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FINAL

Range Environmental Vulnerability Assessment

Marine Corps Base Camp Lejeune

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Report Prepared By:

Malcolm Pirnie, Inc.

101 South Washington Square
Suite 400
Lansing, Michigan 48933
(517) 337-0111

6285-024

MALCOLM PIRNIE

Executive Summary

The United States Marine Corps (Marine Corps) Range Environmental Vulnerability Assessment (REVA) program meets the requirements of the current 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*.

The purpose of REVA is to identify whether there has been a release or substantial threat of a release of munitions constituents (MC) from operational range or range complex areas to off-range areas. This is accomplished through a baseline assessment of operational range areas and the use of both conceptual and quantitative screening-level models of the fate and transport of REVA indicator MC based upon site-specific environmental conditions at the operational ranges and training areas. In addition, environmental sampling is performed, where applicable, to determine whether an actual release of MC has occurred. Indicator MC selected for the REVA program include trinitrotoluene (TNT), cyclotetramethylene tetranitramine (HMX), cyclotrimethylene trinitramine (RDX), and perchlorate.

This report presents the assessment results for the operational ranges and training areas at Marine Corps Base (MCB) Camp Lejeune and Marine Corps Air Station (MCAS) New River, North Carolina, collectively referred to as MCB Camp Lejeune throughout the remainder of this document. This assessment includes MCAS New River because it is a tenant of MCB Camp Lejeune. Currently there is only one operational range area, a small arms range, designated at MCAS New River. This report is the first comprehensive report on MC associated with the operational ranges at MCB Camp Lejeune and serves as the baseline of environmental conditions of the ranges. This report presents:

- Details on the installation's operational ranges and use of military munitions.
- Estimates of "loading rates" of MC at each range or training area based on records of munitions use.
- A prioritization of operational ranges and training areas for evaluation through the REVA process.
- A description of the Conceptual Site Model (CSM) for MCB Camp Lejeune that forms the basis of most assumptions for potential surface water and groundwater pathways for off-range migration of MC.
- Screening-level methods for analysis of surface water and groundwater pathways and the results of those analyses.
- A separate, qualitative assessment of Small Arms Ranges (SARs).

- Results of the REVA field sampling activities completed in 2008.

REVA is a voluntary, conservative, and tiered process. It applies readily-available information or conservative assumptions on munitions use, physical conditions at the installation to EPA-approved screening-level models to predict whether detectable concentrations of MC could migrate off the ranges to areas where human or ecological receptors could potentially be exposed to MC. If the screening-level models predict a detectable concentration, then further assessment, such as a field sampling effort, will be conducted. The results of the field sampling activities are compared to screening values identified by the Department of Defense (DoD, 2008) to evaluate the potential for detected concentrations to affect human health through drinking water or ecological receptors. The potential for off-range migration is assessed separately for SARs because the potential for lead migration and release is not reliably modeled without site-specific information, which was not obtained during the baseline assessment.

Military Munitions Training and Operations

MCB Camp Lejeune maintains operational ranges within the installation boundaries and on the waters of the nearby New River and Atlantic Ocean. The current, as well as historical, uses of these operational ranges were assessed under REVA. The Range Identification and Preliminary Range Assessment Report identifies 216 historical and operational range areas, which were cross-referenced with the 109 operational ranges and training areas identified within the 2003 National Defense Authorization Act (NDAA) Section 366 Report. The 109 operational ranges in the 2003 NDAA Section 366 Report included maneuver training areas, Impact Areas, and small arms ranges, each of which was evaluated for this REVA baseline assessment. Operational water range areas were also noted; however, since other operational ranges were determined to be of a greater potential concern, these water ranges are not further discussed in this report. The Military Munitions Response Program inventory identified 20 closed range areas and one transferred range area that are not within current operational range boundaries (as defined by the Section 366 Report),which also were not evaluated under this REVA baseline assessment.

