GROUP 4

Group 4 MRS-43A, MRS-15 MOCO 01, MRS-46, MRS-15 DRO 01A, MRS-15 DRO 02A, and L6.1

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5.0 GROUP 4 - MRS-43A, MRS-15 MOCO 01, MRS-46, MRS-15 DRO 01A, MRS-15 DRO 02A, AND L6.1

Information supporting the determination of the Group 4 sites as Track 1 plug-in sites is presented below. The discussion of the Group 4 sites consists of two main parts. The first part, contained in Sections 5.1 through 5.5 includes a presentation and assessment of archival data. Specific elements include a review of site history and development, evaluation of potential ordnance at the sites, summaries of previous munitions response investigations, and development of conceptual site models. The above-mentioned information was used to support the second part of this report, which is the Site Evaluation (Section 5.6). The Site Evaluation was conducted in accordance with the procedures described in the *Final Plan for Evaluation of Previous Work* (*Harding Lawson Associates [HLA], 2000b*) and may restate some information presented previously. The Site Evaluation discusses the evaluation of the literature review process (Section 5.6.1), and an evaluation of sampling and removal process(es) (Section 5.6.2). These discussions are based upon information from standardized literature review and sampling review checklists (Attachment G4-1). Section 5.7 provides conclusions and recommendations for the sites. References are provided in Section 5.8.

5.1 Site Description

The Group 4 Plug-in sites consist of MRS-15 DRO 01A, MRS-15 DRO 02A, MRS-43A, MRS-15 MOCO 01, MRS-46, and Parcel L6.1. The boundaries of MRS-15 DRO 01 and MRS-46 are coincident with Parcels E29a.1 and L3.2, respectively. The boundary of MRS-15 MOCO 01 was intended to be coincident with Parcel E29b.2; however, due to a mapping error, a small portion of Parcel E29b.2 is within MRS-15 DRO 02. To facilitate the evaluation of the use of military munitions on the portion of Parcel E29b.2 within MRS-15 DRO 02, this portion of MRS-15 DRO 02 was renamed MRS-15 DRO 02A. All of the Group 4 sites are located in the southwestern part of the former Fort Ord (Plate G4-1). MRS-43A and Parcel L6.1 are located on the western side of South Boundary Road. MRS-15 DRO 01A, MRS-15 DRO 02A, MRS-15 MOCO 01, and MRS-46 are located on the eastern side of South Boundary Road. South Boundary Road was established in its current position from at least the mid 1930s (*Army, 1933-34*). South Boundary Road has historically been the southern boundary of the Impact Area. Topographically significant features within the sites include the following.

- MRS-15 DRO 01A is flat with a slight slope to the west.
- MRS-43A is flat to the east with a ridge on the western boundary.
- Parcel L6.1 contains a ridge in the center of the site.
- MRS-15 DRO 02A and MRS-15 MOCO 01 slope from the east to west.
- MRS-46 slopes from the north and east to the southwest.

5.2 Site History and Development

The following presents a summary of the site history and development that is based on archival research and review of historical training maps and aerial photographs. Plates have been prepared that present pertinent features digitized from historical training maps and scanned aerial photographs reviewed by MACTEC. It should be noted that minor discrepancies between source maps, combined with the natural degradation of older source maps and photographs, has resulted in misalignment of some map features.

In addition, camera angle and lens distortion introduced into older aerial photographs, combined with changes in vegetation and site features over time has also resulted in misalignments of some map features with respect to the aerial photographs.

Pre 1940s Era

The Group 4 sites lie within a land tract purchased from private landowners by the U.S. Army (Army) in 1917. (*Arthur D. Little, Inc. [ADL], 1994*). Prior to 1917, this area was ranch land owned by the David Jacks Corporation. The area immediately adjacent to the southwestern Fort Ord boundary appears to have been open space through the 1930s. No structures are present in the area on the 1941 aerial photograph. By 1933, South Boundary Road was established in roughly the same location as it is today (*Army, 1933-34*).

Army training was conducted on the property by artillery, cavalry, and infantry troops stationed at the nearby Presidio of Monterey. No training maps or aerial photographs are available prior to 1941 documenting the types of training that occurred in the 1930s.

1940s Era

Review of 1940s era documentation including training maps, aerial photographs, and other Fort Ord maps indicates that training within the impact area was established by 1941, and that South Boundary Road continued in its current position (Plate G4-2). The following summarizes the results of the 1940s historical map and aerial photograph review:

- A series of roads is present just to the north of MRS-46 on the 1941 aerial photograph. The use of these roads is not known. Aerial photograph review does not show evidence of ranges south of South Boundary Road in 1941. No evidence of ranges within MRS-46, MRS-15 MOCO 01, MRS-15 DRO 01A or MRS-15 DRO 02A was evident on the 1941 aerial photograph.

- Two firing ranges were established near the Group 4 sites; the Austin Antitank Range and a Machine Gun Transition Range (*Army, 1945*, Plate G4-2). Based on the range fan configuration that is shown on the 1945 training map, firing points were several hundred feet from the Group 4 sites and firing was away from the sites toward the center of the Impact Area. Although not documented, data from the MRS-15 DRO 01 investigation suggests the 2.36-inch rocket launchers were used at this range, and that 37mm projectiles may have been used.

- An area of partially cleared vegetation is evident in the area of MRS-43 in the 1941 aerial photograph. The vegetation does not appear to have been cleared in Parcel L6.1 and MRS-43A.

- No training areas were identified in 1949 aerial photographs in the Sites on the south side of South Boundary Road. In addition, no training was evident within MRS-15 DRO 01A.

1950s Era

Review of 1950s era documentation including training maps, aerial photographs, and other Fort Ord maps indicates that training within the Impact Area continued (Plate G4-3). In addition, no training areas were identified within the Group 4 sites. The following summarizes the 1950s era historical map and aerial photograph review.

- No training was identified south of South Boundary Road on the 1950s training maps (MRS-43A and Parcel L6.1) (*Army, 1954, 1956, 1958*). Training within the southwestern part of the Impact area appears to have been mostly small arms training.

- It appears that a small portion of a rifle night firing range shown on a 1956 Proposed Range Construction Map may have extended into MRS-46; however, these ranges do not appear on subsequent training maps and may not have ever been constructed or used. No range features are evident on the 1956 aerial photograph or on a 1965 aerial photograph mosaic of the Impact Area.

- No training areas were identified on 1950s training maps within MRS-15 MOCO 01, MRS-15 DRO 01A, or MRS-15 DRO 02A (*Army 1954, 1957, 1958*).

- Review of the 1956 aerial photograph indicates that the area bordering the Impact Area in MRS-15 MOCO 01 and MRS-46 was disturbed (a series of trails running perpendicular to the installation boundary) (Plate G4-3); however, there is no indication that this feature is related to training with military munitions.

1960s to Present

Training within the Impact Area continued throughout the 1960s until base closure in 1994. The training inside the Impact Area closest to the Group 4 sites consisted mainly of small arms training with firing toward the center of the Impact Area. Specific information is provided below.

- No training areas were identified within any of the Group 4 sites on 1960s training maps.

- From 1960 until 1988, small arms firing ranges were present on the north side of South Boundary Road Adjacent to the sites. No ranges north of South Boundary Road were established within the Group 4 sites.

- A small area of disturbed soil is present on the 1978 aerial photograph in the northwestern part of MRS-46 (Plate G4-4). It is unknown if this disturbed soil was related to military munitions training.

- From 1976 through 1988, the area between South Boundary Road and the installation boundary was identified as an "Air Defense Training Area (Q)". It is believed that this area was used as a dry fire (non-firing) antiaircraft training area involving the set-up of .30 caliber and .50 caliber antiaircraft weapons (*Hall, 2005*).

Proposed Future Land Use

Future reuse of this area includes reuse as habitat reserve (Parcel L6.1), use as athletic field and additional development for York School (MRS-46), and development (MRS-15 MOCO 01, MRS-15 DRO 01A, MRS-15 DRO 02A, and MRS-43A). Although MRS-15 DRO 01A is identified as a development area, it will be maintained as a habitat area.

5.3 Potential Military Munitions Based on Historical Use of the Area

This section identifies the types of military munitions that may have been used in this area. Historical records do not indicate use of this area for military munitions training; however, items found as part of sampling and removal actions indicate that the area between MRS-43A and Parcel L6.1 was used as a target area for 37mm projectiles, and that portions of MRS-46 may have been used for practice rifle grenade and practice hand grenade training. Three 2.36-inch rockets were found on the ground surface

within MRS-46; however, at least 2 of the items appear to have been placed in the area (*USA, 2000a*). General descriptions of practice hand grenades, 37mm projectiles, and 2.36-inch rockets are provided below.

5.3.1 Practice Hand Grenades

M30 practice grenades (munitions debris) and a M205 series grenade fuze (munitions debris) were found in the northern part of MRS-46. The M30 practice hand grenade used the M205A1 and the M205A2 fuze and was designed to train personnel to arm and throw hand grenades (*Army, 1994*). It was used to simulate the M26 series of fragmentation hand grenades. The M30 emitted a small puff of white smoke and made a loud popping sound when it functioned. A M204 series hand grenade fuze was also identified in the same area. This fuze is generally used in the M26 fragmentation hand grenade; however, no evidence such as fragmentation was identified in the area. In addition, live hand grenade training areas are identified on 1960s training maps. The training areas identified on the 1960s training maps as live hand grenade areas are not in the MRS-46 areas, but are in the northeastern portion of the Impact Area.

5.3.2 37mm Projectiles

Evidence of 37mm projectiles as either fragments or MD were found throughout MRS-43, which is adjacent to both MRS-43A and Parcel L6.1. Fragments of the low explosive Mk 1 37mm projectile were found in MRS-43. No evidence of 37mm projectiles were found in MRS-43A or Parcel L6.1; however, information on 37mm projectiles is provided because of the proximity of these sites to MRS-43.

Guns that may have been used to fire 37mm projectiles in the Impact Area include the M3A1 light antitank weapon. The M3A1 was capable of firing high explosive (HE and LE), antipersonnel, and canister projectiles. The gun has a maximum range of 12,800 yards when firing the high explosive projectile (*Hogg, 2001*). The M1916 gun, with an M5 Subcaliber mount for 37mm munitions was used for training in the firing of the 75mm Howitzer M1A1 and may also have been used at the site. The M1916 gun and its recoil mechanism were fastened to the 37mm Subcaliber Mount, M5, and used for training in the handling and firing of the 75mm Howitzer M1A1 (*Hogg, 2001*).

