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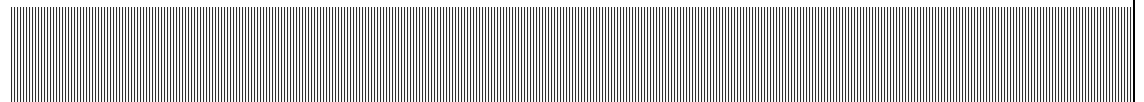
FINAL

Range Environmental Vulnerability Assessment

5-Year Review

MCAS Cherry Point

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Report Prepared By:

701 Town Center Drive
Suite 600
Newport News, VA
23606

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Executive Summary

The United States Marine Corps (Marine Corps) Range Environmental Vulnerability Assessment (REVA) program meets the requirements of the Department of Defense (DoD) Directive 4715.11 *Environmental and Explosives Safety Management on Operational Ranges within the United States* and DoD Instruction 4715.14 *Operational Range Assessments* (2004; 2005). The purpose of the REVA program is to identify whether there is a release or substantial threat of a release of munitions constituents (MC) from the operational range or range complex areas to off-range areas. This is accomplished through a baseline assessment of operational range areas and periodic five-year review assessments, and, where applicable, the use of fate and transport modeling of the REVA indicator MC based upon site-specific environmental conditions at the operational ranges and training areas.

This report presents the five-year review assessment results for the operational ranges and training areas at Marine Corps Air Station (MCAS) Cherry Point, located in North Carolina. This report serves as the first five-year review assessment documenting the period of MC loading associated with operational range activity from the completion of the baseline assessment (July 2005) through July 2010.

Military Munitions Training and Operations

MCAS Cherry Point is located in coastal North Carolina and is composed of widely dispersed properties within Craven, Pamlico, and Carteret counties, approximately 100 miles northeast of Wilmington, 130 miles east of Raleigh, and midway between New Bern and Morehead City, North Carolina. A total of 14 MC loading areas and three small arms ranges (SARs) were identified in the baseline assessment conducted in 2004. The 14 MC loading areas as described in **Table ES-1** are distributed over five noncontiguous properties operated under MCAS Cherry Point (Cherry Point Main Station, Marine Corps Outlying Field [MCOLF] Atlantic Training Area, Marine Corps Auxiliary Landing Field [MCALF] Bogue, Maw Point, and Pamlico Point). In general, the surface water and groundwater screening-level modeling conducted for these MC loading areas during the baseline phase indicated that MC were not likely to migrate off range at concentrations potentially causing an impact to identified receptors.

Table ES-1 provides a summary of the results of the baseline assessment.

Table ES-1: Summary of Baseline Assessment Results for MCAS Cherry Point

MC Loading Area	Historical Use Area	Screening-Level Modeling Results		Included in Five-Year Review
		MC Concentrations Predicted to Exceed REVA Trigger Values ^a Off Range		
		Surface Water	Groundwater	
Cherry Point Field Training Area	N	N	N	Y
NBC Training Area	N	N	N	Y
Boresight Range	Y	N/A ^b	N/A ^b	N
Skeet Range (1972 location)	Y	N/A ^b	N/A ^b	N
MCOLF Atlantic Field Training Area	N	N	N	Y
Rocket Range	Y	N	N	N
Strafing T	Y	N/A ^b	N/A ^b	N
Atlantic Field Harmonizing Range	Y	N/A ^b	N/A ^b	N
MCALF Bogue Field Training Area	N	N	N	Y
No. 2 Bomb Target	Y	N	N	N
Small Arms Range (Bogue)	Y	N/A ^b	N/A ^b	N
Skeet Range (Bogue)	Y	N/A ^b	N/A ^b	N
Maw Point	Y	N	N	N
Pamlico Point	Y	N	N	N
Assessed Using SARAP	Historical Use Area	Surface Water Concern	Groundwater Concern	Included in Five-Year Review
Pistol Range	N	Minimal	Minimal	Y
Action Range	N	Moderate	Moderate	Y



Rifle Range	N	Moderate	Moderate	Y
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Notes:

N = no, Y= yes

N/A = not applicable

NBC = nuclear, biological, chemical

SARAP = Small Arms Range Assessment Protocol

^a REVA trigger values used during the baseline assessment are documented in the *REVA Reference Manual* (HQMC, 2009).^b MC loading calculations were not performed.