The cross-reference of identified operational ranges and historical uses within operational range areas resulted in the identification of 33 REVA MC loading areas. These areas are the locations suspected to have been affected by potential MC resulting from primary military munitions training activities. These MC loading areas were prioritized to determine the most critical areas for modeling purposes, based on MC loading and groundwater and surface water characteristics. Based on the prioritization, 12 of the 33 identified MC loading areas were modeled. Due to overlapping uses over time, the MC loading areas were grouped into 10 MC loading areas and modeled as follows:

- G-10 Impact Area (operational)
- K-2 Impact Area (operational)
- F-5 (operational), F-2 Field Firing Range (historical use within operational area), and Musketry Range A (historical use within operational area)
- F-14 Field Firing Range (historical use within operational area)
- F-6 (operational)
- L-Impact Area (historical use within operational area)
- L-Ranges (operational)
- Combat Town (operational)
- M-10 Range (historical use within operational area)
- M-115 Range (historical use within operational area)

Operational small arms range areas were also identified and are qualitatively assessed in this report, including the following:

- A-1
- B-12
- D-29A and D-29B
- D-30
- F-11A and F-11B
- F-18
- I-1
- Military Operations in Urban Terrain Assault Course (MAC) 1 through 5
- SR-11
- Stone Bay Range Complex

The environmental conditions of the MC loading area operational ranges, along with the results of the groundwater and surface water screening-level analyses, were used to develop CSMs, which identify potential pathways and receptors.

Conceptual Site Model

Based on the procedures defined in the *REVA Reference Manual* (HQMC, 2006), the first step in the surface water and groundwater analyses is the development of a CSM of MC transport, including a description of the water flow system and identification of receptors. Even without additional modeling, the CSM provides a great deal of insight into the potential for MC to reach receptors. The CSM includes the identification of possible pathways (i.e., surface water and groundwater) for MC migration from the MC loading

area to potential receptors. Potential receptors include human population or threatened and endangered (T/E) species (ecological receptors) that use or are exposed to surface water and/or groundwater at MCB Camp Lejeune if a complete MC transport pathway existed. The concepts developed in the CSM are important to understanding potential transport mechanisms for MC and the possibility for receptors to be impacted at MCB Camp Lejeune.

Overview of CSM

MCB Camp Lejeune is situated within the Atlantic Coastal physiographic province and is located in the Lower Coastal Plain of North Carolina, the topography of which consists of flat terraces (also called surfaces) underlain by unconsolidated sediments. Elevations at MCB Camp Lejeune range from mean sea level (msl) to 72 feet (ft) above msl. The majority of the land area at MCB Camp Lejeune is covered by the Talbot surface at an elevation ranging from 24 to 42 ft above msl. Additionally, a thin narrow strip of land near the coast at MCB Camp Lejeune is covered by Pamlico surface at an elevation ranging from sea level to 24 ft above msl. Although the majority of the facility is relatively flat with slopes of less than 2%, steeper topography with slopes of 2% to 15% is present in the valleys of dendritic stream systems that dissect the terraces.

MCB Camp Lejeune is bounded to the southeast by Onslow Bay and the Atlantic Ocean and is bisected by the large New River embayment. The majority of MCB Camp Lejeune drains to the New River embayment and its tributaries. However, some southern areas of MCB Camp Lejeune drain directly to the Intracoastal Waterway, which parallels the coast near the southeast boundary. Much of the interior of MCB Camp Lejeune drains to intermittent and perennial streams that widen into tidal creeks in their downstream segments. Most perennial streams and tidal creeks occupy floodplains with extensive riparian wetlands. The flat terraces of the facility interior also contain regions that drain to low areas with no surface water outlets, including pocosins.

According to data obtained from MCB Camp Lejeune, 23 subwatershed areas have been delineated within the MCB Camp Lejeune installation boundary. These subwatershed areas mostly consist of perennial streams that drain to the New River embayment within the installation boundary. The subwatershed areas range in size from 2,760 to 31,746 acres.