5.3.3 2.36-inch Rockets

No evidence of training with rockets, either high explosive or practice, is identified on any training maps within the Group 4 sites. A historical range that was presumably used to fire 2.36-inch rockets was identified on a 1945 training map as “Austin Anti-Tank Range” and was located approximately 1,000 feet to the north of MRS-15 DRO 02A and MRS-15 MOCO 01. Three M6 series 2.36-inch rockets were found on the ground surface at MRS-46. It appears that at least two of the three M6 series 2.36-inch rockets found within MRS-46 were discarded. The M6 series 2.36-inch rockets are fired from a Bazooka-type launcher at ground targets. The rocket was designed to be effective against the armor plate of tanks and armored vehicles. After penetration the rocket had the effect of throwing a white hot metal spray. The M7 series practice rounds were inert warheads and loaded to conform to the characteristics of a live round (*Hogg, 2001*).

5.3.4 Rifle Grenades

M11 rifle grenades were found in the south central part of MRS-46. The M11 series antitank practice rifle grenade was available for use in the 1940s and 1950s. This item was an inert loaded dummy grenade similar in shape and weight to the M9 series high explosive antitank grenade. No explosive charge was associated with this practice item. The later M11 series differed from the M9 series in that the fins could

be replaced in case they were damaged or wore out (*Army, l994*). Practice rifle grenades are inert; therefore, no MEC other than possible blanks used to fire the rifle grenades would be expected.

5.4 History of Munitions Response Investigations

The following presents a summary of Fort Ord munitions response-related reports and investigations concerning the site.

1997 Archives Search Report

This Revised ASR combined information from previous archive searches with the results of a PA/SI conducted by the USACE. The PA/SI consisted of interviews with individuals familiar with the sites, visits to previously established sites, reconnaissance of newly identified training areas, and the review of data collected during sampling and removal actions. The Revised ASR was conducted in accordance with USACE guidance (*USACE, 1995*). Requirements for preparation of an archives search report are described in the Final Track 1 RI/FS. MRS-43 and MRS-46 are described in the ASR. MRS-15 MOCO 01, MRS-15 DRO 01A, MRS-15 DRO 02A, and Parcel L6.1 were not specifically discussed in the ASR; however, they fall within the boundaries of MRS-15. A summary of the information provided in the ASR for MRS-43, MRS-46, and MRS-15 is provided below.

MRS-43 (South Boundary Area) was identified during interviews conducted during the PA/SI phase of the Fort Ord Archives Search (*USAEDH, 1997*). It was reported that a portion of the ridge in this parcel was used as a backstop area for rifle grenades and shoulder-launched projectiles from 1942 to 1944. It does not state that the area was used as a backstop for 37mm projectiles. Firing positions for the rifle grenades and shoulder launched projectiles were reported excavated along South Boundary Road with firing from the Southeast to Northwest at a diagonal to the hill. The area was reportedly control burned in the early 1940s to support this training. Cutting of brush to support a MEC clearance had been completed at the time the ASR was prepared. During the brush cutting, 37mm black powder projectile (low explosive) fragments were identified in the northwest part of the site. Based on this discovery, the ASR recommended random MEC sampling. The ASR site boundaries for MRS-43 included the portion of the site now known as MRS-43A, but did not include Parcel L6.1.

MRS-46 (York School) was identified as a reuse parcel for York School. The boundary of the site was based on the Public Conveyance Request received from the Department of Education. There is no record that this area was ever used as an impact area. Inspection of this area by the USACE UXO Safety Specialist found evidence of small arms blank ammunition usage. The ASR recommended that the area undergo additional sampling to rule out the potential for MEC at the site.

MRS-15 DRO 01A, MRS-15 DRO 02A, and MRS-15 MOCO 01 fall within the Impact Area as identified in the ASR. This area consists of approximately 8,000 acres and was used for a variety of weapons training. For the purpose of the ASR, the Impact Area was divided into 4 areas (MRS-15A, B, C, and D). MRS-15 DRO 01A, MRS-15 DRO 02A and MRS-15 MOCO 01 fall within MRS-15B. MRS-15B was the outer boundary of the Impact Area behind the firing points and between the roadways. The ASR recommended additional sampling be performed within MRS-15B. MRS-15B is no longer considered a site, but has been divided into several smaller sites, such as MRS-15 MOCO 01, MRS-15 DRO 01A, and MRS-15 DRO 02A.

Investigations by USA Environmental (USA/CMS)

Several sampling and removal investigations were conducted within the Group 4 sites by CMS Environmental, Inc. (CMS) and USA Environmental (USA). In June 1998, CMS was purchased by USA

Environmental, which became the company responsible for conducting the military munitions investigations at the former Fort Ord. For the purpose of clarity, USA will be referenced as having conducted the work at these sites. Contract requirements for the USA work are described in the Track 1 RI/FS (*MACTEC, 2004*). USA conducted work at MRS-43A (MRS-43 at the time) and Parcel L6.1, MRS-46, MRS-15 MOCO 01, MRS-15 DRO 01, and MRS-15 DRO 02A. No work was completed within MRS-15 DRO 01A, but grids adjacent to MRS-15 DRO 01A were sampled.

MRS-15 DRO 01

The initial military munitions investigations conducted at MRS-15 DRO 01 and MRS-15 DRO 02 included random grid sampling, 4-foot removal action within the firebreak along the eastern margin of the site, and site-specific grid sampling. No sampling was performed within the portion of MRS-15 DRO 01 now referred to as MRS-15 DRO 01A. Munitions debris and MEC were identified within the eastern portion of MRS-15 DRO 01 and the northeastern portion of MRS-15 DRO 02, and these areas were subjected to a removal action to a depth of 4 feet. Upon completion of the removal action, the removal area and the rest of the sites were resurveyed using digital geophysical equipment (EM61). The digital geophysical survey of MRS-15 DRO 01 and MRS-15 DRO 02 on the southern margin of the sites included investigation up to the fence-line that runs parallel to South Boundary Road. Items found and removed during the geophysical survey at MRS-15 DRO 01 and MRS-15 DRO 02 were predominantly expended practice rockets, practice projectiles, and practice grenades (*USA, 2001b*). Only one item (munitions debris) was found within 300 feet of MRS-15 DRO 01A, a M7 2.36-inch practice rocket. This item was expended and located near the road.

Several recommendations were made for expansion of MRS-15 DRO 01 toward the west into MRS-43. No recommendations for expansion into MRS-15DRO 01A were made in the After Action Report.

MRS-15 DRO 02A

Prior to the evaluation in this approval memorandum, MRS-15 DRO 02A was part of MRS-15 DRO 02. The initial investigation at MRS-15 DRO 02 included 100 percent grid sampling. Twenty-seven 100- by 100-foot grids were established through out MRS-15 DRO 02 to evaluate the site. The sample grids were 100 percent sampled (all anomalies were investigated) to a depth of 4 feet using the Schonstedt Model GA-52/Cx. One of the 27 sample grids was partially within MRS-15DRO 02A. No MEC or munitions debris was found within this grid or any of the grids located within the southern portion of MRS-15 DRO 02. Based on results of the 100 percent grid sampling, the Army determined that a non-time critical removal action was appropriate within a portion of MRS-15 DRO 02 as documented in the *Notice of Intent, Removal Action at Sites OE-15DRO.2 and OE-43, Former Fort Ord, California (Army, 2000a)*. A specific "removal area" was delineated based on an imminent and substantial threat. The removal area included approximately 14 acres in the northern portion of MRS-15 DRO 02, but did not include MRS-15 DRO 02A. Because the parcel adjacent to Parcel E29b.2 was being considered for early transfer (Parcel E29b.1), the Army conducted a digital geophysical investigation over all of MRS-15 DRO 02 to support the early transfer of Parcel E29b.1. As a result, the digital geophysical survey included the portion of Parcel E29b.2 within MRS-15 DRO 02 (MRS-15 DRO 02A). All subsurface anomalies were intrusively investigated, and no MEC or munitions debris were found within MRS-15 DRO 02A.

MRS-43

Based on the ASR, sampling was recommended for MRS-43. This investigation was for MRS-43, which was later subdivided into MRS-43 and MRS-43A. The initial military munitions investigations conducted at MRS-43 included SiteStats/GridStats in nineteen 100 by 200 foot grids and 100% grid sampling over portions of the site. Seven grids were located inside MRS-43A and one grid was located

outside of MRS-43 in Parcel L6.1. No military munitions were identified within the seven grids located in the southeastern portion of MRS-43 (MRS-43A), or in the grid located in Parcel L6.1. Munitions debris and MEC were identified within the northwestern portion of MRS-43 and this area was subjected to a removal action to a depth of 4 feet. Upon completion of the removal action, the removal area was resurveyed using geophysical equipment. The geophysical survey of MRS-43 included the unpaved shoulder of South Boundary Road and extended beyond the existing MRS-43 boundary (as delineated in the ASR) at the northwest end of the site. As a result of the geophysical survey, both MEC and munitions debris were found adjacent to South Boundary Road and adjacent to MRS-43 at the northwest end of the site. Based on the presence of these items, the boundary of MRS-43 was expanded to the northwest to include the area where MEC and munitions debris were discovered. As stated above, no MEC or munitions debris was found in MRS-43A or Parcel L6.1 (*USA, 2001a*). MEC found in grids adjacent to Parcel L6.1 included a M2 series ignition cartridge and 0.25 pounds of TNT. Both items appeared to be discarded.

MRS-46

Sampling of MRS-46 was initially conducted as part of the investigation of the adjacent Impact Area (MRS-15B) in 1997 and 1998. Four of the sample grids associated with MRS-15B were located within MRS-46. During the 100 percent sampling, two 2.36-inch rockets (MEC) were found on the ground surface within one of the sample grids (*USA, 2000a*). One expended practice hand grenade (munitions debris) was also found. The contractor conducting the sampling concluded that the two rockets were discarded military munitions (DMM); however, based on their presence, random 100 percent grid sampling of the entire site was recommended.

In 1998 a fuelbreak was completed around the western and southern portions of the Impact Area. The fuelbreak was 30 feet wide and was completed along the entire northern boundary of MRS-46 and the Impact Area. No MEC or munitions debris was encountered within the MRS-46 section of the fuelbreak.

