

**FINAL**

**PATUXENT RIVER COMPLEX  
RANGE CONDITION ASSESSMENT (RCA)  
DECISION POINT 1 RECOMMENDATIONS REPORT**

**Executive Summary**



**FOR THE**

**BLOODSWORTH  
ISLAND RANGE  
(BIR)**

**AND**

**STRIKE LAUNCH COMPOUND (SLC) RANGE AREA**



**Prepared Under Contract N00421-06-C-0005 for the  
NAVAIR Ranges Sustainability Office, NAS Patuxent River, MD**

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## EXECUTIVE SUMMARY

### INTRODUCTION

This Decision Point 1 Recommendations Report entails the findings of the Patuxent River Complex (PRC) Range Condition Assessment (RCA) of the Bloodsworth Island Range (BIR) and the Strike Launch Compound (SLC) range area. RCA's are part of the United States (U.S.) Navy's Range Sustainability Environmental Program Assessment (RSEPA), which satisfies the requirements of Department of Defense (DoD) Instruction 4715.14, Operational Range Assessments. 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 answering the following two RSEPA Decision Point 1 questions:

- 1) Are further steps required to maintain environmental regulatory compliance?
- 2) Is further analysis required to assess the risk of potential off-range release?

### BACKGROUND

The PRC is comprised of land assets, supporting military facilities, restricted military airspace and a water range. Naval Air Station (NAS) Patuxent River, Webster Outlying Field and the BIR encompass the majority of PRC operational land assets. NAS Patuxent River is the headquarters of Naval Air Systems Command (NAVAIR), the Naval Air Warfare Center Aircraft Division, the U.S. Navy's Test Pilot School (TPS), as well as home to four aircraft test squadron tenants. The PRC supports the U.S. Navy's Aviation Research, Development, Test, and Evaluation (RDT&E) mission during military aircraft acquisition test phases, including the testing of U.S. Navy aircraft and the integration of weapons with aircraft. The PRC also affords training opportunities for U.S. Navy Fleet operational air wings and other Federal and state military services through access to restricted airspace and instrumented range assets.

The PRC restricted military airspace overlays restricted and prohibited water range areas or "surface danger zones" in the Chesapeake Bay. These surface danger zones correspond to the Aerial and Surface Firing Range and three water targets – Hooper, Hannibal and Tangiers. In addition to these three water targets, there are three supersonic flight weapons separation aim points and two shallow water test areas. PRC range assets are scheduled by the Atlantic Test Range (ATR) organization. The Code of Federal Regulations (CFR), *Danger Zone and Restricted Area Regulations* (33 CFR 334) define the military restricted and prohibited surface water areas, types of allowable ordnance operations, and procedures for the removal of unauthorized personnel from the danger zone/restricted area. Only inert (non-explosive) munitions are dropped or launched from aircraft over the water targets in the PRC.

## **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 N45, Range Assessments Division, in conjunction with the PRC RCA Management Team determined that two islands of the BIR, Bloodsworth and Pone, and the SLC range area at NAS Patuxent River would be assessed in this RCA. They are the only designated land-based operational range areas within the PRC that have either conducted or currently do conduct munitions-related operations.

### ***Bloodsworth Island Range (BIR)***

The BIR is situated in Dorchester County, Maryland, in the middle of the Chesapeake Bay approximately 20 miles southeast of NAS Patuxent River and 27 miles southwest of Salisbury, Maryland. As specified in 33 CFR 334.190, the BIR includes the restricted land and the surrounding restricted waters of its surface danger zone. The land assets of the entire range consist of five barrier islands: Bloodsworth, Pone, Adam, Northeast and the submerged Great Cove Island, with a combined land area of 6,013 acres. The largest island is Bloodsworth with 5,361 acres. Ordnance has been fired or dropped upon only Bloodsworth and Pone islands. Within the surface danger zone is a 0.5 nm radius circle on the west side of Bloodsworth and Pone islands where access is prohibited. The restricted waters of the BIR surface danger zone define the range boundary. Since the focus of the PRC RCA is Bloodsworth and Pone islands, "BIR" refers to only these two islands throughout the RCA report.

