading values are used as an input to the CalTOX screening level model along with site specific data about the site. For modeling purposes, the concentrations listed in the table above are estimated to be in the soil at the range subject to migration via the surface water pathway. The CalTox model is used to estimate potential down gradient concentrations of each RSEPA MC based upon site specific data. An overview of the CalTOX model is presented below.

CALTOX MODEL

The multimedia transport and transformation model in CalTOX is a dynamic model that can be used to assess time-varying concentrations of contaminants introduced initially to the soil layer or for contaminants released continuously to air or water. This model allows the prediction of how chemical and landscape properties would affect the mass of contaminants transported to different environmental media, including: air, ground-surface soil, plants, root-zone soil, vadose-zone soil below the root zone, surface water, and sediments. CalTOX uses a fugacity model to estimate chemical partitioning in the different environmental media. It mathematically addresses the inventory of a chemical in each media and evaluates the likelihood for a chemical to be transported to another media, remain in the media or be transformed to some other chemical species over a given period of time. Mass flows within environmental media include solid-phase flows, such as dust suspensions or deposition, and liquid-phase flows, such as surface run-off and groundwater recharge. The transport of chemical species among environmental media occurs by diffusion and advection at the media boundaries (CalTOX Documentation, California Office of Scientific Affairs Department of Toxic Substances Control, 1994).

CalTOX was used to assess MC deposited on the surface of the EDR Site which may potentially migrate via surface runoff. The high frequency of precipitation in this region coupled with clayey soils and shallow rock likely contributes to rapid runoff from the range. MC dissolved in surface runoff would be carried through the unlined earthen ditch to the culvert beneath the access road. At this point, water is discharged down the steep ravine to the east and into the Almagosa River, which ultimately discharges to the Fena Reservoir, 2,400 feet downstream from the range. As the reservoir serves as a potable water source, there is a potentially complete exposure pathway to these receptors from MC originating on the range.

The results of the screening-level analysis predict that concentrations of TNT, RDX and 2,4-DNT exceed both the MDL and the RL in surface water runoff at the discharge point of the Almagosa River into the Fena Reservoir within the final seven years of the loading period. TNT was predicted to have the highest concentration at the discharge point into the reservoir (0.84- $\mu\text{g/L}$). In contrast, RDX and 2,4-DNT concentrations were predicted to be approximately at their respective RLs. Further, perchlorate and HMX concentrations were predicted to be below their detection limits at the discharge point into the Fena Reservoir.

All MC concentrations were predicted to be below their USEPA risk-based concentration levels in surface water runoff at the discharge point of the Almagosa River into the Fena Reservoir. This suggests that even though TNT, RDX and 2,4-DNT are predicted to be released from the range at detectable levels, these MCs are not released into the reservoir at levels representing a health concern.

PREDICTIVE MODELING SUMMARY

A confirmation sampling and analysis effort was conducted in August 2007 to confirm the results of the predictive model and to verify whether MC deposited on the range is migrating at elevated concentrations to the Fena Reservoir. The report is provided in Appendix G; a comparison of the analytical results to the RSEPA screening values is provided on Forms 21 and 22. Soil samples collected around the culvert prior to discharge down the ravine indicate that MC are not present in concentrations exceeding RSEPA screening criteria [which are based on EPA Region IX Preliminary Remediation Goals (PRGs)]. TNT and 2,4-DNT were the only explosive compounds detected (in one sample); perchlorate (tested in two of the eight soil samples collected) was detected at an estimated concentration in only one sample. Three soil samples collected from the drainage channel immediately adjacent to the Fena Reservoir had no detectable levels of perchlorate or explosive compounds. Four surface water samples collected at the discharge point to the Fena Reservoir had no detectable concentrations of explosive compounds.