In 1999 seventy-three 100- by 100-foot grids were established through out MRS-46 to evaluate the site. The sample grids were 100 percent sampled (all anomalies were investigated) to a depth of 4 feet using the Schonstedt Model GA-52/Cx. One MEC item, a M204 series hand grenade fuze, was found during 100 percent grid sampling. Thirteen munitions debris items (practice hand grenades, stabilizing fins from practice rifle grenades, and the stabilizing fins from a 2.36-inch rocket) were also recovered during sampling. In December 1999, following the completion of sampling, an additional MEC item (M6 series 2.36-inch rocket) was found lying on the ground surface by a UXO escort that was providing support to non-UXO qualified personnel working in the area. This item was found in a location that had not previously been sampled.

Because a portion of MRS-46 was going to be leased to York School for the construction of an athletic field, it was determined that the entire lease area (approximately 31 acres) should be investigated. Approximately 34 of the sample grids within the lease area were evaluated during the 100 percent grid sampling completed in 1999. The remaining grids (approximately 93 grids and partial grids) not included in the 100 percent grid sampling operations were sampled in 2000 using a Schonstedt Model GA-52/Cx. No MEC was encountered during sampling. Five practice rifle grenades (munitions debris) and fragments from two other practice rifle grenades were recovered. Upon completion of the sampling of the York School lease area, a digital geophysical survey of the York School lease area was completed using the Geonics EM61 or the Geonics EM61-HH (hand held version of the EM61). No MEC or munitions debris were found during the digital survey of the York School lease area and no further military munitions-related investigation was recommended within the lease area (*USA, 2000b*).

For the areas outside of the 31-acre lease area the after action report recommended consideration of additional investigation in grids adjacent to the grid where the M6 series 2.36-inch rocket was encountered and in the area where the practice hand grenade munitions debris items and the live grenade fuze were encountered. In addition, the after action report recommended that the portions of MRS-46 not previously investigated, be investigated for surface and subsurface MEC. The report also recommended installation of a fence between the lease area and the rest of MRS-46 until the rest of MRS-46 and the adjacent Impact area are cleared. Although additional subsurface clearance was not conducted in the portions of MRS-46 outside the lease area, a visual surface removal was completed within accessible areas as described below under Parsons' activities.

MRS-15 MOCO 01

The investigation at MRS-15 MOCO 01 included 100 percent sampling (every detected anomaly was investigated) of thirteen 100- by 100-foot grids (*USA, 2001c*). No MEC or munitions debris was found. Based on these results, no further action was recommended.

Investigations by Parsons

Parsons completed visual surface removals at MRS-15 MOCO 01 and MRS-46 in 2002. These removals were completed at various sites in response to the potential imminent and substantial danger to the public posed by the proximity and accessibility of surface MEC to the public. The action was designed to reduce the imminent safety hazard by removing the surface MEC and MEC-like (munitions debris) items.

MRS-15 MOCO 01

MEC surface removal operations in accessible areas within the entire MRS-15 MOCO 01 site were performed. The operations were performed without vegetation removal or foraging through brush. Approximately 50 percent of the 30 acre site was surveyed. No MEC or MEC-like (munitions debris) items were found during the survey (*Parsons, 2002a*).

MRS-46

MEC surface removal operations were conducted in MRS-46 over all, except for the 31 acres where a subsurface removal had been conducted (York School lease area). The operations were performed without vegetation removal or foraging through brush. Approximately 60 percent of the site was surveyed. No MEC or MEC-like (munitions debris) items were found during the survey (*Parsons, 2002b*).

MRS-15 DRO 01A

A sitewalk was conducted by a Parsons team at MRS-15 DRO 01A on June 7, 2004. The walk was conducted in accessible areas of MRS-15 DRO 01A because the area was not investigated as part of the DRO group investigation. The site walk was conducted by a two-person team, both UXO QC personnel. One person swept accessible areas with a Schonstedt GA-52/Cx magnetometer and the second person carried a Leica Global Positioning System that documented the path walked. A total of 12 metallic anomalies were identified and investigated. All anomalies were determined to be range related debris (*Parsons, 2004b*).

Construction Support Activities York School Athletic Fields (31 Acre Lease Area)

Parsons was contracted by York School to provide UXO construction support as part of the grading and trenching activities associated with construction of athletic fields within the 31-acre lease area of MRS-46. All construction support activities were conducted according to IAW EP 1110-1-18, Chapter 23, UXO Support for Construction Activities, EP 75-1-2, Chapter 6, UXO Support During Construction Activities, and York School/DTSC agreement.

Prior to construction activities all contractors assigned to complete vegetation removal, grading, and trenching were given MEC safety and recognition training. During the initial grading and trenching activities UXO technicians visually observed all grading, fill, and trenching operations and performed checks between lifts using a Schonstedt GA-52/Cx fluxgate magnetometer. No MEC or munitions debris were encountered during the construction activities.

Following the initial construction activities, a final sweep of the area was conducted. The sweep was conducted using the Schonstedt GA-52/Cx fluxgate magnetometer over all areas where: (1) the final grade (elevation) surface has been graded and is comprised of the original ground elevation with less than two vertical feet of material removed (cut), or (2) the final grade (elevation) surface is comprised of material which was originally located at surface –to-two feet, which does not have two feet of clean material placed upon it. No MEC or munitions debris were identified during the final sweep. In addition to the sweep a 10 percent QC was conducted over the final sweep area. Areas that required additional trenching received a 100 percent QC check. No MEC or munitions debris was identified during the sweep (*Parsons, 2002c*). Additional construction support was not provided for subsequent construction activities, trenching to 18 inches for installation of the irrigation system, planting of trees, and installation of a fence, because the areas had been previously cleared or activities were being conducted in areas with greater than 4 feet of implaced fill (*DTSC, 2002*).

Investigations for the Basewide Range Assessment

MRS-15 DRO 01, MRS-15 DRO 02, MRS-15 MOCO 01, MRS-43, and MRS-46 were also investigated as part of the Basewide Range Assessment (BRA) for small arms and multi-use ranges. The assessment of these sites for potential hazardous and toxic waste-related contamination included a literature review, site reconnaissance, and mapping of the site, and in some cases, site characterization soil sampling. Several historical areas (HAs) were investigated within the MRSs. The ranges within MRS-15 DRO 01 were and identified as HA-24D, HA-25D, HA-26D, HA-61, and HA-62, and the entire MRS-15 DRO 01 site was identified as HA-110. MRS-15 DRO 02 was identified as HA-111, MRS-15 MOCO 01 was identified as HA-116, MRS-43 as HA-173, and MRS-46 as HA-176. A site reconnaissance was conducted if warranted by the results of the data review. Prior to conducting the site reconnaissance, a review of historical maps and aerial photographs was conducted. Areas of interest (e.g., training area boundaries, disturbed vegetation areas, and roads) were identified from maps and photos and their locations (waypoints) uploaded into a GPS unit. The site reconnaissance was conducted by a two-person team that included a military munitions specialist and a second team member trained in military munitions recognition. The site reconnaissance included walking portions of the site and navigating to the waypoints using the GPS unit.

HA-110 (MRS-15 DRO 01)

This historical area encompasses all of MRS-15 DRO 01 including MRS-15 DRO 01A and HA-24D, HA-25D, HA-26D, HA-61D and HA-62. Investigations at these historical areas included site

reconnaissance, sampling, and remediation. No further action under the BRA is recommended (*MACTEC/Shaw, 2005*).

HA-111 (MRS-15 DRO 02)

This historical area encompasses all of MRS-15 DRO 02 including MRS-15 DRO 02A. The literature review conducted under the BRA did not identify any small arms firing ranges within MRS-15 DRO 02. No further action under the BRA is recommended (*MACTEC/Shaw, 2005*).

HA-116 (MRS-15 MOCO 01)

This historical area encompasses all of MRS-15 MOCO 01. The literature review conducted under the BRA did not identify any small arms firing ranges within MRS-15 MOCO 01. No further action under the BRA is recommended (*MACTEC/Shaw, 2005*).

HA-173 (MRS-43/MRS-43A)

This historical area encompasses all of MRS-43. The Investigation at this historical area included site reconnaissance and sampling. No military munitions were observed. No further action under the BRA is recommended (*MACTEC/Shaw, 2005*).

HA-176 (MRS-46)

This historical area encompasses all of MRS-46. The investigation at this historical area included a literature review only. No further action under the BRA is recommended.

5.5 Conceptual Site Model

Conceptual site models (CSMs) are generally developed during the preliminary site characterization phase of work to provide a basis for the sampling design and identification of potential release (functioning of the MEC item, (e.g., detonation) and exposure routes. CSMs usually incorporate information regarding the physical features and limits of the area of concern (the site), nature and source of the contamination (in this case MEC), and exposure routes (potential scenarios that may result in contact with MEC).

The CSM for the Group 4 Track 1 sites is based on currently available site-specific and general information including the ASR (*USAEDH, 1997*), and Draft Final Literature Review Report (*HLA, 2000a*), review of aerial photographs, training maps, sampling results, field observations, and technical manuals. The CSM was developed to help evaluate the adequacy of the investigation completed to date and to identify potential release and exposure pathways. Plates G4-6 through G4-9 present diagrams of the conceptual site models for the training that is suspected to have occurred in or around the Group 4 sites.

5.5.1 Training Practices

Training practices are discussed below to provide information on the potential types and distribution of military munitions that may have been used at the Group 4 site, and the potential areas of concern remaining at the sites, if any.

Practice Hand Grenade Training

There is no available information about how specific training was performed in the northern part of MRS-46. Training with practice hand grenades could involve either familiarization training in an area with throwing bays or trenches and targets, or training in a confidence or qualification course.

Practice training would include practice in the proper way to hold the grenade and throw the grenade (FM3-23.30 [*Army, 2000b*]). According to FM3-23.30, all soldiers must go through a mock-bay training before going through to the live bay. It is anticipated that hand grenade training in the 1950s through 1970s would also include mock bay training. According to current training manual FM3-23.30 the targets in the mock training bay would include soldiers in the open at 20 meters, a fortified mortar pit at 20 meters, a fighting position at 30 meters and a trench target at 40 meters.

Training could also have been related to a qualification course. The qualification course would allow soldiers to engage targets under nature terrain, possibly with simulated battle conditions. Based on current information provided in FM3-23.30, the qualification course would consist of several stations that could include fighting positions, bunkers, logs, silhouettes, and other obstacles. It is suspected that either type of practice hand grenade training could have occurred at the edge of MRS-46. It should be noted that in the 1970s a close combat course was located at Range 27, which is northeast of where the expended practice hand grenades were found.