Ten MC loading areas that were identified and assessed in the baseline were not reassessed in the five-year review; these areas are historical use areas that showed no potential for MC release to off-range areas during the baseline assessment. Because there was no additional training conducted in these areas since the baseline, they were not assessed during this five-year review. These areas included Rocket Range, Strafing T, Atlantic Field Harmonizing Range, No. 2 Bomb Target, Maw Point, and Pamlico Point MC loading areas (Boresight Range, Skeet Range [1972 location], Small Arms Range [Bogue], and Skeet Range [Bogue] The Skeet Range (1972 location), having been identified to have a potential lead release, is being addressed under a separate effort. There has not been additional loading activities at the Skeet Range (1972 location) since the baseline.

Three operational ranges at MCAS Cherry Point (Explosives Ordnance Disposal [EOD] Range, Bombing Target [BT]-9, and BT-11) were not evaluated as part of the baseline assessment but were evaluated during the five-year review. The EOD Range originally was not included because the site was regulated under a Resource Conservation and Recovery Act Subpart X permit. Since then, the Subpart X permit has been closed and the EOD range is still operational. Therefore, it was assessed during the five-year review. BT-9 and BT-11 are considered to be water ranges¹ and were not included in the baseline assessment, although were addressed under a separate program. These water ranges are assessed as part of the five-year review effort.

In addition to the three ranges discussed above, the following seven operational ranges and three SARs were evaluated during this five-year review based on the results of the baseline assessment and additional data collected for the five-year review. The operational ranges assessed include the following:

- Cherry Point Field Training Area
- EOD Range
- NBC Training Area
- MCOLF Atlantic Field Training Area

¹ Water ranges are defined as ranges containing any surface water body such as a stream, creek, river, pond, lake, sea, ocean, etc. that is recorded on a map.

Executive Summary

- MCALF Bogue Field Training Area
- BT-9
- BT-11

The SARs assessed include the following:

- Pistol Range
- Action Range
- Rifle Range

The REVA assessment team estimated MC loading rates for identified MC loading areas and current SARs at MCAS Cherry Point. A conceptual site model was developed for the training areas to qualitatively assess the potential for MC transport from the loading areas to impact identified off-range human and ecological receptors.

Conceptual Site Model for MCAS Cherry Point

MCAS Cherry Point is located in the Atlantic Coastal Plain physiographic province. The topography near MCAS Cherry Point is relatively flat, with an average elevation of about 20 feet above mean sea level (CH2M HILL, 2009). The Coastal Plain province of North Carolina is underlain by an eastward-thickening wedge of unconsolidated gravel, sand, silt, and clay with scattered beds of shells and loosely consolidated beds of limestone, sandy limestone, and shell limestone (Winner and Coble, 1996). The unconsolidated sediments near MCAS Cherry Point consist of 17 hydrologic units that include nine aquifers separated by eight confining units. Out of all the aquifers, the Castle Hayne aquifer is the most productive aquifer in the area of North Carolina Coastal Plain where MCAS Cherry Point is located. The Castle Hayne aquifer is the principle source of drinking water at MCAS Cherry Point. Near MCAS Cherry Point, three aquifers and three confining units overlie this aquifer. It is generally composed of limestone, sandy limestone, medium- to fine-grained sand, and clay beds.

MCAS Cherry Point is located within the Neuse and White Oak River basins. The subwatersheds at Cherry Point Main Station consist of dry, intermittent, and perennial streams and tidal creeks that drain toward Hancock Creek or Slocum Creek, which border the installation on the east and west, respectively. Other operational range areas within MCAS Cherry Point, including MCOLF Atlantic Training Area, MCALF Bogue Training Area, and BT-11, do not have well-defined drainage channels within their installation boundaries. These areas are bordered by the near-shore marine environment, and surface drainage from these areas directly discharges to the marine environment.

