



FINAL OPERATIONAL RANGE ASSESSMENT PROGRAM REPORT FORT RUCKER, ALABAMA

To meet Department of Defense (DOD) requirements and support the U.S. Army's Sustainable Range Program, the Army is conducting assessments to determine whether a release or substantial threat of release of munitions constituents of concern (MCOC) from an operational range to an off-range area creates a potentially unacceptable risk to human health or the environment. The initial assessment—Phase I—was a qualitative evaluation of whether: (a) a MCOC source existed on the operational range footprint, (b) there is a potential migration mechanism, and (c) human or sensitive ecological receptors are present. For the operational range footprints having a potentially complete source-receptor pathway, the Army conducted a Phase II, a quantitative assessment of potentially complete pathways of MCOC. This Operational Range Assessment Program (ORAP) Phase II Report presents evaluation of source-receptor pathways at Fort Rucker, Alabama. EA Engineering, Science and Technology, Inc. (EA) conducted this evaluation under contract W9128F-10-D-0056 to the U.S. Army Corps of Engineers (USACE)-Baltimore District.

Initially, the ORAP Phase II establishes whether the source-receptor pathway identified during Phase I is complete or new information has been identified that would impact the Phase I's conclusions. To determine whether MCOC are potentially leaving an operational range footprint by an identified pathway (e.g., groundwater or surface water) and pose a potential risk to off-site receptors, the Phase II considers existing and any new sampling data. The ORAP team may accomplish Phase II through reevaluating existing literature (e.g., prior sampling and/or reports), modeling, and/or collecting additional samples. In Fort Rucker's Phase II report, available information was used to establish a weight-of-evidence case that determines whether there has likely been release from the operational range footprint that may pose a potentially unacceptable risk to an off-range receptor.

Fort Rucker occupies 63,251 acres and is situated in southeast Alabama approximately 20 miles northwest of Dothan, in Dale and Coffee counties. Fort Rucker currently utilizes 230 operational ranges totaling 58,636 acres. These operational ranges include artillery firing points, maneuver and training areas, small arms ranges, firing ranges, grenade ranges, maneuver areas, airfields, impact areas (dudded and non-dudded), and a demolition/explosives training area. One recreational skeet range is also included in the total range count. The remaining 4,615 acres consist of the non-operational area (including the cantonment area).

The Phase I was completed for Fort Rucker in 2006 and evaluated 229 operational ranges. The 12-acre recreational skeet range, located within the cantonment area on Fort Rucker, was programmatically excluded from the ORAP Phase I Assessment. The ranges were categorized as either "Unlikely" (MCOC are unlikely to migrate to off-range receptors at concentrations that pose an unacceptable risk), or "Inconclusive" (a determination could not be made based on readily available information).

The Phase I concluded that all three components may exist for 63 operational ranges and categorized them as Inconclusive for evaluation under the Phase II. The 63 operational ranges categorized as Inconclusive totaled 34,737 acres and consisted of 22 artillery firing points, 19 maneuver and training areas, 7 small arms ranges, 4 firing ranges, 3 grenade ranges, 3 maneuver areas, 2 airfields, 2 impact areas (dudded and non-dudded), and 1 demolition/explosives training area. Following a re-evaluation of the Phase I Inconclusive ranges, two operational maneuver and training areas were re-categorized as

Unlikely, based on limited munitions use. Therefore, 61 operational ranges totaling 33,742 acres remained Inconclusive and were evaluated under the Phase II.

The Phase I identified potential human receptors for groundwater as users of private domestic wells within 4 miles downgradient of the Inconclusive ranges at Fort Rucker that obtain water from the shallow aquifer. During the Phase II site reconnaissance, well logs were obtained from the Geological Survey of Alabama for private/domestic wells located downgradient from Fort Rucker. Upon review of the well logs, two private wells installed in the 1970s, downgradient of the Inconclusive ranges at Fort Rucker, were noted to be completed in the shallow aquifer. EA conducted a visual windshield survey of the area, during which no well head casings were observed. Multiple fire hydrants were noted near the clusters of residences indicating that municipal water was readily available. According to the Daleville Water Department Superintendent, a public waterline has been installed in the area immediately southeast of Fort Rucker along Route 134 between the city of Daleville and the town of Newton; this water supply is obtained from wells completed in the deep, confined Nanafalia-Clayton Aquifer. The Superintendent of the Daleville Water Department, the contractor who installed public waterlines (Hicks & Associates), and the Dale County Health Department representative were not aware of any private wells still in use in the area. Based upon the additional information collected during the site reconnaissance, the presence of groundwater receptors at Fort Rucker is highly unlikely. Therefore, groundwater was excluded from the Phase II Assessment at Fort Rucker.