The BIR was used by the U.S. Navy as a shore bombardment and bombing range from 1942 until 1995. Activities that were conducted at the BIR during this time included air-to-ground (A/G) training and testing in weapons delivery (bombing and strafing), Naval Gunfire Support (NGFS) training, and Special Warfare (SPECWAR) training. Training consisted of firing or dropping live munitions, which contained explosives, and practice/training munitions, which contained spotting/marketing charges, propellants or other energetic chemicals. Testing included the use of inert munitions that contained pyrotechnics and/or propellants, but no explosive chemicals. Majority of testing included the use of wholly inert ordnance that contained no reactive substances. In 1995, the last range impact operations, including all those that were munitions-related, occurred on Bloodsworth and Pone islands. Land ownership and management of the BIR was transferred to NAS Patuxent River, MD from Naval Amphibious Base, Little Creek, Norfolk, Virginia, in March of 2001. Since 1942, the ATR has controlled the airspace over BIR and, as of 2001, manages the range. The BIR is currently an important Navy asset in support of NAVAIR RDT&E and TPS non-impact operations.

### ***Strike Launch Compound Range Area (SLC)***

The SLC range area is an operational range area situated in the southeast corner of the NAS Patuxent River installation where weapons systems ground testing has been conducted since 1943. Its boundaries are defined by the restricted operational land area (~30 acres), 75 yards of prohibited waters from the SLC shoreline, and the restricted waters of the Aerial and Surface Firing Range of the Chesapeake Bay (33 CFR 334.180). The SLC land range area and the prohibited/restricted waters together define the range boundaries.

The SLC range area includes the following operational facilities: the Firing Tunnel; two Stores Drop Test Pits; and three firing points, the Helicopter Missile Launch pad, Aerial Target Launch Area, and Rocket Test Stand. The installation property line defines the southern land range boundary. The Firing Tunnel is the northernmost and westernmost facility within the SLC that

conducts munitions-related operations and; therefore, under RSEPA, defines the north and west operational land boundaries. In addition, the graded topography of the SLC range area supports the western land range boundary, which is graded towards the bay. The SLC land range area is bordered to the east by the shoreline, which is contiguous with the restricted waters of the Aerial and Surface Firing Range.

No high explosive-containing munitions have ever been fired from or tested within the SLC range area. Munitions that contain propellants, pyrotechnics, and other energetics have been and are still used at the SLC range area.

### **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 BIR and SLC. The PRC RCA Phase II occurred from May – June 2006.

All range, installation and environmental program stakeholders at NAS Patuxent River were notified of the start of the RCA and provided information describing the PRC RCA process. A Range Management In-brief was held with ATR management and the NAS Patuxent River Environmental Department (Commander, Navy Installations Command; Naval District Washington Southeast) was 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 six on-site support contractors from the NAVAIR Ranges Sustainability Office, conducted the RCA Phase III “On-Site Visit Information Collection and Review”, during the week of 10 July 2006.

During the site visit, the Technical Team interviewed key NAVAIR range managers and NAS Patuxent River environmental program managers. Additional range, operational, and environmental records were collected at this time. Interview forms from the RSEPA Policy Implementation Manual 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 Management
- Safe Drinking Water

The NAS Patuxent River environmental programs that oversee the environmental management of the BIR and SLC range area were determined to be in compliance with applicable U.S. Navy environmental program requirements. Technical Team members did identify some measures that could improve upon range management, which are provided in the Decision Point 1 section below.

Technical Team members' assessments of environmental programs' compliance with respect to management of the BIR and SLC range area are provided in detail within the report. Assessments are based upon the information gained during interviews and from supporting documents. NAS Patuxent River 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 munitions constituents (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.