Rifle Grenade Training

No Fort Ord-specific information is available for rifle grenade training 1940s; however, it was stated in the 1997 ASR that the hill within MRS-43 may have been used as a backstop for rifle grenade training in 1942 and 1943. In addition, M11 practice rifle grenades were identified during MEC investigation within MRS-43 and MRS-46.

Range configuration information for practice rifle grenade training was obtained from Policies and Procedures for Firing Ammunition for Training, Target Practice and Combat (*Army, 1983*). Technical information for rifle grenades was obtained from the American Arsenal (*Hogg, 2001*). According to the 1983 policies and procedures manual, live rifle grenades are fired behind a protective barrier equivalent to a screen of sandbags 0.5 meter thick or reinforced concrete walls 0.16 meter thick. It is suspected that sandbags would be used in a practice training area. The maximum danger radius for the high explosive rifle grenade is 200 meters. The maximum range of the practice rifle grenade M29 (model described in TM 43-001-29) is 150 meters. It is therefore expected that the training area used would be at least 150 meter in length. According to information in the American Arsenal the depth to which the launcher is inserted into the rifle stabilizer tube determines the range attained by the fired grenade. Therefore, it is expected that targets would be placed at various distances to practice firing at different ranges. Because the practice rifle grenades used at the former Fort Ord are inert, no MEC associated with this practice rifle grenade training, other than possible blanks used to fire the rifle grenade, would be expected.

37mm Training

Based on available information the distribution of 37mm projectiles appear to be confined to MRS-43. No 37mm items were found inside any of the Group 4 sites; however, a description of the type of training that may have occurred is presented below because MRS-43A and Parcel L6.1 are adjacent to MRS-43.

37mm guns that may have been used in the Impact area include the M3A1 light antitank weapon. The M3A1 was capable of firing HE, antipersonnel, and canister projectiles. The gun has a maximum range of 12,800 yards when firing the high explosive projectile (*Hogg, 2001*). The M1916 gun, with an M5

Subcaliber mount for 37mm munitions was used for training in the firing of the 75mm Howitzer M1A1 and may also have been used at the site. The M1916 gun and its recoil mechanism were fastened to the 37mm Subcaliber Mount, M5, and used for training in the handling and firing of the 75mm Howitzer M1A1 (*Hogg, 2001*). It appears that the 37mm guns were fired from within the Impact area towards MRS-43. According to the ASR, the hillside within MRS-43 acted as a backstop for rifle grenades and shoulder launched projectiles. Although use of a portion of the hill as a backstop for 37mm projectiles was not documented, the presence of several 37mm UXO items (the closest about 400 ft from Parcel L6.1) and 37mm fragments within MRS-43 indicates that the hillside within MRS-43 may have been used as a backstop for 37mm projectiles. It should be noted that the hillside is lower in Parcel L6.1 than in MRS-43 and ends at General Jim Moore Blvd. Review of 37mm data from the removal actions completed at adjacent sites MRS-15 DRO 01 and MRS-43 indicate that 37mm fragments are perpendicular to the hillside within MRS-43, indicating that the most likely Impact Area for 37mm projectiles is within MRS-43 (Plate 4). The former fire chief, Mr. Fred Stephani, indicated that the firing positions for shoulder launched projectiles were excavated along South Boundary Road and that firing was from the Southeast to Northwest along a diagonal to the hill.

2.36-inch Rocket Training

The 2.36-inch rocket was designed to be fired from a Bazooka-type launcher at ground targets. The M6 series 2.36-inch rocket was designed to be effective against the armor plate of tanks and armored vehicles. After penetration, the rocket had the effect of throwing a white hot metal spray (*Hogg, 2001*). The optimum range of the M6 series 2.36-inch rocket was 200 yards although the maximum range of the rocket was 600 yards. Based on existing training maps, an antitank training area was located just to the northeast of MRS-46, MRS-15 DRO 02A, and MRS-15 MOCO 01, to the east of MRS-43A, and southeast of MRS-15 DRO 01A (Plate G4-2). Based on the configuration of the range fan, firing was toward the center of the impact area. It is possible that based on the proximity of the Group 4 sites to the 1945 antitank range, the items discovered within MRS-46 and withinsite MRS-15 DRO 01, adjacent to MRS-15 DRO 01A and MRS-43A, were discarded.

5.5.2 Site Features

A cleared area in the northwest corner of MRS-46 is shown on the 1978 aerial photograph, which could be the area where the practice hand grenade training took place. An area of cut or burned vegetation is also present in the area north of MRS-43A and south of Parcel L6.1. This could be the area where the 37mm projectiles and practice rifle grenades were fired. A ridge is present within MRS-43 and extends into Parcel L6.1, although at a lower elevation, and into MRS-43A. No training areas were identified on available training maps from 1945 and no additional cleared areas were present within the other Group 4 sites. The area remains undeveloped except for the portion of MRS-46 where athletic fields were constructed.

5.5.3 Potential Sources and Location of MEC

Practice M30 hand grenades and M204 and M205 series fuzes could still be present in the north part of MRS-46. M11 practice rifle grenades contain no live components so they are not discussed below. It appears that the 2.36-inch rockets found at MRS-46 are discarded items that did not result from military munitions training at the site and would also not be expected to be present at the site. The rational for not including 37mm projectiles as potential MEC in the Group 4 sites is described above in Section 5.5.1 and includes the following.

- No 37mm items were found within any of the Group 4 sites.

- One grid was completed within Parcel L6.1 boundaries and no MEC or munitions debris was identified. Munitions debris (37mm fragments) were found on top of the ridge within MRS-43, suggesting that similar occurrences of fragments should have been present on the top of the ridge within Parcel L6.1 if the ridge was also used as a backstop within Parcel l6.1. However, none were found during SS/GS sampling.

- Based on the distribution of 37mm fragments and LE items found within MRS-43 and MRS-15 DRO 01 it appears that the main impact area for 37mm projectiles was south of Parcel L6.1 and that firing was perpendicular to MRS-43 and did not include the lower part of the ridge that exists within Parcel L6.1.

- The top of the ridge is about 70 feet lower in elevation within Parcel L6.1. Because the ridge is on the boundary of the installation, it is more likely that the higher portion of the ridge would have been used as a backstop.

5.5.4 Potential Exposure Routes

Based on review of existing data as described above, it is unlikely that the Group 4 sites were used as target areas for 37mm projectiles, or 2.36-inch rockets; therefore it is unlikely that exposure to these items would occur. No explosive material is present within the M11 practice rifle grenade; therefore, it does not pose a risk. It does appear that potential exposures to MEC, although unlikely, could result from encountering fuzed practice hand grenades or grenade fuzes.

For each of the MEC items potentially remaining at the site, the following discussions provide information on: (1) how the item was designed to function, (2) the likelihood the item would function if found onsite and handled, and (3) the type of injury the item could cause if it functions.

M205A1 and M205A2 Fuze: Pyrotechnic Delay Igniting. The M205A1 and M205A2 fuzes differ in body construction only. The fuzes contain a M42 primer and an igniter containing a small amount of zirconium nickel alloy, potassium perchlorate barium chromate, and black powder (*Army, 1994; Navy, 1947*).

Summary: It is possible that a person could cause a fuze to function through casual contact if one were found at the site and be burned or exposed to metal fragments, but the fuze would have been exposed to moisture, degradation, and weathering for many years, which could decrease the effectiveness of the components that cause it to function.

M30 Practice Hand Grenade. The M30 practice hand grenade is used for training in care, handling and throwing of fragmentation grenades M26A1 and M26. The M26A1 and M26 hand grenade is used to supplement small arms fire against the enemy in close combat (*Army, 1994*). The body is not loaded with a high explosive filer but may have a small, separate black powder charge. Hand grenade fuzes M205A1 and M205A2 are pyrotechnic delay-igniting fuzes. Removal of the safety pin permits release of the safety lever. When the safety lever is released it is forced away form the grenade body by a striker acting under the force of striker spring. If the grenade were to be activated, the igniter would initiate the black powder charge. A loud report, like that of a firecracker, and a puff of white smoke follow. These could be caused to function by incidental contact by movement, (i.e., stepping on, picking up, or kicking the grenade). If caused to function, the type of injury that could be sustained would be burns from the black power, or possibly, exposure to metal fragments from the detonator. The detonator is part of the fuze and is contained within the grenade housing. The functioning fuze is not designed to have sufficient force to fragment the grenade itself.

Summary: It is possible that a person could cause the hand grenade to function if one were found at the site and be burned or exposed to metal fragments from the exploding detonator housed within the grenade, the practice grenade itself would not fragment. However, the grenade would have to contain a live fuze and functioning detonator, and these components would have been exposed to moisture, degradation, and weathering form many years, which could decrease their effectiveness.

M204A1 and M204A2 Fuze: Pyrotechnic Delay Detonating. The M204A1 and M204A2 fuzes are used in the M26A1 and M26A2 hand grenades to initiate the explosive charge. The fuzes are pyrotechnic delay-detonating fuzes. They differ only in body construction. The fuze contains M42 Primer. The detonator consists of lead azide, lead styphnate, and RDX (*Army, 1994*).

Summary: It is possible that a person could cause a fuze to function through casual contact if one were found at the site and be burned or exposed to metal fragments, but the fuze would have been exposed to moisture, degradation, and weathering for many years, which could decrease the effectiveness of the components that cause it to function.

5.6 Site Evaluation

The available data (e.g., archival and reconnaissance data) regarding the Group 4 sites were reviewed and evaluated according to procedures described in the *Final Plan for Evaluation of Previous Work* (*HLA, 2000b*). The evaluation process is documented through the completion of a series of checklists. Copies of the checklist are provided as Attachment G4-1. This section presents a summary of the results of the checklist evaluation. It is divided into two sections, an assessment of the literature review and an assessment of the sampling performed at the site.

5.6.1 Literature Review

Type of Training and Military Munitions Expected

According to the review of Fort Ord facilities and training maps, no training areas are identified within any of the Group 4 sites. However, because the Group 4 sites are located close to the Impact area and adjacent to a 37mm and practice rifle grenade impact area, the potential for MEC items associated with nearby training exists. Items suspected based on nearby training included 37mm projectiles, rifle grenades, and 2.36-inch rockets.

Subsequent Use of the Area

An approximately 31-acre lease area within MRS-46 was developed as athletic fields following base closure. The rest of the Group 4 sites remain undeveloped. No MEC or munitions debris were discovered during construction of the athletic fields.