Almost two-thirds (65%) of MCB Camp Lejeune is covered by forest, including pine forest, bottomland hardwood, and mixed pine-hardwood forest. About 22% of the facility area consists of pocosin. The installation area is about 5% developed, including base housing and operations buildings, and about 5% barren, most of which consists of military operations areas. The flat, upland regions of MCB Camp Lejeune are underlain by a variety of sandy and loamy soils of highly variable drainage characteristics.

Below the surficial deposits of MCB Camp Lejeune are southeast-dipping marine sediments of Cretaceous to Miocene age with a total thickness of over 1,400 ft at Onslow Beach. These sediments have been divided into seven hydrostratigaphic units and commonly are divided into seven aquifer systems (aquifers and associated confining units). The aquifer systems from deepest to shallowest are Lower Cape Fear, Upper Cape Fear, Black Creek, Peedee, Beaufort, Castle Hayne, and Surficial aquifer systems. The Castle Hayne and Surficial aquifer systems were evaluated as part of REVA for MCB Camp Lejeune because the Castle Hayne aquifer is used for potable water at the base and the Surficial aquifer overlies the Castle Hayne aquifer and may act as a recharge source for the Castle Hayne aquifer. The Castle Hayne aquifer is overlain by the Castle Hayne confining unit.

After development of the CSM, quantitative analysis methods were used at selected ranges, in accordance with the approaches described in the *REVA Reference Manual* (HQMC, 2006). The quantitative methods used are considered screening-level models. They rely on multiple conservative assumptions, are more likely to overestimate than underestimate MC concentrations, and are used to determine whether or not particular ranges merit additional investigation.

Human and Ecological Receptors

Potential receptors include human populations or T/E species (ecological receptors) that use or are exposed to surface water and groundwater at MCB Camp Lejeune. These are possible receptors of potential MC migration if a complete transport pathway existed.

Camp Lejeune is home to federally listed T/E animals and plants. In addition, there are several species of endangered marine mammals and three species of endangered sea turtles that can frequent the adjacent waters. The following is a list of the protected animals, plants, and marine mammals identified:

- Red-cockaded woodpecker
- Sea turtles – Atlantic loggerhead turtle and green sea turtle
- Bald eagle (now removed from T/E species list)
- American alligator
- Endangered plants – rough-leaved loosestrife and seabeach amaranth

Other species of conservation significance include migratory shorebirds that receive federal protection. They use the southern section of Onslow Beach as a unique and important nesting habitat. The Venus flytrap is a state-listed species and is protected by North Carolina.

Surface Water Analysis Summary

Under REVA, the screening-level surface water analysis is used to estimate the MC concentrations potentially in surface water runoff at the edge of the MC loading areas. If this analysis predicts impacts at the edge of the loading area, then further calculations are performed to estimate the MC concentrations at a downstream receptor.

Average annual surface water concentrations of the indicator MC (TNT, RDX, HMX, and perchlorate) were estimated based on the average annual MC loading of each indicator MC to each MC loading area. The estimation of MC concentrations in surface water assumes that a portion of the MC may enter the surface water through several mechanisms: (1) erosion of particulate or adsorbed MC in soil; (2) direct dissolution of MC in surface water runoff; and (3) connectivity of groundwater and surface water. At MCB Camp Lejeune, it was assumed that MC primarily enters surface water through either erosion or dissolution into surface water runoff.

Results of the surface water screening-level analysis were compared to the REVA trigger values listed in Table ES-1 to evaluate the potential for MC releases to off-range receptors. The REVA trigger values are only used to compare modeling results to determine whether additional evaluations are necessary.