#### ***Bloodsworth Island Range***

The BIR ORSM summarized below supports the Technical Team's assessment that munitions-related activities conducted at the BIR warranted further analyses due to the expected quantities of MCs associated with live NGFS and A/G training. Based upon the types and quantities of live munitions that were recorded to have been used at the BIR, the RCA Technical Team estimated the mass loading of residual MCs at the BIR. Sampling test results at the BIR indicate no observable release of MCs off-range.

#### Operational

Bloodsworth and Pone Islands have been used for NGFS (1942-1989), SPECWAR (1980s-1995) and A/G (1940s-1995) training and A/G weapons system testing (1940s-1995). Training activities utilized live (explosive) and practice (non-explosive; w/propellants or spotting charges) munitions. Weapons systems testing used primarily wholly inert stores and some rockets and missiles with propellants. Appendix A of the report lists the types and quantities of munitions as well as the years they were used at the BIR. Records and aerial photographs of the BIR illustrate that the western portion of Bloodsworth Island and most of Pone Island were impacted by NGFS ship-to-shore bombardment.

Current and foreseeable future operations entail testing of U.S. Navy aircraft non-impact electronic weapons systems.

#### Land Use

Military land use is as described above. The northern end of Bloodsworth is designated a No Fire Zone for the purpose of protecting natural and cultural resources in this area. Conservation Division personnel from the NAS Patuxent River, Environmental Department access the island when feasible to survey and maintain the cultural resources and heron rookeries located within the No Fire Zone. Island access is restricted to Navy personnel or others escorted by the Navy. State permitted waterfowl hunting and recreational/commercial fishing is allowed in the restricted waters surrounding BIR. Hunting on the island is not allowed.

#### Environmental

Nearly the entire 5,872 acres of Bloodsworth and Pone Islands consists of tidal marsh that is bisected by a series of low ridges, the most prominent of which is Fin Creek Ridge in the

northernmost section of Bloodsworth Island. Both Bloodsworth and Pone Islands are less than 5 feet above mean sea level and are largely inundated daily by brackish Chesapeake Bay tides, as well as by periodic storm surges. Much land has been lost due to sea level rise, erosion from tidal action, and bombing since the Navy took ownership in 1942. The BIR shorelines are highly irregular and are cut by numerous coves and inlets.

Although no well drilling data is available for the BIR, it is probable that the BIR overlies the Chesapeake Group aquifer, which is composed of several groundwater formations. An unconfined, surficial sedimentary layer and non-potable aquifer immediately underlie the BIR. Due to the unconsolidated and highly permeable nature of the surficial sediments, brackish tidal waters and precipitation readily infiltrate the deposits and recharge this surficial aquifer. Lateral flow within this layer is hydraulically connected to bay waters. The surficial aquifer is separated from the underlying Kent Island and Manokin formations by intermediate confining units. The Manokin formation is a potable source to populations on the Eastern Shore of Maryland, located east of the BIR. The direction of groundwater movement in aquifers located below the Eastern Shore is generally in a southwesterly direction, towards the center of the Chesapeake Bay.

The wetlands on the range are predominantly estuarine emergent marshes dominated by Black Needlerush (*Juncus roemerianus*). Wetlands are intermixed with open water as a result of tidal channels that extend through the islands and from craters caused by previous ordnance deliveries. Upland vegetation communities located on Fin Creek Ridge, in the No Fire Zone, are being replaced by lowland vegetation as water levels rise and soil salinity increases. As habitat changes, so do the species that favor the new habitat.

Surveys of BIR indicate that one known Federally-listed threatened species, the bald eagle (*Haliaeetus leucocephalus*), and one state listed endangered species, the peregrine falcon (*Falco peregrinus*), have been sighted at the BIR. In addition to supporting federally and state listed animals, the BIR is an important over-wintering site for migratory birds and several species of waterfowl. Three state endangered plant species, the seaside knotweed (*Polygonum glaucum*), slender seapurslane (*Sesuvium maritimum*) and swamp dock (*Rumex floridanus*), have been found on the island. Both Federal and state-listed threatened and endangered (T&E) species have also been observed in the surrounding Chesapeake Bay waters and on the nearby Maryland Eastern Shore.