The Phase II multi-season field sampling was conducted during October 2011 and March 2012. Samples were collected at various locations on Fort Rucker. Surface water, sediment, and benthic macroinvertebrate samples were collected from seven locations at Fort Rucker: five locations downstream of potential MCOC source areas and two reference locations upstream.

Dry and wet season surface water, sediment, and benthic macroinvertebrate sampling was conducted to identify potential seasonal variations in water quality transport characteristics. Diurnal variations in surface water quality were accounted for using 24-hour composite samples for most of the samples. Sediment samples were collected as composited grab samples from all surface water sampling locations.

The Fort Rucker region was experiencing drought conditions during the first half of 2011 which impacted the availability of sufficient surface water to sample at some locations. During the dry season sampling event, one downstream sampling location in the northern portion of the installation contained only stagnant pools of water within the stream channel. Two grab surface water samples were collected from a pool adjacent to the original sampling location in place of the 24-hour composite samples due to the no-flow conditions. Another downstream sampling location in the central portion of the installation was dry and could not be sampled. Only sediment samples were collected from this location. As an alternative to the 24-hour composite samples, two grab surface water samples were collected downstream of the original sampling location.

Surface water samples were analyzed for explosives, perchlorate, metals (i.e., antimony, copper, lead, and zinc); and standard water quality parameters. Sediment samples were analyzed for explosives, metals, total organic carbon, and submitted for simultaneously extracted metals/acid-volatile sulfides analysis. Benthic macroinvertebrate samples were collected at each sampling location if suitable sampling conditions were present. Due to limited flows and dry conditions experienced during the dry season sampling event, benthic macroinvertebrate samples could not be collected at two of the downstream sampling locations. Analytical data from each sample location at Fort Rucker were selected for additional statistical analysis. The statistical analysis process included comparison to reference locations through a *t*-test and calculation of 95 percent upper confidence limit of the mean for comparisons to screening levels.

No explosives were detected in any surface water or sediment samples. The average perchlorate and the average antimony surface water concentrations observed at one downstream location were statistically greater than the average reference concentration. However, observed concentrations of both analytes were below screening levels. Perchlorate was also observed at an additional downstream location and at two reference locations, suggesting that the presence of perchlorate is not related to munitions use within the Inconclusive range area. The 95 percent upper confidence limit of the mean copper concentrations exceeded site-specific screening levels at all surface water sampling locations, including reference locations. These copper exceedances were likely the result of equipment contamination observed during the dry season sampling event. The 95 percent upper confidence limit of the mean lead concentration was also above the screening level at one downstream surface water location. The screening levels used assume a chronic exposure to the receptor and using the 95 percent upper confidence limit of the mean provides for a conservative comparison to those screening levels. Additionally, the average lead concentration was less than screening levels and not statistically greater than reference. Based on the average concentration of lead observed at the location being less than screening levels, and given that only one individual sample exceeded the screening level, it is unlikely that lead is migrating from Inconclusive ranges at concentrations that pose an unacceptable risk to ecological receptors. Average lead and copper concentrations in sediment at one downstream location were statistically greater than average reference concentrations. However, the 95 percent upper confidence limit of the mean sediment concentrations for all metals were below screening levels at all sampling locations.

Benthic macroinvertebrate results indicate some impairment at two downstream sampling locations. However, based on analytical results, it does not appear to be MCOC related. Impairment at one location is likely due to the intermittent nature of the stream, while the other location may be influenced by factors unrelated to historical munitions use upstream. Additionally, normalized simultaneously extracted metals/acid-volatile sulfides results suggest metals are neither bioavailable for uptake nor likely to have a toxic impact on benthic organisms.