Potassium, manganese, and zinc concentrations were also analyzed in soil and surface water samples as part of the confirmation sampling effort. While these constituents are not considered RSEPA MC, they were determined to be potentially present at elevated levels due to training operations. Manganese and zinc were detected in all soil and surface water samples below their respective EPA Region IX PRGs. A PRG has not been established for potassium. Based on the results of the confirmation sampling, an incomplete exposure pathway is documented for potential MC migration from the EDR Site to the Fena Reservoir and watershed. As the current operational tempo for the range is expected to be maintained, the pathway is likely to remain incomplete in the near future. However, the pathway should be re-evaluated during the next RSEPA review of the range.

Predictive modeling for MC migration at this range was completed as part of a modification to this contract. The predictive modeling results were incorporated into the preliminary ORSM towards selecting potential MCs in soil and surface water. In August 2007, confirmation sampling and analysis was performed at the EDR site using the preliminary ORSM. EDR analytical data was found to be below residential Preliminary Remediation Goals (PRGs) and was incorporated into the existing predictive

model (see Appendix F) for MC migration evaluation. Findings indicated that migration of MCs had not exceeded PRGs and that a follow-up RCA in 2011 (every 5-years) should be performed at the EDR site in accordance with the RSEPA 2006 technical guidance. A letter report summarizing the EDR confirmation sample analytical results was incorporated as a separate Appendix G to this final Marianas DPI report.

DECISION POINT 1

ARE FURTHER STEPS REQUIRED TO MAINTAIN COMPLIANCE?

Findings from Interviews and Records Review

Records review and interviews with environmental compliance managers and range personnel at FDM and EDR indicate that installation environmental programs are in compliance with U.S. Navy environmental program requirements and are; therefore, considered to be in compliance with Federal environmental regulatory requirements. No further steps are required to maintain environmental compliance of the Marianas Land-Based Operational Range Complex. Some areas have been identified that could enhance compliance with U.S. Navy range management requirements.

RECOMMENDATIONS/PROTECTIVE MEASURES PLAN

The following measures are recommended to enhance compliance of the Marianas Range Complex area with the requirements specified in DoDD 4715.11:

Maintaining Range Records

- Document duds of munitions used within the Marianas Range Complex that illuminate or have live motors, such as flares, rockets or missiles.
- Establish a permanent record of all UXO clearance activities.

Range Access

- Establish procedures to determine which Marianas Range Complex visitors require an escort.
- Prepare a training aide that includes photographs and/or video clips of the potential UXO hazards for authorized visitors to the Marianas Range Complex.
- Add UXO hazard labels to the No Trespassing signs at the EDR area to alert the public to the explosive hazards of trespassing onto the ranges.

UXO Hazard Education

- Implement a proactive education program to alert personnel of the potential UXO hazards at FDM and at the EDR site.

IS FURTHER ANALYSIS REQUIRED TO ASSESS RISK OF POTENTIAL OFF-RANGE RELEASE?

Findings from Munitions Data and ORSM

FDM DATA AND ORSM FINDINGS

The Technical Team's assessment is that the aerial bombing and ship bombardment training activities conducted at FDM are a significant source of MCs. Since FDM is an uninhabited isolated island, the Technical Team concludes that the munitions-related operations have no risk of exposure to human receptors. No further analysis is required to assess the risk of an off-range release of MCs at FDM. The range should be re-evaluated when the RCA is repeated in 5 years.

EDR SITE DATA AND ORSM FINDINGS

The Technical Team's assessment is that the emergency disposal and training of munitions-related activities conducted at the EDR Site are not a significant source of MCs. ORSM, predictive model, and subsequent confirmation soil and surface water sampling found no MC related pathway / receptor interactions associated with EDR and the nearby Fena Reservoir. The Technical Team concludes that EDR Site munitions-related operations have not posed an unacceptable risk to public health or the environment and no further analysis is required to assess the risk of an off-range release of MCs at the range from past munitions-related operations. The Technical Team recommends that the range be re-evaluated with a RCA in another 5 years.