There are three cultural sites on Bloodsworth Island within the designated No Fire Zone that together are eligible for listing on the National Register of Historic Preservation (NRHP). Pone Island has three identified sites that have suffered from sea level rise and Navy bombardment. They are not considered eligible for listing in the NRHP.

There are no IR sites on the BIR; however, the island has had a history of sampling for evidence of MCs and their migration off-range. No sampling events indicated the presence of MCs.

#### BIR ORSM: Assessment

Historical records and interviews indicate that live munitions used during NGFS and A/G training would have been responsible for the deposition of the majority of residual explosives on the BIR. Due to the time elapsed since the last live munitions impact operations and the 50 years over which munitions operations occurred, it is expected that residual MCs exposed to the environment would have naturally degraded in that time. MC sampling data results for the BIR indicate that natural attenuation of residual MCs, estimated to have been deposited on the range, did occur.

### ***Strike Launch Compound***

The SLC ORSM supports the Technical Team's assessment that the inert munitions-related activities conducted at the SLC are not a significant source of MCs and have not posed an unacceptable risk to public health and the environment based upon drinking water and groundwater sampling analytical results that rule out the presence of MCs. For these reasons and based upon RSEPA Policy Implementation Manual guidance (2006) that Predictive Modeling is only necessary where live munitions are used, no further analyses was conducted for munitions-related testing in the SLC range area.

#### Operational

The following summarizes past and current munitions-related activities at the SLC range area and their potential as sources of MCs. It is important to remember that the type of testing conducted within the PRC is testing of aircraft and their systems, not munitions. However, inert munitions may be involved during testing of aircraft for the purpose of integrating the munition with the aircraft. Aircraft equipment that operates with inert munitions is flight tested over the PRC water targets and ground tested at the SLC range area. The following is a brief description of the inert munitions associated with categories of ground tests conducted at the SLC range area. Perchlorate is the MC that may be found in some the inert munitions that are propelled, fired or illuminated at the SLC range area.

**Cartridge Actuated Devices (CADs)** – Drop tests involve the release of a wholly inert bomb, for example, from a rack over an outdoor pit for the purpose of testing the release mechanism. CADs are small, self-contained energy sources that are sometimes used to push the ordnance away from the attachment point on the aircraft. Some of the CADs used contain perchlorate, but in quantities less than or equal to  $10^{-3}$  lbs. In the past, more drop testing was conducted outside. Today, 95% of drop tests are conducted indoors.

**Flares** – The effectiveness of flare launchers have been tested primarily from the Rocket Test Stand by launching decoy, parachute or signal flares towards the beach along the SLC. Flares were allowed to completely burn. Any remnants were removed and turned in to the NAS Patuxent River Weapons Department for proper disposal. Due to the low number of flares fired from the Rocket Test Stand over the years, the low quantity of perchlorate in the flares, and the fact that almost all perchlorate is consumed during firing, the total quantity of perchlorate that may have been deposited on the sand would have been minute.

**Aircraft Gunfire** – The firing of small and large caliber ammunition into the Firing Tunnel at its entrance does not result in the deposition of pyrotechnic, propellant or energetic MCs, but rather metal particulates, for which quantities were found to be below federal reporting requirements under the EPCRA.

**2.75-inch Rockets** – Many (~2,250) 2.75-inch inert rockets were fired from 1957-1980 from the Rocket Test Stand in the direction of the Hooper water target where they landed in the bay. Interviews with Ordnance Division personnel determined that MK 4/MK 40 and MK 66 were the most commonly used models of 2.75-inch rocket motors, which do not contain perchlorate.

**5-inch Rockets** – Approximately, three hundred (300) 5-inch inert rockets were fired from 1957-1980 from the Rocket Test Stand in the direction of the Hooper water target where they landed in the bay. The 5-inch rockets fired from the Rocket Test Stand used MK16 and MK71 rocket motors, which do not contain perchlorate.