Establishment of Site Boundaries

The boundary for MRS-43 is the only site boundary based on historical information. There is evidence of a partially cleared area of MRS-43 on the 1941 aerial photograph that corresponds to the area where the M11 practice rifle grenades and 37mm projectile MEC and munitions debris were found. The area of MRS-43A is outside of this cleared area. This cleared area could be used to help define the boundaries of MRS-43 and MRS-43A. The boundaries for the other four sites area based on reuse parcels and not based on historical information.

Summary of Literature Review Analysis

Based on the literature review, MRS-43 was used as a backstop area for rifle grenades and shoulder-launched projectiles. A cleared area was present within the northeastern part of MRS-43. This cleared area does not overlap with MRS-43A or Parcel L6.1. No evidence of military munitions training was found within the literature for the other Group 4 sites; however, these sites are adjacent to known training areas within the Impact Area. Based on the fact that the sites are adjacent to the Impact Area or MRS-43 which was identified as a backstop area for shoulder-launched projectiles and practice rifle grenades, there was enough information to warrant further investigation.

5.6.2 Site Walk Review

A site walk was conducted by a Parsons team at MRS-15 DRO 01A on June 7, 2004. The walk was conducted in accessible areas of MRS-15 DRO 01A because the area was not investigated as part of the DRO group investigation. The site walk was conducted by a two-person team, both UXO QC personnel. One person swept accessible areas with a Schonstedt GA-52/Cx magnetometer and the second person carried a Leica global positioning system that documented the path walked. The site walk was performed according to general practices described in the munitions response Programmatic Work Plan (PWP, *Parsons, 2004a*). No deficiencies were noted in the site walk; however, the area that was walked was limited to the edges of the site due to thick vegetation. A copy of the site walk memorandum is provided as Attachment G4-2.

5.6.3 Sampling Review

This section describes the items that were found at the site and how these items support historical information concerning past use of the site. Site boundaries are assessed in terms of the items found. There is also a discussion regarding sampling equipment, methods, and quality control measures used during prior munitions response sampling programs.

Sampling and Removal Results (Items Found)

As summarized in Section 5.2, the investigation of the Group 4 sites was conducted by USA Environmental and Parsons (*Parson's 2002a, b; USA, 2000a, b, 2001a, b, c*), which included investigation within MRS-43A, Parcel L6.1, MRS-46, MRS-15 MOCO 01, MRS-15 DRO 02A, and adjacent to MRS-15 DRO 01A. Munitions debris and MEC were not found in four of the five sites. The only site where MEC was found was MRS-46. One M204 hand grenade fuze, and three M6 2.36-inch rockets comprised the MEC items that were found. Munitions debris found in MRS-46 included M30 practice hand grenades, one M205 series hand grenade fuze, a M6 series 2.36-inch tail boom, and M11 practice rifle grenades.

Munitions debris found along South Boundary Road adjacent to MRS-43A included two M11 practice rifle grenades, two M228 grenade fuzes, a M29 practice rifle grenade, and a M7 2.36-inch practice rocket. Three MEC items, a M18 smoke grenade, a M25A1 riot grenade, and a M201 grenade fuze were also found. Because these items were found along the road, it is possible that they were discarded. A smoke grenade (munitions debris) and a 37mm LE Mk1 fragment were found within MRS-43 about 200 feet north of MRS-43A.

Munitions debris found adjacent to Parcel L6.1 were three 37mm LE Mk1 fragments, and one M7 2.36-inch practice rocket. One quarter pound block of TNT was found within adjacent Parcel L6.2 (part of MRS-43). MEC items found adjacent to Parcel L6.1 were a M2 ignition cartridge and a M781 40mm practice projectile. The rocket, M2 ignition cartridge (DMM), and M781 40 mm items were all found

adjacent to the road and it is possible they were discarded items. The 37mm fragments were likely related to use of MRS-43 as a target area for 37mm projectiles. There was no historical evidence that would suggest use of TNT (demolition charges) in this area; therefore, it is likely that the TNT could also be a discarded item.

Only one item, an expended M7 2.36-inch practice rocket, was found adjacent to MRS-15 DRO 01A. No other items were found within 300 feet of the site. The rocket was found along South Boundary Road and therefore may be a discarded item.

One MEC item, a M576 40mm multiprojectile was found adjacent to MRS-15 MOCO 01. This item was also found along South Boundary Road and appears to have been a discarded item. Table G4-2 presents a list of the items found within MRS-46, Table G4-3 presents items found adjacent to the other four Group 4 sites.

Visual Surface Removal Review

As discussed in Section 5.2.4, a visual surface removal was conducted at various sites in 2002 by Parsons to reduce the potential imminent safety hazard by removing the surface MEC and MEC-like (munitions debris) items in MRS-46 and MRS-15 MOCO 01 (Plate G4-5). The team performed a visual surface removal of the area and recorded their path walked using a real-time kinematic (RTK) GPS unit. The operations were performed without vegetation removal operations or foraging through brush. Approximately 50 percent of the MRS-15 MOCO 01 and 60 percent of MRS-46 was surveyed. No MEC or MEC-like (munitions debris) items were found during the survey.

Site Boundaries Review

Only the boundaries of MRS-43A were developed based on historical information, and at the time the site boundaries were established, MRS-43A was included as part of MRS-43. It appears that the division of MRS-43 into MRS-43 and MRS-43A is supported based on sampling data and historical aerial photograph review. Eight sitestat/gridstat grids were sampled within MRS-43A and no munitions debris or MEC was found. In addition, review of a 1941 aerial photograph shows that the vegetation in the approximate MRS-43 boundaries was either cut or burned, likely to facilitate training. The boundaries for MRS-46, MRS-15 MOCO 01, MRS-15 DRO 01A and Parcel L6.1 were developed based on establishment of reuse parcel boundaries and do not require modification. The boundary of MRS-15 DRO 02A is coincident with a portion of Parcel E29b.2 that extended into MRS-15 DRO 02.

Equipment Review

This section describes results of a review of the geophysical instruments used during the sampling and removal actions performed within the Group 4 sites. Information used in this review included the penetration study presented in the Phase 2 EE/CA (*USAESCH, 1998*), the Ordnance Detection and Discrimination Study (ODDS) (*Parsons, 2001*), and results of the Del Rey Oaks removal (*USA, 2001b*).

Schonstedt Model GA-52/Cx Magnetometer

The sampling investigation for MEC and munitions debris (MD) within the Group 4 sites was performed by USA Environmental, Inc., using a Schonstedt GA-52/Cx magnetometer. This instrument is a passive dual flux-gate magnetometer – a highly sensitive magnetic locator that detects ferrous (iron) metal objects; however, it cannot detect non-ferrous metal objects (e.g., lead, brass, copper, aluminum). In general, magnetometers make passive measurements of the earth's natural magnetic field; ferrous metal objects (and rocks) are detected because they produce localized distortions (anomalies) in the magnetic

field. The Schonstedt GA-52/Cx magnetometer actually detects slight differences in the magnetic field (the "gradient") by means of two sensors mounted a fixed distance apart within the instruments' staff. Because the magnetic response falls off (changes) greatly even over a short distance, a gradient magnetometer like the Schonstedt GA-52/Cx is especially sensitive to smaller, near-surface ferro-metal objects (*Breiner, 1973*).

The Schonstedt GA-52/Cx magnetometer is a hand-held device that, when properly adjusted, will emit a distinctive tone when placed near a ferrous metal object; the volume and pitch of this tone can provide an experienced operator with qualitative information about the nature of the detected object (e.g., size, location, burial depth). It should be noted, however, that Schonstedt GA-52/Cx magnetometers will also respond to soil and rock ("hot rocks") containing ferrous minerals. It should also be noted that asphalt pavement may contain enough ferrous mineralization to produce a Schonstedt GA-52/Cx response, which can mask the response from potential MEC items. Accordingly, it is recognized that the interpretation of the Schonstedt GA-52/Cx instrument response can be subjective; for deeper targets, especially, the operator often must analyze a subtle change in the audio output and decide whether the instrument is responding to a potential MEC item or to pavement or soil minera1ization. Additionally, it can be difficult to determine the exact location of a more deeply buried object because the Schonstedt GA-52/Cx's audio response may be dispersed over an area that is several feet wide.

The Schonstedt GA-52/Cx magnetometer is a so-called analog device that does not itself record (save) any data; typically, the location of a detected object (a "hit") is marked in the field or promptly excavated to uncover the detected object. For that reason, Schonstedt GA-52/Cx surveys are sometimes called "mag and flag" or "mag and dig" surveys.

Group 4 Sampling Procedures

Two different methods of sampling were performed at the Group 4 sites; 100 percent grid sampling and sitestats/gridstats sampling. In both types of sampling, the site was surveyed using a Schonstedt GA-52/Cx. Each of the sampling methods is described below.

Sitestats/Gridstats Sampling (SS/GS)

SS/GS is a computer program that is used to statistically estimate the MEC density of a site or grid during field investigations. It estimates the number of military munitions items at a given site or grid during field investigations. It can also be used to assess whether a site as been characterized adequately. The program was designed so that there were equal chances of finding MEC and non-MEC items.

When using SS/GS, the first step is to divide the site into homogeneous sectors with the same military munitions characteristics, terrain, and past military munitions use. The grids are visually inspected and electronically investigated using a magnetometer and identified anomalies are located, marked, and recorded. The grids are investigated using 5-foot wide search lanes. The technician walks the lane while moving the magnetometer in a sweeping motion across the width of the lane. SS/GS requires that if a grid has 20 or fewer anomalies, then all of the anomalies should be investigated. If a grid has more than 20 anomalies, 20 anomalies plus 27 percent of all identified anomalies over 20 will be investigated. Excavation of anomalies is performed in accordance with direction of the program; generally, 32 to 40 percent of the flagged anomalies are investigated using this technique (*CMS, 1995*). The approach used by USA to investigate the anomalies involved digging down to the ferrous metal item, removal, re-scanning with the Schonstedt GA-52/Cx and digging until the Schonstedt GA-52/Cx indicated no ferrous metal was present or to a minimum depth of 4 feet.