Table ES-1.
REVA Trigger Values for MC

MC	Trigger Value (µg/L)
RDX	0.16
TNT	0.08
HMX	0.08
Perchlorate	0.98

Note: µg/L – micrograms per liter

Groundwater Analysis Summary

The purpose of the groundwater screening-level analysis in the REVA program is to make best use of the available information to infer whether indicator MC can be transported in groundwater from loading areas to receptors. The groundwater analysis approach determines which sites show no potential for arrival of MC at the water table with concentrations above the REVA trigger values, and those are eliminated from further consideration. Those sites that do show the potential for MC to reach the water table at concentrations above the trigger values are further analyzed using a saturated zone groundwater model. For most other REVA sites, the saturated groundwater model used for this phase of the groundwater analysis is BIOCHLOR, a simplistic two-dimensional transport model that estimates contaminant transport in one-dimensional horizontal flow field with retardation (sorption) and first-order decay. This type of model

can only be used where the site groundwater conditions are well understood and are generally homogeneous and isotropic.

In the case of MCB Camp Lejeune, the one-dimensional groundwater modeling typically completed as part of the initial REVA baseline assessment was not conducted because the groundwater flow system that underlies the installation was potentially too complex and not well-enough defined for a one-dimensional analysis to be meaningful. These complexities include a two-aquifer flow system with an intervening aquitard of unknown characteristics and extent, limiting the ability to quantify the connection between aquifers, as well as the presence of multiple nearby pumping wells tapping the deeper aquifer. The two aquifers of potential concern at MCB Camp Lejeune are the Surficial aquifer and the Castle Hayne aquifer, separated by the Castle Hayne confining unit. There is evidence that these aquifers are interconnected at some locations on MCB Camp Lejeune (USGS, 2004); however, the degree of connectivity between the aquifers at the MC loading areas is unknown.

Based on these complexities, it was determined that the one-dimensional groundwater modeling may not yield results representative of actual site conditions and would not identify the potential for off-range migration. Therefore, two possible options were available for continuation of the groundwater analysis and the determination of the possibilities for MC migration off range. The first option was to utilize an advanced three-dimensional groundwater model, which would require significant data, time, and resources. The second option was to perform groundwater sampling at two of the larger and most highly used MC loading areas (G-10 and K-2 Impact Areas) to determine directly whether MC have potentially migrated from the operational ranges and conduct a hydraulic assessment test near the G-10 Impact Area (where monitoring wells are screened in the Surficial aquifer and water supply wells are screened in the Castle Hayne aquifer) to assess the degree of hydraulic connection between the two aquifers in this area. Groundwater sampling and the hydraulic assessment test was determined to be the best option. During the REVA process, the operational ranges were prioritized to determine which areas had the greatest potential for concern (i.e., G-10 and K-2). It was assumed that if these highest priority areas had potential MC migration, additional evaluation would be conducted of other areas; however, it was considered that if these areas showed minimal to no possible MC migration, additional evaluation would not be necessary at this time for lower priority sites.

Uncertainties regarding the interconnectivity and effects of the MCB Camp Lejeune water supply wells on the groundwater flow system led to the collection of additional field data. These field data were intended to help determine whether additional environmental sampling data and/or additional modeling were necessary. The additional field activities included the following:

- Collecting surface water samples along stream channels in streams adjacent to the K-2 and G-10 Impact Areas to further evaluate the potential for off-range MC release through surface water.
- Collecting groundwater samples from the Surficial aquifer obtained from monitoring wells surrounding the K-2 and G-10 Impact Areas and collecting groundwater samples from the Castle Hayne aquifer obtained from MCB Camp Lejeune water supply wells located around the G-10 Impact Area to further evaluate the potential for off-range MC release near the K-2 and G-10 Impact Areas.
- Assessing the hydraulic connection between the Surficial and Castle Hayne aquifers during a shutdown of selected MCB Camp Lejeune water supply wells and measuring the corresponding effect on the water levels in monitoring wells in the Surficial aquifer and water supply wells in the Castle Hayne aquifer near the G-10 Impact Area.

Screening-Level Modeling Results

Results of the vadose zone screening-level modeling and surface water screening-level modeling at MCB Camp Lejeune MC loading areas are provided below.