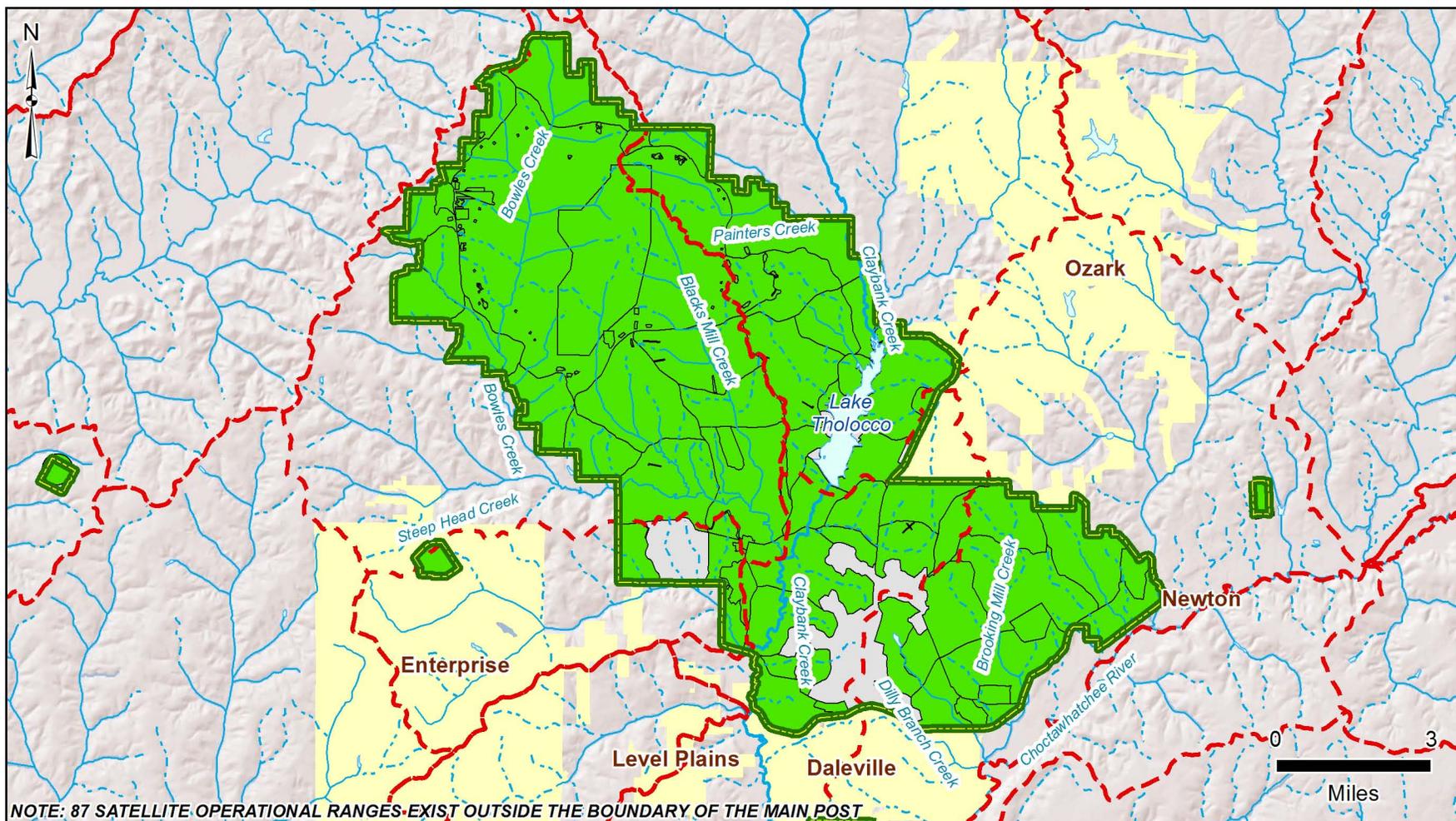
The results of Fort Rucker's Phase II show that MCOC from the operational ranges are not migrating at levels that pose an unacceptable risk to off-range human and or ecological receptors. Therefore, the Inconclusive ranges should be re-categorized as Unlikely and the operational ranges at Fort Rucker should be placed into a periodic review program under the ORAP (**Figure 1**).



Operational Range Assessment Program
Phase II Quantitative Assessment
Fort Rucker, Alabama



Figure 1
Summary of Phase II Conclusions



NOTE: 87 SATELLITE OPERATIONAL RANGES EXIST OUTSIDE THE BOUNDARY OF THE MAIN POST

Installation Data

- Installation Boundary
- Non-Operational Area

Recommendation

- Operational Range - Periodic Review

Hydrology

- Perennial Stream
- Intermittent Stream
- Water Body
- Watershed Boundary

Data Sources:

MPI 2006
ArcGIS Map Service 2010, ESRI ArcGIS
Online World Shaded Relief 2009

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