The SS/GS methodology was reviewed by the EPA's Federal Facilities Restoration and Reuse Office. The Technical Support Center, EPA National Exposure Research Laboratory (NERL) in Las Vegas, Nevada, also provided statistical assistance in reviewing the SS/GS methodology (*NERL, 2000*). Several problems were identified as a result of the review. The primary conclusions were: (1) that the statistical procedures were vague and not well documented, (2) conclusions about site homogeneity were not consistent, (3) the stopping rules were faulty, and (4) the methodology was not able to identify MEC clusters at a site. Although these problems associated with the statistical evaluation portion of the program were identified, the information obtained during sampling was useful in identifying the presence and type of MEC at a site.

100 Percent Grid Sampling

In 100 percent grid sampling 100-by 100-foot grids were selected to cover at least 10 percent of the site. All identified anomalies within the 100-by 100-foot grids were investigated as follows: the hand-held Schonstedt GA-52/Cx instrument, which resembles a "walking stick" in appearance, was swung from side to side as the operator walked down the centerline of a maximum 5-foot wide search lanes delineated by lengths of rope laid on the ground. Schonstedt GA-52/Cx responses indicative of potential MEC items ("hits") were marked in the field with pin flags and the hit location was excavated until a metal object was encountered or the instrument no longer showed a response. Found objects were then mapped and cataloged.

Functional checks of the Schonstedt GA-52/Cx instruments were performed daily. Additionally, QC and QA surveys were performed. QC procedures entailed a resurvey of at least 10% of each grid by a USA Quality Control Officer. QA procedures generally entailed a second 10% resurvey by USACE personnel.

Evaluation of Schonstedt Model GA-52/Cx Detection Efficiency

The detection efficiency of the Schonstedt GA-52/Cx used with 5-foot lane widths was tested during the ODDS seeded test and during the Del Rey Oaks (DRO) removal action. These two data sources are described below.

As part of the ODDS, seeded tests were performed to evaluate the ability of the Schonstedt GA-52/Cx to detect MEC items buried at various depths. The seeded test was conducted with multiple lane widths, including the 5-foot width used during the 100 percent grid sampling. The ODDS seeded test evaluated instrument performance based on two different search radii, 1.6-foot and 3.3-foot. If the distance between the location identified by the instrument and the actual location of an item was equal to or less than the search radius the item was considered detected by that instrument.

During the DRO removal action, 55 lots of items were seeded in the DRO Group sites prior to the removal action. Twenty-one of these items were seeded in areas where the Schonstedt GA-52/Cx was subsequently used to perform the removal. Locations that contained multiple seeded items were not included in this analysis.

The ODDS report included the percent of items detected (Pd) in the seeded test for each instrument. However, this Pd should not be directly translated to the Pd at an actual site. For any detection equipment, the Pd depends on the depth distribution of items. If all the items are shallow, the Pd will be high, but if all the items are deep, the Pd will be low. The depth distribution of seeded items in the ODDS was designed to test and compare the detection capabilities of different detection instruments, not to represent a typical site. According to the ODDS Work Plan, items were seeded at three different depths, at the limit of detection, 6-12 inches shallower than the limit of detection, and 6-12 inches deeper than the

limit of detection. The limit of detection was based on the ODDS static, free air tests conducted prior to the seeded tests.

The following table lists the ODDS and DRO seeded items that are of the same type as items that were found in the Group 4 sites. The final column indicates whether these items were detected with the Schonstedt GA-52/Cx during the ODDS seeded test using 5-foot lane widths and a 1.6-foot search radius, or recovered during the Schonstedt GA-52/Cx DRO removal action.

Item ID	Depth (in)	Item Description	Detected
OEI113	3	Rocket, 2.36 inch, Practice, M7 Series	Y
DRO138G	12	Rocket, 2.36 inch	Y
OEI031	12	Rocket, 2.36 inch, Practice, M7 Series	Y
OEI111	19	Rocket, 2.36 inch, Practice, M7 Series	Y
OEI110	23	Rocket, 2.36 inch, Practice, M7 Series	N
OEI112	23	Rocket, 2.36 inch, Practice, M7 Series	N
OEI035	24	Rocket, 2.36 inch, Practice, M7 Series	Y
DRO143FA	24	Rocket, 2.36 inch	Y
OEI033	36	Rocket, 2.36 inch, Practice, M7 Series	N
DRO143FB	36	Rocket, 2.36 inch	N
DRO1 46G	6	Projectile, 37mm	Y
DRO1 33I	6	Projectile, 37mm	Y
DRO1-30P1	12	Projectile, 37mm	Y
OE43 23I	18	Projectile, 37mm	N
DRO1-46G	18	Projectile, 37mm	Y
DRO1-38G	18	Projectile, 37mm	N
OEI121	2	Grenade Hand, MK-2, Practice	Y
OEI015	6	Grenade Hand, MK-2, Practice	Y
OEI017	6	Grenade Hand, MK-2, Practice	Y
DRO-26O1	6	Grenade Hand, M68	Y
OEI120	7	Grenade Hand, MK-2, Practice	Y
DRO-26O2	9	Grenade Hand, M68	Y
OEI118	10	Grenade Hand, MK-2, Practice	N
OEI119	11	Grenade Hand, MK-2, Practice	N
DRO1-30P2	12	Grenade Hand, MK-2, Practice	Y
DRO1-26U	12	Grenade Hand, MK-2, Practice	Y
OEI016	12	Grenade Hand, MK-2, Practice	N
OEI018	12	Grenade Hand, MK-2, Practice	N
OEI107	12	Grenade, Rifle, AT, Practice, M9	Y
OEI028	12	Grenade, Rifle, AT, Practice, M9	Y
OEI108	15	Grenade, Rifle, AT, Practice, M9	Y
OEI109	24	Grenade, Rifle, AT, Practice, M9	N
OEI029	24	Grenade, Rifle, AT, Practice, M9	N
OEI030	36	Grenade, Rifle, AT, Practice, M9	N

Based on the data listed above, the Pd for six depth intervals (0-6, 7-12, 13-24, 25-36, 37-48, >48 inches) were calculated. These Pds are shown on the table below with the number of seeded items in parentheses.

MEC Type	Max Pen. Depth[2] (in)	Pd for Depth Interval bgs (in)[1]					
		0-6	7-12	13-24	25-36	37-48	>48
Rocket, 2.36-inch	4.8	100% (1)	100% (2)	60% (5)	0% (2)	*NE*	*NE*
Projectile, 37mm	46.8	100% (3)	50% (2)	17% (6)	0% (2)	*NE*	*NE*
Hand Grenade	*NP*	100% (4)	50% (8)	*NE*	*NE*	*NE*	*NE*
Rifle Grenade	*1.2*	*100%*	100% (2)	33% (3)	0% (1)	*NE*	*NE*

NE = Not Evaluated.
NP = Non-Penetrating – Items expected on the surface only.
[1]The number of items seeded in the depth interval is included in parentheses.
[2]Maximum penetration depths are from the penetration study conducted as part of the Phase II EECA.

The Pd values in the table above are based on small numbers of each seeded MEC type in each depth interval. This small sample size increases the uncertainty of these Pd values. However, the Pd for the items potentially present at the site at the depths at which the items would be expected indicates that the Schonstedt GA-52/Cx is capable of detecting the items at the expected depths.

Digital Geophysical Surveys MRS-46 and MRS-15 DRO 02A

Digital geophysical surveys were performed over a 31-acre area that was proposed for leasing to York School for athletic fields, and over MRS-15 DRO 02 (approximately 16 acres) in accordance with the approved Work Plans (*USA, 2000c and 2000d*). The survey of MRS-15 DRO 02 included MRS-15 DRO 02A. The surveys were performed primarily with the Geonics EM61 time domain metal detector. The EM61 is capable of detecting both buried ferrous and non-ferrous metals, while being less sensitive to cultural features such as fences, buildings, and power lines. For most of the MRS-46 survey the instrument was operated in the trailer mode. The survey of MRS-15 DRO 02 was completed entirely with the EM61.

A small portion of the 31-acre lease area within MRS-46 (less than 1 percent) was surveyed using the EM61-HH. The primary difference between the EM61 and the EM61-HH is that the effective sensing depth of the instrument is less than that of the standard EM61 and requires smaller survey lane spacing to achieve similar coverage.

The performance of the Geonics EM61 and EM61-HH were evaluated as part of the Ordnance Detection and Discrimination Study (*Parsons, 2001*). As part of the ODDS, studies were performed to evaluate:

- Signatures of inert military munitions suspended in air at varying orientations and distances from the geophysical sensor (static tests).

- The ability of various instruments to detect and discriminate between different MEC items buried at various depths (seeded tests).

- Geophysical instrument performance at actual MEC sites (field trial testing).

This discussion presents information on the results of the seeded tests and the field trial tests. It is recognized that the ODDS study areas may not represent the same field conditions as the Group 4 sites; therefore, differences in field conditions, if applicable, should be considered when using information from the ODDS.

During the seeded test, the EM61 detected between 67 and 89 percent of the Type I items (MK II hand grenades and illumination signals) buried at depths ranging from just below the surface to 1 foot. The EM61-HH detected between 80 and 96 percent of the Type I items at a 1-foot line spacing. Between 49 and 77 percent of the Type II items (2.36-inch rockets and M9 rifle grenades) were detected with the EM61 at a 2-foot line spacing. The EM61-HH detected 69 and 90 percent of the Type II items at a 1-foot line spacing. The detection rate percentage presented in the ODDS vary according to the search radius used (either 1.6 or 3.3 feet) for the analysis, and assume a 2-foot wide search lane. A standard search radius for investigation anomalies was not specified in the Geophysical Work Plans; therefore, the detection "range" based on the two search radii is presented above. The results for the Type I and Type II items are presented because they represent the items that were found in MRS-46, the only site where MEC or munitions debris were found. These detection rates are considered conservative because an additional 1 foot was added to the items' calculated penetration depth to allow for soil deposition over time. It should be noted that the detection rates presented below are also considered conservative because during the ODDS testing the digital survey team was asked to come up with a dig list after the survey without opportunity to reacquire the anomaly. A step that is allowed before coming up with a dig list during normal operations. Because the field conditions at the seeded test site and orientations of buried items may not be comparable to the MRS-46 and MRS-15 DRO 02 conditions, the results should only be used as an indication that the equipment is capable of detecting the same types of items. The ODDS also evaluated the detection capabilities of the instruments in relation to the depth that items were buried. The EM61 detected between 50 and 75 percent of items buried between 0 and 12 inches bgs, and 25 and 55 percent of items buried between 13 and 24 inches bgs. The EM61-HH detected between 75 and 92 percent of the items buried between 0 and 12 inches and between 40 and 82 percent of items buried between 13 and 24 inches.