Surface water runoff can be an important transport pathway of MC to surface water bodies located within and around MCAS Cherry Point. MC transported in groundwater also could discharge into surface water, as the shallow groundwater is a known source base flow to streams. The soil and site characteristics at MCAS Cherry Point generally indicate relatively low



potential for soil erosion throughout the installation; however, erosion potential is higher at the EOD Range MC loading area due to the sparse vegetative cover and soil/sediment disturbance from range activities and maintenance. This indicates a higher potential for MC to be transported with sediment from the EOD Range MC loading area. Some MC loading areas, such as BT-9, BT-11, the northern portion of MCOLF Atlantic Training Area, and the coastal edges of MCOLF Bogue Field Training Area, are subject to tidal flooding from the surrounding marine environment. In these areas, tidal flushing and wave action provides the primary surface water transport mechanism. The sediment underlying these areas also is eroded by coastal tides. MC transported through surface water runoff, tidal flushing, sediment or base flow could reach human and ecological receptor exposure points. Human and ecological receptor exposure points include tidal creeks and the near-shore marine environment (e.g., Hancock and Slocum creeks, Neuse River, Pamlico Sound), which potentially are used for recreational purposes and for supporting ecological receptors, potentially including threatened and endangered species. Surface water at MCAS Cherry Point is not a drinking water source.

At MCAS Cherry Point, the potential for MC to be transported to the groundwater table is relatively high because of the shallow water table at most areas and the relatively high infiltration rate that occurs. The water table is generally subparallel to the surface topography. At Cherry Point Main Station, the potential shallow groundwater pathway is from the centrally located, north-to-south trending topographic and groundwater divide toward the bordering major surface water streams (Hancock Creek on the east and Slocum Creek on the west). Locally, portions of the shallow groundwater may discharge into smaller tributary streams or other surface water features. At other operational range areas, including MCOLF Atlantic Field Training Area, MCOLF Bogue Field Training Area, and BT-11, the shallow groundwater flow directions are generally toward the bordering near-shore marine environments. Public water supply at MCAS Cherry point is derived from the deep Castle Hayne aquifer and there are no known current shallow groundwater users. To date, it is not anticipated that off-site receptors are coming in contact with shallow groundwater sources. The shallow groundwater, however, discharges to surface water features. Potential receptors are humans using the surface water for recreational purposes and ecological receptors, including threatened and endangered species.

Twenty-nine wells at MCAS Cherry Point supply potable water from the confined Castle Hayne aquifer. The majority of these wells are located at Cherry Point Main Station; two wells are located at MCOLF Atlantic Field Training Area, and one well at BT-11. Based on very detailed hydrogeologic investigations, there is likely no groundwater pathway between the shallow groundwater and the deeper Castle Hayne aquifer due to the presence of continuous, thick, confining units overlying the Castle Hayne aquifer at the installation and in its vicinity (Brown & Root Environmental, 1996a and 1996b; USGS, 1994).

Screening-Level Surface Water, Sediment, and Groundwater Transport Analyses

Screening-level analysis of potential MC transport via surface water, sediment, and groundwater pathways was conducted for the EOD Range MC loading area. Screening-level analysis of potential MC transport via surface water and sediment pathways also was conducted for the BT-9 MC loading area. These two areas were modeled due to the high use of high explosive munitions and their proximity to potential receptor exposure locations. The BT-9 MC loading area was not analyzed for the groundwater pathway because it is a water range and has no associated groundwater.

Different surface water and sediment screening approaches were used for the two MC loading areas modeled because they are located in very different hydrologic settings. Annual average MC concentrations in surface water runoff, tidal water, and sediment at the edge of the MC loading areas and MC concentration in surface water runoff entering the downstream receptor exposure point (Hancock Creek) were estimated.

The surface water and sediment screening-level analysis predicted that average annual concentrations of cyclotrimethylene trinitramine (RDX) could be detectable in surface water runoff at the edge of the EOD Range MC loading area, and all other MC were predicted to be below their REVA trigger values (REVA trigger values are based on method detection limits). The concentration of RDX in surface water runoff entering Hancock Creek, the downstream receptor exposure point from the EOD Range MC loading area, was predicted to be below its REVA trigger value. The screening-level analyses also predicted that the average annual concentration of trinitrotoluene (TNT) in tidal water at the edge of the BT-9 MC loading area could be detectable, whereas the concentrations of all other MC in tidal water at the edge of the BT-9 MC loading area were predicted to be below their REVA trigger values. MC concentrations in sediment at the edge of the EOD Range and the BT-9 MC loading areas were predicted to be below REVA trigger values.