- G-10 Impact Area – Initial vadose zone modeling indicated that there is a potential for HMX, RDX, and TNT to reach the water table at detectable concentrations. Screening-level model results for surface water runoff indicated that the annual average edge-of-loading area HMX, RDX, and TNT concentrations could exceed the REVA trigger values. The annual average RDX and TNT concentrations in runoff entering the New River downstream of Town Creek and upstream of Stones Bay and the Intracoastal Waterway at the confluence point with Bear Creek were predicted to potentially exceed the REVA trigger values.
- K-2 Impact Area – Initial vadose zone modeling indicated that there is a potential for both RDX and TNT to reach the water table at detectable concentrations. Screening-level model results for surface water runoff indicated that the annual average edge-of-loading area MC concentrations for RDX and TNT could potentially exceed the REVA trigger values. The annual average RDX and TNT concentrations in runoff entering the New River downstream of Town Creek and upstream of Stones Bay and the New River at Stones Bay were predicted to potentially exceed the REVA trigger values.
- F-5, F-2 Field Firing Range, Musketry Range A – Initial vadose zone modeling indicated that there is a potential for RDX to reach the water table at a detectable concentration. Screening-level model results for surface water runoff indicated that the annual average edge-of-loading area MC concentration for RDX could exceed the REVA trigger value. The annual average MC concentrations in runoff entering the New River at its confluence point with Wallace Creek were predicted to be below the REVA trigger values.
- Historical Use F-14 Field Firing Range – Initial vadose zone modeling indicated no potential for the indicator MC to reach the water table at a detectable concentration

above the REVA trigger values. Screening-level model results for surface water runoff indicated that the annual average edge-of-loading area MC concentrations were predicted to be negligible.

- F-6 – Initial vadose zone modeling indicated that there is a potential for RDX, TNT, and perchlorate to reach the water table at detectable concentrations. Screening-level model results for surface water runoff indicated that the annual average edge-of-loading area MC concentrations for RDX, TNT, and perchlorate could exceed the REVA trigger values. However, the F-6 MC loading area was predicted to contribute small to negligible mass of MC into the New River between Town Creek and Stones Bay.
- Historical L-Impact Area – Initial vadose zone modeling indicated no potential for the indicator MC to reach the water table at a detectable concentration above the REVA trigger values. Screening-level model results for surface water runoff indicated that the annual average edge-of-loading area MC concentrations were predicted to be negligible.
- L-Ranges – Initial vadose zone modeling indicated that there is a potential for RDX to reach the water table at a detectable concentration. Screening-level model results for surface water runoff indicated that the annual average edge-of-loading area MC concentration for RDX could exceed the REVA trigger value. However, the L-Ranges MC loading area was predicted to contribute very little mass of MC in runoff (maximum of less than 5%) into the New River at Stones Bay.
- Combat Town – Initial vadose zone modeling indicated no potential for the indicator MC to reach the water table at a detectable concentration above the REVA trigger values. Screening-level model results for surface water runoff indicated that the annual average edge-of-loading area MC concentrations were predicted to be below the REVA trigger values.
- Historical Use M-10 Range – Initial vadose zone modeling indicated no potential for the indicator MC to reach the water table at a detectable concentration above the REVA trigger values. Screening-level model results for surface water runoff indicated that the annual average edge-of-loading area MC concentrations were predicted to be negligible.
- Historical Use M-115 Range – Initial vadose zone modeling indicated no potential for the indicator MC to reach the water table at a detectable concentration above the REVA trigger values. Screening-level model results for surface water runoff indicated that the annual average edge-of-loading area MC concentrations were predicted to be negligible.

Although the MC concentrations were predicted below levels of potential concern, the Marine Corps conducted field sampling activities at off-range surface water and groundwater locations at MCB Camp Lejeune. The field sampling was conducted to

determine whether actual MC migration had occurred as well as provide a general, although not direct, confirmation of the modeling results.