Results of the ODDS field tests were also reviewed for potential use in evaluating instrument performance at MRS-46 and MRS-15 DRO 02. Detection ranges for the EM61 and EM61-HH were calculated for 4 of the 6 test sites; the remaining sites did not have enough MEC or munitions debris detected to allow calculation of site statistics. A standard search radius for investigating anomalies at MRS-46 and MRS-15 DRO 02 was not specified in the after action reports; therefore, the detection range based on the two search radii (1.6 and 3.3 feet) is presented below. It should be noted that the detection rates presented below are also considered conservative because during the ODDS testing the digital survey team was asked to come up with a dig list after the survey without opportunity to reacquire the anomaly. A step that is allowed before coming up with a dig list during normal operations. The calculated detection rates for the combined sites ranged from 27 to 91 percent depending on the search radius used for the calculation. The calculated detection rates for the EM61-HH ranged from 33 to 82 percent depending on the search radius used for the calculation. It should be noted that the ODDS field trial sites were selected to represent high MEC density. In comparison, the Track 1 sites are expected to have very low ordnance densities. Therefore, the field trial results may not be applicable to the Track 1 sites.

Although not directly comparable to MRS-46 and MRS-15 DRO 02, the results of the ODDS indicate that the EM61 and EM61-HH are capable of detecting the subsurface MEC potentially present at this site.

Sampling Methods Discussion

Several sampling methodologies were used within the Group 4 sites. SS/GS sampling grids are located within MRS-43A and Parcel L6.1. 100 percent grid sampling and a visual surface removal were conducted within MRS-15 MOCO 01 and MRS-46, as well as 100 percent grid sampling and digital geophysical investigation within MRS-15 DRO 02A. A removal to 4 feet using both the Schonstedt GA-52/CX and a digital geophysical survey were completed over a 31-acre portion of MRS-46. Each of the sampling methods is discussed below.

Sitestat/Gridstat Sampling

SS/GS sampling methodologies were used at MRS-43A and Parcel L6.1. SS/GS is a computer program used to statistically estimate the military munitions density of a site or grid during field investigations. It estimates the number of MEC items at a given site or grid and can be used to assess whether a site has been characterized adequately. This program was designed so there were equal chances of finding MEC and range-related debris items. Excavation of anomalies identified with a magnetometer is performed in accordance with direction of the program; generally, 32 to 40 percent of the flagged anomalies are investigated using this technique (*CMS, 1995*). Ths SS/GS methodology was reviewed by EPAs Federal Facilities Restoration and Reuse Office. The Technical Support Center, EPA NERL in Las Vegas, Nevada also provided statistical assistance in reviewing the SS/GS methodology. Several problems were identified as a result of the review. The primary conclusions were: (1) that the statistical procedures are vague and not well documented, (2) the conclusions about homogeneity are not consistent, (3) that the stopping rules are faulty, and (4) not able to identify UXO clusters at a site. Although these problems were identified the information obtained during sampling is useful in identifying the presence of and type of MEC or munitions debris present at the site.

As part of the sampling effort at MRS-43 eight standard grids of 100 feet by 200 feet were sampled. Seven were located within MRS-43A, and one was located within Parcel L6.1. Two-hundred forty-one anomalies were identified within these grids, and 114 anomalies were sampled. As noted above, no MEC or munitions debris items were located within these grids.

100 Percent Grid Sampling

USA conducted 100 percent grid sampling at MRS-15 DRO 02, MRS-15 MOCO 01, and MRS-46. A portion of one sample grid associated with MRS-15 DRO 02 lies within MRS-15 DRO 02A. In 100 percent grid sampling, 100-by 100-foot grids were selected to cover at least 10 percent of the site. In 100 percent grid sampling methodology, all identified anomalies in each of the grids are investigated. The selected areas were investigated with a magnetometer along maximum 5-foot wide search lanes. Whenever a subsurface anomaly or metallic surface object was encountered, it was investigated. Near surface anomalies were excavated with hand tools. While digging, a magnetometer was used to check and verify the location of the anomaly (*CMS, 1995*). No MEC or munitions debris was found within the sample grid that lies partly within MRS-15 DRO 02A or within the MRS-15 DRO 02 sample grids adjacent to MRS-15 DRO 02A. No MEC or munitions debris was found in 13 grids surveyed in MRS-15 MOCO 01. Seventy-seven 100-by 100-foot grids and forty-five 30-by 110-foot grids were sampled at MRS-46 (over 17 acres). Munitions debris identified during the sampling included a M205 series hand grenade fuze, eight M30 practice grenades, three M11 practice rifle grenade tail booms, and one M6 2.36-inch rocket tail boom. One MEC item, a M204 hand grenade fuze, was also detected. An additional one hundred twenty-six 100-by 100-ft and partial grids (31 acres) were also investigated within MRS-46. Seven M11 practice rifle grenades, and munitions debris items, two of which were fragments, were identified during this investigation.

Visual Surface Removal

Parsons completed visual surface removals at MRS-15 MOCO 01 and MRS-46 in 2002. These removals were completed in response to the potential imminent and substantial danger to the public posed by the proximity and accessibility of surface MEC to the public. The action was designed to reduce the imminent safety hazard by removing the surface MEC and MEC-like (munitions debris) items. As part of the visual surface removal, the removal team recorded their path walked using a real-time kinematic (RTK) GPS unit (Plate G4-5). The visual surface removal operations were performed in accessible areas without vegetation removal operations or foraging through brush. Approximately 50 percent of the

MRS-15 MOCO 01 and 60 percent of MRS-46 was surveyed. No MEC or MEC-like (munitions debris) items were found during the survey.

Digital Geophysical Survey

A digital geophysical survey was also performed within the 31-acre lease area of MRS-46, and within MRS-15 DRO 02A, following the Schonstedt GA-52/Cx investigations described above. Over 99 percent of the digital surveys within the 31-acre lease area were performed with the Geonics EM61 time domain metal detector. The remaining portion of the lease area was surveyed using the EM61-HH (hand held) unit. The digital survey of MRS-15 DRO 02A was performed entirely with the Geonics EM61. No MEC or munitions debris were found during the geophysical survey.

Quality Assurance/Quality Control

The QA/QC procedures used during sampling are described below.

Field Sampling QA/QC

USA Sampling (Sitestat/Gridstat and 100 percent grid Sampling)

Sitestat/Gridstat -Throughout operations, USA performed daily operational checks and QC inspections. Because of the nature of the SS/GS sampling, QA/QC was limited to inspections of operations activities and documentation. No deficiency reports were written on the SS/GS operations. In accordance with the work plan, (*CMS, 1995*), all instruments requiring maintenance and/or calibration were to be checked prior to the start of each work day. Batteries were to be replaced as needed and the instruments were to be checked against a known source. The QC specialist was responsible for ensuring that personnel perform operational checks and making appropriate log entries. The QC specialist also was to perform random unscheduled checks of various sites to ensure that personnel perform the work as specified in the work plan. No QC deficiencies were reported during the SS/GS sampling.

100 percent Sampling - The QC Specialist also was to conduct a quality audit of completed sites after the work was complete at the 100 percent sampling sites (MRS-46, MRS-15 DRO 02, and MRS-15 MOCO 01). The audits were to be performed by scanning at least 10 percent of each search grid with a magnetometer. If any MEC or MEC-like items were identified the grid was to be reworked. All grids passed the initial QC inspection. The QC specialist also audited logs prepared by contract personnel (*CMS, 1995*). Each grid also received a QA inspection by a USACE Safety Specialist. All 100 percent sampling grids passed the initial QA inspection (*USA, 2000b, 2001c*).

USA Schonstedt Investigation Within MRS-46 Lease Area

The QC specialist conducted quality control audits as described above. The audits included Schonstedt Model GA-52/Cx magnetometer inspections of ten percent of each grid. The pass/fail criteria for the audit was no MEC or MEC like items or identification of 5 or more uninvestigated anomalies. All 100 percent investigation grids passed the initial QC audit. In addition to the field inspection, the QC Specialists conducted an audit of all field documentation to make sure the proper entries were made. No deficiencies were noted during any of the QC audits. Each grid also received a QC inspection by a USACE Safety Specialist. All 100 percent investigation grids passed the initial QA inspection (*USA, 2000b*).

Visual Surface Removal

The visual surface removals at MRS-15 MOCO 01 and MRS-46 were conducted according to Parson's Programmatic Work Plan (*Parsons, 2004a*). No details of the QC were provided in the Technical Information Papers (TIPS; *Parsons, 2004a, b*).

EM61 Operations within York School Lease Area and MRS-15 DRO 02

QC of each of the grids surveyed with EM61 was initially conducted by placing a metal nail or tent peg at a known location along the beginning and ending boundaries of each grid being surveyed. This process confirmed data repeatability and proved the accuracy of the positioning and data reduction process. Additional QC was accomplished by performing a second geophysical survey. The second survey was performed using the same instrument as the initial survey. The pass-fail criteria for the second survey audits was zero MEC items encountered, zero MEC like items encountered, and fewer than 5 anomalies. The grids to be surveyed were selected by USA, and the resurvey was performed by Parsons' personnel. The QC was performed using the following four-step plan:

- Step one - Resurvey 100 percent of three grids. If the grids passed the pass-fail criteria, the QC moved on to step two.
- Step two - Resurvey 30 percent of five grids. If the grids passed the pass-fail criteria, the QC moved on to step three.
- Step three - Resurvey 20 percent of five grids. If the grids passed the pass-fail criteria, the QC moved on to step four.
- Step four - Resurvey all remaining grids at a 10 percent level. There were no grid failures at the 10 percent level.

In addition, five percent of the total grids were 100 percent resurveyed during the Phase 2 QC. This resulted in the 100 percent resurvey of six additional grids. There were no QC deficiencies noted in the After Action Reports.

The USACE provided QA of the EM61 operations at MRS-15DRO 02. A USACE UXO Safety Specialist conducted the final QA inspection at the site using a Schonstedt magnetometer. All grids surveyed with the EM61 magnetometer at MRS-15 DRO 02 passed USAESCH QA inspection standards and were accepted by the USACE (*USA, 20001b*).