The initial groundwater screening-level analysis estimated the maximum possible annual average concentration of MC in infiltrating water. RDX was estimated to exceed the REVA trigger value, and all other MC were estimated to be below their respective REVA trigger values. For this reason, RDX was modeled at the EOD Range MC loading area for migration through the vadose zone. Due to the chemical properties and the conservative assumptions used in the model, RDX was predicted to reach the water table at concentrations above the REVA trigger value. RDX then was modeled at the EOD Range MC loading area for movement through the surficial aquifer. The concentration in groundwater potentially reaching the nearest receptor exposure point (Still Gut, a tributary to Hancock Creek) was estimated using saturated zone groundwater model, BIOCHLOR 2.2. The RDX concentration was estimated to decrease below the REVA trigger value a short distance from the edge of the loading area (within 100 feet) and far from the nearest receptor exposure point (over 900 feet). This indicates negligible groundwater contributions into Hancock Creek.



Small Arms Range Assessments

Three SARs, the Pistol Range, the Action Range, and the Rifle Range, were qualitatively evaluated as part of the five-year review using the SARAP. The three SARs comprise a SAR complex located near the northeastern portion of Cherry Point Main Station, with the ranges firing in a northeasterly direction. The analysis of the three SARs resulted in minimal environmental concern rankings for the Pistol Range and Rifle Range. The Action Range received a minimal surface water environmental ranking but a moderate groundwater environmental ranking. The rankings were based on the results of the qualitative assessment of the ranges using the REVA SAR protocol and professional judgment. The predominantly minimal scores for the ranges were due primarily to higher pH of surface water (pH range of 6.5 to 8.5), the presence of vegetation cover, the presence of engineered best management practice controls on the ranges, and the frequent occurrence of range maintenance activities. The moderate groundwater ranking for the Action Range is a result of the high precipitation rate, shallow depth to groundwater, lower pH of soil (pH of 4.5 to 5.5) and groundwater (pH of 5.22 to 6.35), and the absence of range maintenance activities.

Results and Conclusions of the REVA Five-Year Review

A summary of the results and conclusions for the MC loading areas assessed at MCAS Cherry Point in the REVA five-year review are presented on **Table ES-2**.

Table ES-2: Summary of 5-Year Review Assessment Results for MCAS Cherry Point

MC Loading Area	Surface Water Screening-Level Analysis Result	Sediment Screening-Level Analysis Result	Groundwater Screening-Level Analysis Result	Conclusion
EOD Range	Indicates that only RDX exceeds the REVA trigger value at the edge of the MC loading area	Indicates no migration of REVA MC to sediment	Indicates that only RDX reaches the water table above the REVA trigger value	No Further Action. RDX in SW and GW is predicted to decrease in concentration below REVA trigger values before reaching receptors (Still Gut, 900 ft from edge of loading area).
BT-9	Indicates that only TNT exceeds the REVA trigger value at the edge of the MC loading area	Indicates no migration of REVA MC to sediment	Not modeled	No Further Action. TNT in surface water is anticipated to mix with tidal waters in Pamlico Sound and dissipate quickly.
BT-11	Not modeled	Not modeled	Not modeled	No Further Action. Munitions used are inert and no pathway to impact human receptors

Executive Summary

MC Loading Area	Surface Water Screening-Level Analysis Result	Sediment Screening-Level Analysis Result	Groundwater Screening-Level Analysis Result	Conclusion
Cherry Point Field Training Area	Not modeled	Not modeled	Not modeled	No Further Action based on a lack of pathways to impact human receptors
NBC Training Area	Not modeled	Not modeled	Not modeled	No Further Action based on a lack of pathways to impact human receptors
MCOLF Atlantic Field Training Area	Not modeled	Not modeled	Not modeled	No Further Action based on a lack of pathways to impact human receptors
MCALF Bogue Field Training Area	Not modeled	Not modeled	Not modeled	No Further Action based on a lack of pathways to impact human receptors
Assessed Using SARAP	Surface Water Concern	Sediment Concern	Groundwater Concern	Conclusion
Pistol Range	Indicates minimal score	Not assessed	Indicates minimal* score	No Further Action based on a lack of pathways to impact human receptors
Action Range	Indicates minimal score	Not assessed	Indicates moderate score	Recommend BMP evaluation or potential sampling to prevent the potential discharge of lead from the site.
Rifle Range	Indicates minimal score	Not assessed	Indicates minimal* score	No Further Action

Notes:

GW = groundwater

SW = surface water

Field sampling was not performed for ranges.

*Identifies that scores were adjusted using best professional judgment. Refer to the SARAPs for details.

To view the complete report, please go to:

<http://www.marines.mil/unit/mcascherrypoint/pages/ea/FINALREVA5YrReviewMCASCherryPointReport6Feb12.pdf>