**Missiles** – A total of twelve (12) inert missiles were fired from the Helicopter Missile Pad in the direction of Hooper water target, including 1 Sparrow (AIM-7), 3 Sidewinders (AIM-9), 1 Maverick (AGM-65) and 7 Hellfire (AGM-114) missiles from 1963 to 2005. The motors that

propel the Hellfire and Maverick missiles do contain perchlorate. The propellant formulations for the Sparrow and Sidewinder missiles are classified. Due to the low numbers of missiles fired and the fact that virtually all (99.99%) propellants are consumed during firings leads to the conclusion that only a minute quantity of perchlorate may have been emitted at the firing point.

**Aerial Targets** – MK91 Jet-Assisted Take-Off (JATO) bottles were used in the 3 BQM-74 aerial target launches in 1985-1986 and MK117 JATOs were used in the 8 BQM-74 aerial target launches in 2005. The MK117 JATO does contain perchlorate; however, all but a small percentage of perchlorate is consumed during firing. Therefore, it can be expected that a minute fraction of the total perchlorate may have been deposited at the firing point.

The only current and foreseeable future SLC range operation that has the potential to deposit MCs is the infrequent launching of aerial targets.

### Land Use

Access to SLC range area is restricted to authorized Navy personnel. Non-Navy personnel can access the SLC range area with an escort. Access to adjacent waters, out to 75 yards, and beach along the SLC range area is prohibited from unauthorized entrants. It is, however, physically possible to access the range area by boat or by wading across Pine Hill Run and then walking through the currently damaged property fence on Strike Beach. It is recommended that this fence be repaired.

### Environmental

The SLC range area includes buildings, structures, and test facilities, such as the Firing Tunnel, that are part of the NAS Patuxent River's Armament Test Historic District, which is eligible for inclusion in the NRHP.

The area is developed, and includes paved areas over fill dirt, alongside native Matapeake silt loam. All operational areas of the range are in close proximity to the bay, where surface water runoff would be carried. Some surface water may percolate into the shallow water table, which would be expected to move laterally into the adjacent creek or bay and not vertically into the confined potable aquifers below. There are no recharge zones at the installation for the underlying potable aquifers.

The predominant vegetation of the SLC range area is mowed turf grass. Lining the banks of the Pine Hill Run to the south of the range area, there is vegetation indicative of wetlands including tidal marsh, though according to the Conservation Division of NAS Patuxent River there is no habitat favorable for supporting any Federal or state listed species. No T&E species inhabit areas on the range area or Strike Beach.

There are no IR sites on the SLC range area. There is, though, an old, adjacent Discarded Military Munitions site (Site 10, "Strike Beach") that is considered to be mitigated and stable after seven Explosive Ordnance Detachment sweeps, including a Removal Action.

### SLC ORSM: Assessment

Based upon the low number of munitions fired that contained perchlorate and the fact that virtually all perchlorate is consumed during firing, it is expected that if any perchlorate were deposited at the firing points it would have been minute and would have undergone natural attenuation. The Technical Team concludes that past SLC range area munitions-related operations have not posed an unacceptable risk to the environment.

In addition, the results from four drinking water sampling events and one ground water sampling event that occurred from 2002 – 2006 indicate that perchlorate has not entered underlying potable aquifers. Therefore, based upon the fact that the range area overlies confined potable

aquifers, the absence of an aquifer recharge zone at NAS Patuxent River, and laboratory analytical results that indicate that perchlorate is not detectable in drinking water, the Technical Team concludes that past SLC range area munitions-related operations have not posed an unacceptable risk to the public drinking water supply and public health.

## **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 BIR, as it is the only range area where live munitions-related activities occurred. The Mass Loading section below provides a summary of the estimated masses of MCs that may have been deposited on the BIR, based upon range utilization records. No estimation of residual MC concentrations was required for BIR, since actual surface water, soil and sediment sample MC concentrations are available. Therefore, the Environmental Fate and Transport section below discusses the possible fate and transport of MCs in the BIR environment based upon sampling results, which demonstrate that no explosives were detected in sediment or water samples on- or off-range.