The USACE provided QA at MRS-46 including seeding of the site with MEC like inert items. Fifteen items were buried as part of the QA and seven items were found. The items that were not found were 35mm subcaliber rockets, MK II hand grenades, M69 hand grenades, and grenade fuzes. All of the seeded 2.36-inch rockets buried at the site were found. A discussion of the QA was provided in the *Draft Site OE-46 York School Lease Area, Geophysical Survey Analysis, Technical Memorandum* (*USACE, 2000*). The seeded test program included a number of items that were not expected to be found within the MRS-46 York School Lease Area to test the overall performance of the EM61 for future use at other sites. In addition, some of the items were placed in locations that would make the detection very difficult. For example, one of the hand grenades was buried at 6 inches in a vertical position only six inches from one of the grid corner stakes. The second grenade was buried at a depth of 18 inches. Both were buried at depths greater than expected for hand grenades and do not necessarily represent conditions that would be expected at a site. The seeding of these items was done to help improve the use of the EM61 at future sites, rather than as a check of the work completed at MRS-46.

Data Management QA/QC

Parsons, the current munitions response contractor, performed a 100 percent QC review of the data associated with the Group 4 sites. This review followed guidelines presented in the Standard Operating Procedures provided as Appendix A of Track 1 RI/FS. This evaluation included a review of field grid records (if available) and the database created by the munitions response contractor. The USACE followed the QC review with a 10 percent QA of the Parsons' data review. The requirements of the QA review are described in the SOP provided in the Final Track 1 OE RI/FS Report (*MACTEC, 2004*). The purpose of the data review was to complete a 100 percent check of all available grid records to identify discrepancies between the reports documenting field activities and the grid records. Discrepancies were then researched and corrections made, if appropriate, prior to loading the data into the project database.

Data Quality Conclusions

For the Group 4 sites, the following conclusions can be made regarding the quality of the data:

- The Schonstedt GA-52/Cx is capable of detecting the types of items potentially present at the Group 4 sites, especially shallow items. It is not effective in detecting non-metallic items.
- The results of the ODDS indicate that the EM61 and EM61-HH are capable of detecting the types of items potentially present at the MRS-46 lease area.
- All work passed contractor QC and USACE QA.
- Because some anomalies were not excavated using the SS/GS investigative approach, some subsurface MEC or munitions debris may still be present within the sampling grids at MRS-43A and Parcel L6.1.
- No sampling was completed within MRS-15 DRO 01A; however, a site walk was performed within the boundaries and no MEC was found. Sampling was completed adjacent to the site, and no MEC or munitions debris were identified within 300 feet to the east of the site and items detected to the west of the site were found along South Boundary Road and were most likely discarded items.

5.7 Conclusions and Recommendations

This section presents conclusions and recommendations for the Group 4 sites that are based on review of historical information, sampling, and investigation data collected from the sites.

5.7.1 Conclusions

Site Use and Development

- Based on the literature review and site sampling results, it appears that MRS-15 MOCO 01, MRS-15 DRO 01A and MRS-15 DRO 02A were not used for military munitions training.
- Based on the literature review and sampling results, it appears that MRS-43A and Parcel L6.1 were adjacent to an area used as a 37mm projectile and practice rifle grenade training area. However, no evidence of rifle grenades or 37mm projectiles was found within either of the sites.

- A 2.36-inch rocket range was present in the vicinity of the Group 4 sites. This nearby range may be the source of the 2.36-inch rockets found within MRS-46 and along South Boundary Road adjacent to MRS-15 DRO 01A and Parcel L6.1 that appear to be incidental occurrences.

- It is not anticipated that 37mm projectiles or 2.36-inch rockets were used at any of the Group 4 sites, and are not expected to be present at the Group 4 sites.

- It appears that the northwest portion of MRS-46 was used as a hand grenade training area. A practice rifle grenade impact area may have been located in the central part of the site.

- The following MEC items, if present at MRS-46, are considered to pose an acceptable risk if encountered, for the following reasons:

  M205A1 and M205A2 Fuze: Pyrotechnic Delay Igniting: It is possible that a person could cause a fuze to function through casual contact if one were found at the site, and be burned or exposed to metal fragments, but the fuze would have been exposed to moisture, degradation, and weathering for many years, which could decrease the effectiveness of the components that cause it to function.

  M204A1 and M204A2 Fuze: Pyrotechnic Delay Detonating: It is possible that a person could cause a fuze to function through casual contact if one were found at the site, and be burned or injured by metal fragments, but the fuze would have been exposed to moisture, degradation, and weathering for many years, which could decrease the effectiveness of the components that cause it to function.

  M30 Practice Hand Grenade: It is possible that a person could cause the practice hand grenade to function if one were found at the site, and be burned or injured by metal fragments from the functioning detonator housed within the grenade; the practice grenade itself would not fragment. However, the grenade would have to contain a live fuze and functioning detonator, and these components would have been exposed to moisture, degradation, and weathering form many years, which could decrease their effectiveness.

Sampling Adequacy and Data Quality

- Schonstedt GA-52/Cx magnetometers were used by USA during previous investigations. These instruments were evaluated as part of the ODDS and with the exception of non-metallic items, which are not expected in the Group 4 sites, and small arms ammunition, these instruments are capable of detecting the type of MEC items expected at the sites.

- The EM61 was used for a geophysical survey in a 31-acre area of MRS-46. Based on the ODDS results, these instruments are capable of detecting the items suspected in that portion of the site (M11 Rifle grenades and 2.36-inch rockets).

- The EM61 was used for the geophysical survey of MRS-15 DRO 02. No MEC or munitions debris was found in the southern portion of MRS-15 DRO 02, including MRS-15 DRO 02A, which supports the historical information that MRS-15 DRO 02A was not used for military munitions training.

- Sampling results indicate the possible presence of a practice hand grenade range in the northwest part of MRS-46. No evidence of an impact area or other military munitions training was identified based on sampling at any of the other Group 4 sites.

- The sampling data was useful in providing information on the occurrence of MEC and munitions debris at the Group 4 sites. MEC and munitions debris were only detected in MRS-46. The remaining 5 sites contained no MEC or munitions debris, which supports the historical information that the sites were not used for military munitions training.

- Although the previous MEC sampling efforts performed at the Group 4 sites are not consistent with requirements in place today, the quantity and quality of available information is sufficient to make an informed decision regarding the sites. All sites were not one hundred percent sampled; however, the sampling methods were sufficient to confirm that munitions debris and MEC were not present in 5 of the 6 Group 4 sites (MRS-15 MOCO 01, MRS-15 DRO 01A, MRS-15 DRO 02A, MRS-43A, and L6.1).

- Military munitions items (practice hand grenades) used in MRS-46 (the only Group 4 site where MEC was detected) are considered to pose an acceptable risk (see Section 5.5). In addition, only one MEC item and munitions debris items were found related to a potential training area in previous investigations at MRS-46. Additional MEC sampling at the site would not add significantly to the understanding of the site or change the conclusions of this report.

5.7.2 Recommendations

Based on review of existing information, MEC is not expected to be found at the Group 4 sites, and No Further Action Related to MEC investigation is required for these sites.

MRS-15 MOCO 01, Parcel L6.1, MRS-15 DRO 01A, and MRS-43A meet the Track 1, Category 1 criteria because no evidence was found to indicate military munitions were used at the sites. MRS-15 DRO 02A is a variant Track 1 Category 1 site because a digital geophysical investigation was conducted at MRS-15 DRO 02A after completion of 100 percent grid sampling; however, the digital geophysical investigation was conducted to support the early transfer of adjacent property and not on evidence of the use of military munitions at MRS-15 DRO 02A. No MEC or munitions debris was found at MRS-15 DRO 02A or in the southern portion of MRS-15 DRO 02 during the digital geophysical investigation supporting the conclusion that military munitions were not used at the site.

MRS-46 is a Track 1 Category 3 site because historical research and field investigations identified evidence of past training at MRS-46 involving military munitions, and training at this site involved only the use of practice and pyrotechnic items that are not designed to cause injury. MRS-46 is a variant Track 1 Category 3 site because a digital geophysical investigation was conducted within a 31-acre portion of MRS-46 after completion of 100 percent grid sampling; however, the digital geophysical investigation was conducted to support the construction of an athletic field within the 31-acre area and not because of the presence of military munitions; and no MEC or munitions debris was found during the digital geophysical investigation. The following MEC items may be present at MRS-46 based on past site use: practice hand grenades and grenade fuzes. In the unlikely event that a MEC item is found of the type previously observed at MRS-46, it is not expected that it could be caused to function through casual contact (i.e., inadvertent and unintentional contact). The MEC types potentially present at MRS-46 have been exposed to moisture, degradation, and weathering for many years which could prevent many of them from functioning.

For all of the Group 4 development parcels (all but Parcel 6.1), digging or underground "intrusive" activities are planned for the proposed site reuse and development. No actionable risk was identified through the remedial investigation process. However, in the interest of safety, reasonable and prudent precautions should be taken when conducting intrusive operations in these areas. As a basewide effort to promote safety and because of Fort Ord's history as a military base, the Army provides "ordnance

recognition and safety training" to anyone who requests that training. Construction personnel involved in intrusive operations at the former Fort Ord may attend the Army's "ordnance recognition and safety training" to increase their awareness of and ability to identify MEC items. Section 1.3.1 (Description of the Remedy) of the Track 1 ROD (*Army, 2005a*) describes the scope of the safety training. Section 1.3.1 (description of the Remedy) of the Track 1 ROD (*Army, 2005a*) describes the scope of the safety training. If MEC is discovered during future development activities in these areas, trained construction personnel should immediately stop any intrusive or ground-disturbing work in the area or in any adjacent areas and should not attempt to disturb, remove or destroy the MEC item, but should immediately notify the local law enforcement agency having jurisdiction on the parcel. The local law enforcement agency will arrange for an appropriate agency (e.g., an EOD unit) to respond.

For MRS-46, the Army recommends construction personnel involved in intrusive operations attend the Army's ordnance recognition and safety training. The Army will request notice from future landowners of planned intrusive activities, and in turn will provide ordnance recognition and safety training to construction personnel prior to the start of intrusive work. The Army will provide ordnance recognition and safety refresher training as appropriate. MRS-46 should be added to the list of Track 1 sites with management controls shown in the *Munitions Response Site (MRS) Security Program* (*Army, 2005b*). This document presents elements of the ordnance recognition and safety training, notification procedures, and army and local law enforcement responsibilities. In accordance with the Track 1 ROD (*Army, 2005a*), the Army will assess whether the education program should continue. If information indicates that no MEC items have been found in the course of development or redevelopment of the site, it is expected that the education program may, with the concurrence of the regulatory agencies, be discontinued, subject to reinstatement if a MEC item is encountered in the future.

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