SAR Assessments

The small arms ranges were qualitatively assessed using the Small Arms Range Assessment Protocol (SARAP) (HQMC, 2006). This protocol evaluates each range using factors such as range design and layout, physical and chemical characteristics of range area, range use, maintenance practices, and potential pathways and receptors. The results of the assessments are provided in Table ES-2.

Table ES-2
Small Arms Range Assessments

Range Name	Surface Water Environmental Concern	Groundwater Environmental Concern
A-1	Moderate	Moderate
B-12	Moderate	Moderate
D-29A and B	Moderate	Moderate
D-30	High [a]	High
F-11A and F-11B	Moderate	Moderate
F-18	Moderate	High
I-1	Minimal	Moderate
MAC 1 – 5	Moderate	Moderate
SR-11	Minimal	Moderate
Stone Bay Complex Range		
o Dodge City	High [a]	Moderate
o Multipurpose Range	Moderate	Moderate
o Mechanical Range	Moderate	Moderate
o Non-Mechanical Range	Moderate	Moderate
o Alpha Range	High [a]	Moderate
o Bravo Range	High [a]	Moderate
o Charlie Range	High [a]	Moderate
o Hathcock Range	High [a]	Moderate

[a] Ranking increased based on professional judgment

Professional judgment was used to increase some of the surface water environmental concern rankings because wetlands or surface water bodies are located in the surface danger zone.

The University of South Carolina-Beaufort is currently conducting a study concerning the fate of lead in the environment at Marine Corps bases, including MCB Camp Lejeune. This data, when available, may be used to refine the small arms range assessments.

Field Sampling Activities

The initial assessment of the screening-level surface water and groundwater modeling predicted low levels of explosives potentially present within the surface water. In addition, the further groundwater assessment was necessary due to unknown subsurface aquifer connections. As a result, groundwater and surface water sampling was recommended. Sampling events were conducted between November 2007 and April 2008. The *Final Field Sampling Report* contains additional details from the sampling events (Appendix D).

Field activities included sampling of off-range surface water and groundwater.

- Seven surface water locations, downgradient of operational ranges
- Raw ground water from nine operational drinking water supply wells, screened in the Castle Hayne aquifer
- Groundwater from 16 monitoring wells, screened in the Surficial aquifer
- Surface water at one background location, upgradient of operational ranges near K-2 Impact Area

Sample locations were selected based on modeling results for high explosives (HE) at mixed use ranges, not on the results of the SARAP.

All samples were analyzed for the full suite of explosives, including perchlorate, and total and dissolved lead. Groundwater samples were also analyzed for inorganic ions to determine its chemical characteristics. The sampling included more constituents than were modeled during the REVA process.

Lead was included in the field sampling as a proactive measure at locations already selected on the basis of predicted HE concentrations. Lead is also known to be a consistent of HE munitions; therefore, its inclusion was expected to provide an indicator of possible heavy metal constituents.

Field Sampling/Activities Results

The analytical results were compared to DoD Range and Munitions Use (RMUS) Subcommittee screening values, which were developed from existing USEPA or state guidelines to promote consistency across the services' operational range assessment programs. The results were also compared the North Carolina NCAC 2L surface water and groundwater standards.

Surface Water Sampling

None of the surface water samples had detectable concentrations of explosives. Two samples had perchlorate detected at concentrations above the method detection limit (MDL) but below the laboratory reporting limit (0.016 and 0.014 µg/L, respectively).

However, the perchlorate concentrations detected were well below the RMUS surface water screening value of 9,300 µg/L. Total lead was detected in six samples at concentrations above the MDL but below the laboratory reporting limit. The dissolved lead concentrations were all nondetectable. The RMUS surface water screening value for lead is 2.5 µg/L, but is only applicable to dissolved lead. All the analytical results for both total and dissolved lead were below this screening value.