### ***Mass Loading***

As discussed previously, live munitions were used at the BIR for NGFS, SPECWAR and A/G training exercises. NGFS training included 5"54 and 5"38 caliber naval gun rounds. SPECWAR included small and large caliber ammunition (25 mm, 40 mm and 60 mm), some containing high explosives and others pyrotechnics. A/G live munitions training included bombs (CBU-12, MK-20, MK-77, MK-82), rockets (2.75-inch), missiles (AIM-9) and small caliber ammunition. Tables 3-7, 3-8 and 3-9 of the report provide the number of each live munition type expended during NGFS, SPECWAR, and A/G training, respectively.

Due to the insignificant contribution of residual MCs from high-order detonations (.001%), they were not included in MC mass loading calculations. The small percentage of live munitions that malfunction can either partially detonate (low-order detonation event) or they do not detonate at all (dud). Those that undergo low-order detonation, discharge a portion of their contents upon impact. Duds typically do not discharge their contents upon impact unless they crack or are impacted by another fired munition as it impacts the range (sympathetic detonation). Since a percentage of low-order detonations and duds have the potential to discharge their MC contents upon impact, they were included in calculating estimated mass loading of residual MCs. RSEPA-recommended low-order detonation and dud rates were used in mass loading calculations, unless a rate specific to a given type of munition was available.

Calculations estimated that a total of 170 live munitions may have undergone low-order detonations and 487 resulted in duds that either split or experienced sympathetic detonation. It is also estimated that NGFS may have contributed the highest number of duds, while SPECWAR may have contributed the highest number of low-order detonations. Overall, the highest contribution of residual MCs can be attributed to low-order detonations, with NGFS and A/G low-order detonations contributing near equal masses of residual MCs. The MCs with the highest calculated residual mass loading are RDX (Research Department composition X; cyclotrimethylenetrinitramine) (960 lbs) and TNT (Trinitrotoluene) (224 lbs). The combined estimated mass of the remaining residual MCs (HMX (High-Molecular-weight rdx; cyclotetramethylene-tetranitramine), DNT (Dinitrotoluene), perchlorate and lead) was calculated at 2 lbs.

A central assumption in these calculations is that all MCs deposited at the BIR over a 50 year period are present and measurable at the same point in time. However, the estimated total mass of residual MCs from live munition low-order detonations and duds (that split or underwent sympathetic detonation) does not take into account that they were deposited over a large surface area and at different points in time over 50 years. Fractions of the estimated total residual MCs would have been deposited on the range as many as 50 years ago. Therefore, mass MC calculations are an overestimate of the amount of residual MC that may be present at any instance in time. Once deposited, residual MCs would have been exposed to water, sunlight, bacteria and other environmental factors that naturally degrade MCs and likely underwent natural attenuation. The laboratory analytical results from BIR sampling events, discussed in the next section, are consistent with this theory.

### ***Environmental Fate and Transport***

In the case of the BIR, transport modeling was not required due to the availability of laboratory analytical results from surface water, soil and sediment samples taken at the BIR. Therefore, this section discusses the environmental fate and transport of MCs at the BIR in light of these sampling event results.

The conclusion of the 2001 BIR sampling study in the *Final Technical Memorandum, Environmental Conditions Evaluation Bloodworth Island Range, Chesapeake Bay, Maryland, 2005* was that the analytical results for explosives and metals do “not indicate the presence of a release from the BIR that poses an unacceptable risk to human health and the environment.” U.S. Environmental Protection Agency (EPA) Region III reviewed and commented on the final BIR sampling results report and in a letter to the Director of Environmental Compliance and Restoration Policy, Department of the Navy, Office of the Assistant Secretary, Installations and Environment, EPA stated that “Based on the evaluation of the data within the Technical Memorandum, it is reasonable to conclude that Naval activities at the BIR have not resulted in unacceptable risk to human health or the environment.” A 1980 sampling event for explosives at BIR came to a similar conclusion. Section 3.4.2 of the report reviews sampling event results in more detail.