Groundwater Sampling

None of the groundwater samples had detectable concentrations of explosives. Perchlorate was detected above the laboratory reporting limit in four samples at concentrations between 0.14 and 0.31 µg/L. All the perchlorate concentrations detected were well below the established RMUS human drinking water screening value of 15 µg/L. Total lead was detected in two samples at concentrations of 5.7 and 100 µg/L, respectively. The 100 µg/L value was abnormally high and was suspected to be erroneous. A second sample collected from the well by MCB Camp Lejeune personnel on January 9, 2008, had less than 3 µg/L of total lead and less than 3 µg/L of dissolved lead, which are below the RMUS human drinking water screening value of 15 µg/L. Both wells were resampled during the April 2008 sampling event and had concentrations of total lead of 1.5 and 0.49 J, respectively (J – estimated value, the analyte was positively identified, the quantization is an estimation).All total and dissolved lead concentrations were below the RMUS human drinking water screening value of 15 µg/L.

Hydraulic Test

A hydraulic test was conducted in the area surrounding the G-10 Impact Area. The hydraulic test was performed by shutting down selected MCB Camp Lejeune water supply wells and measuring the corresponding effect in water levels in the monitoring wells in the Surficial aquifer and water supply wells in the Castle Hayne aquifer. In addition to the hydraulic test, groundwater samples collected were also analyzed for inorganic ions to determine the chemical makeup of the groundwater at sampled locations. These geochemical analytical results and the hydraulic test helped to assess the hydraulic connection between the Surficial aquifer and the Castle Hayne aquifer.

Based on the hydraulic test results and the geochemical difference between the groundwater from the Surficial and Castle Hayne aquifers, there does not appear to be a significant hydraulic connection between the Surficial and Castle Hayne aquifers near the G-10 MC loading area. There are no wells screened in the Castle Hayne aquifer near the K-2 MC loading area. The results of the hydraulic test indicate that there is a minimal possibility of MC migration from the Surficial aquifer to the Castle Hayne aquifer near the G-10 Impact Area.

Monitoring Well Installation

During August 4-11, 2008, a deep monitoring well was installed at the request of the installation and HQMC in order to evaluate the groundwater in the Castle Hayne aquifer in the northeast side of the G-10 Impact Area. The monitoring well was sampled for the full explosive suite, perchlorate, lead, and inorganic ions on October 9, 2008. There were no detections of explosives, perchlorate, or lead.

Conclusions and Further Actions

The REVA field sampling results for MCB Camp Lejeune indicate that perchlorate and lead were detected more frequently than explosives at the locations sampled. No detections of MC, lead, or perchlorate exceeded DoD RMUS screening values for the identified receptors. The hydraulic test conducted indicated that there does not appear to be a significant hydraulic connection between the Surficial and Castle Hayne aquifers near G-10.

The field sampling effort was a continuation of the baseline assessment but was not intended to be a direct confirmation of the modeling results. Nevertheless, this REVA sampling provides a general confirmation of modeling results, which were based on conservative assumptions. Sampling results may be considered a conservative snapshot of off-range MC migration at the time they were collected.

Trace concentrations of MC were detected below screening values identified by DoD to assess impact to human health and environment. Nevertheless, to ensure the sustainability of MCB Camp Lejeune operational ranges, options for further management and assessment are being considered for high priority ranges identified through this REVA baseline assessment. In addition, subsequent vulnerability assessments will be conducted on operational ranges at MCB Camp Lejeune on a five-year cycle or when significant changes are made to existing operational ranges that potentially affect the determinations made during this baseline assessment, as described in the *REVA Reference Manual* (HQMC, 2006).

Based on the assessment results presented in this report, no immediate environmental concern of MC migration to off-range areas was identified; however, further actions may be evaluated to continue to mitigate the possibility of MC migration from operational ranges at MCB Camp Lejeune to ensure future range sustainability.

To view the complete report, please go to http://www.lejeune.usmc.mil/reva/.