### ***Predictive Modeling Summary***

It was determined that NGFS and A/G training with live munitions would have contributed the highest quantities of MCs at the BIR, based upon associated types of munitions, their quantity and composition. It is estimated through mass loading calculations that the majority of MCs residual on the BIR would have consisted of RDX and TNT. Past sampling of soil, sediment and surface water at the BIR for explosives and metals indicates that past ordnance activities on the range have not resulted in an observable release that poses an unacceptable risk to human health and the environment, a conclusion with which EPA Region III agreed. Considering the tidally affected, saturated, anaerobic soils on the BIR, the lack of evidence of MCs in soil, sediment and surface water samples; and the time since deposition, the natural attenuation of MCs is consistent with available scientific knowledge.

## **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 NAS Patuxent River 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 BIR and the SLC range area. 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 BIR and SLC range area with the requirements specified in DoD Directive 4715.11 Environmental and Explosives Safety Management on Operational Ranges Within the United States:

##### **Maintaining Range Records**

- Document duds of munitions used within the PRC that illuminate or have live motors, such as flares, rockets or missiles.
- Begin tracking ordnance use within the SLC range area, including but not limited to the use of CADs and Firing Tunnel munitions.
- Establish a permanent record of all unexploded ordnance (UXO) clearance activities, henceforth.
- Conduct UXO surveys at the BIR shoreline on a periodic basis in order to define the coordinates of exposed UXO due to shoreline erosion.

##### **Range Access**

- Repair the security fence that is located near the Pine Hill Run on Strike Beach.
- Establish procedures to determine which BIR 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 BIR.
- Add UXO hazard labels to the No Trespassing signs at BIR and along SLC range area beach 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 the BIR and the Strike Beach area adjacent to the SLC range area.

##### **Environmental Impacts**

- Use established procedures for assessing the potential environmental impacts associated with future aerial target, rocket or missile launches from the SLC range area.

#### ***Is Further Analysis Required to Assess Risk of Potential Off-Range Release?***

##### Findings from Munitions Data and ORSM

##### **Strike Launch Compound Range Area Data and ORSM Findings**

The Technical Team concludes that SLC range area munitions-related operations have not posed an unacceptable risk to public health or the environment. This conclusion is based upon the inert munitions-related activities conducted at the SLC range area are not a significant source of MCs. Perchlorate is a constituent of some munitions fired at the SLC range area; however, based upon the low number of perchlorate-containing munitions fired and the fact that the majority of perchlorate is consumed during firing, it is expected that the amount of perchlorate deposited at SLC firing points would have been insignificant and would have naturally degraded on range. The Technical Team's conclusion is also based upon the confined

potable aquifers underlying the SLC; the lack of aquifer recharge zone at NAS Patuxent River; and the lack of evidence of perchlorate in drinking water based upon sampling results.

### **Bloodsworth Island Range Data and ORSM Findings**

The Technical Team concludes that past munitions-related activities at the BIR have not resulted in an observable release of MCs that poses an unacceptable risk to human health and the environment, a conclusion with which EPA Region III agreed (*Final Technical Memorandum Environmental Conditions Evaluation, Bloodsworth Island Range, Chesapeake Bay, Maryland, 2005*). The BIR ORSM focused on the potential deposition of MCs at the BIR from past munitions-related operations. Based upon historical records and interviews, it was determined that NGFS and A/G training with live munitions would have been responsible for the deposition of the majority of residual explosives on the BIR. It is estimated through mass loading calculations that RDX and TNT are the two MCs that would have made up the majority of explosive residual at the range. The basis for the Technical Team's conclusion are the results from a 2001 sampling event in which no explosives were detected in surface water or sediment samples within or outside range boundaries. Only one explosive degradation compound, 1,3,5-trinitrobenzene was detected in one background soil sample location; however, it did not exceed EPA soil screening values for flora and fauna and is; therefore, not considered to present a risk to the environment.

### Recommendations /Protective Measures Related to Off-Range Release

#### **Strike Launch Compound**

Based upon the Technical Team's assessment that the SLC range area munitions-related operations are not a significant source of MCs and does not pose a risk to public health or the environment, no further analysis is required to assess the risk of an off-range release of MCs at the SLC range area.

#### **Bloodsworth Island Range**

Since the last munitions-related operations occurred at the BIR in 1996, there is no threat of off-range release of MCs from current or future operations at the BIR. Based upon the findings of the ORSM and Predictive Modeling, the Technical Team concludes that no further analysis is required to assess the risk of an off-range release of MCs at the BIR from past munitions-related operations.

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## ACRONYM LIST

A/G	Air-to-Ground
ATR	Atlantic Test Range
BIR	Bloodsworth Island Range
CAD	Cartridge Activated Device
CFR	Code of Federal Regulations
DNT	Dinitrotoluene
DoD	Department of Defense
EPA	Environmental Protection Agency
EPCRA	Emergency Planning and Community Right to Know Act
HMX	High-Molecular-weight rDX; cyclotetramethylene-tetranitramine
IR	Installation Restoration
JATO	Jet-Assisted Take-Off
MC	Munition Constituent
NAS	Naval Air Station
NAVAIR	Naval Air Systems Command
NGFS	Naval Gunfire Support
NRHP	National Register of Historic Places
ORSM	Operational Range Site Model
PRC	Patuxent River Complex
RCA	Range Condition Assessment
RDT&E	Research, Development, Test, and Evaluation

RDX	Research Department composition X; cyclotrimethylenetrinitramine
RSEPA	Range Sustainability Environmental Program Assessment
SLC	Strike Launch Compound Range Area
SPECWAR	Special Warfare
T&E	Threatened and Endangered
TNT	Trinitrotoluene
TPS	United States Navy Test Pilot School
U.S.	United States
UXO	Unexploded Ordnance

## GLOSSARY OF TERMS

The following terms are used throughout this RCA and are defined by the RSEPA Policy Implementation Manual (CNO, 2006) and as they are used in this document.

**Discarded Military Munitions (DMM)** (10 United States Code [U.S.C.] 2710(e)(2)): Military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal. The term does not include unexploded ordnance (UXO), military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed of consistent with applicable environmental laws and regulations.

**Inert Munitions (RSEPA-specific):** Inert munitions may be expendable or recoverable. They may contain all of the propellant normally contained in live munitions, but they do not include explosive or chemical agent fillers.

**Live Munitions:** Live munitions are expendable and contain high explosives. They may also contain pyrotechnics, propellants and other energetics, if required. These include, but are not limited to small and large caliber projectiles, aerial bombs, grenades, mines, missiles, and rockets.

**Operational Range:** A military range that is used for range activities, or a military range that is not currently being used, but that is still considered by the Secretary of Defense or the Secretary of a Military Department to be a range, is under the jurisdiction, custody, or control of DoD, and has not been put to a new use that is incompatible with range activities.

**Operational Range Site Model (ORSM):** An ORSM is a description of a particular site and its environment that is based on existing knowledge. It describes potential sources of MCs and other potentially hazardous substances, transport pathways and mechanisms, and routes of exposure to off-range receptors.

**Release:** Munitions or MCs that escape into the environment beyond the defined range boundary.

**Unexploded Ordnance (UXO) (40 CFR §266.201):** Military munitions that have been primed, fused, armed, or otherwise prepared for action, and that has been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installation, personnel, or material and remains unexploded either by malfunction, design, or any other cause.

**Wholly Inert:** Those munitions or munitions components that have never contained reactive materials. Typically made of metal and filled with concrete or water to simulate the weight and aerodynamic properties of a munition.