# SITE OE-1

# FLAME THROWER RANGE

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# SITE OE-1 – FLAME THROWER RANGE

## 3.1 Site OE-1 (Flame Thrower Range)

This summary report consists of two parts. The first part, contained in Sections 3.1.1 through 3.1.5, includes a presentation and assessment of archival data. Specific elements include a review of site history and development, evaluation of potential ordnance at the site, a summary of previous ordnance and explosives (OE) investigations, and a conceptual site model. The above-mentioned information was used to support the second part of this report, which is the Site Evaluation (Section 3.1.6). 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 3.1.6.1) and evaluation of sampling process(es) (Section 3.1.6.2 ). These discussions are based on information from standardized literature review and sampling review checklists (Attachment 1-A1). Section 3.1.7 provides conclusions and recommendations for the site. References are provided in Section 3.1.8.

### 3.1.1 Site Description

Site OE-1 comprises approximately 25 acres in the northwestern part of Fort Ord (Plate 1-1). The site lies within a residential housing area that was formerly occupied by the Army. The initial site boundary was identified in the 1993 Archives Search Report (ASR; *U.S. Army Engineer Division, Huntsville [USAEDH], 1993*). The boundary was based on the area designated as the "Flame Thrower Range" on a 1957 training map.

### 3.1.2 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 Harding ESE. 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 may contribute to misalignments of some map features with respect to the aerial photographs.

#### *Pre-1940s*

This site lies within a tract of land purchased from private landowners by the U.S. Army (Army) after July 1940 (*Arthur D. Little, Inc. [ADL], 1994*) and was privately owned prior to that time. During interviews with former Fort Ord personnel in 1994, a retired Fort Ord military engineer stated that he heard that the site vicinity was reportedly used in the early 1900s by cavalry stationed at the Presidio of Monterey. He went on to say that he heard that 75mm Pack Howitzers were fired from this area into the multi range area (MRA) (*HLA, 1994*). The 75mm Pack Howitzers have a maximum range of 9,750 yards or 29,250 feet which would be sufficient to reach the northern portion of the MRA, approximately 20,000 feet to the south. Although the range of the Pack Howitzers was sufficient to reach the MRA, it is unlikely that the Howitzers would have been fired into this area because targets are generally set at the intermediate range of the equipment (*Hall, 2003b*).

No evidence was found during the archive search process and literature review that would support that the area was used for artillery use. Additionally, no evidence of artillery use was found during OE sampling. The area reportedly used as the 75mm Pack Howitzer firing area was not purchased by the Army until 1940 (*ADL, 1994*).

### 1940s Era

Review of aerial photographs indicates that in the 1940s, the area was cleared and a network of unpaved roads or trails was developed. According to historical maps, the site was used as a camouflage area. More specific information is provided below:

- On a 1941 aerial photograph, the site appears to have been cleared of vegetation based on the presence of straight boundaries between vegetation and what appears to be dune sand. The dune sand is also marked with vehicle tracks. There are no apparent equipment or structures present at the site.

- The area was identified as a camouflage area on a 1945 training facilities map and 1946 master plan for Fort Ord (*Army, 1945 and 1946*).

- On a 1949 aerial photograph, the cleared area is partially re-vegetated and the area is transected by several trails. There is a small linear feature within the cleared area that could be a berm or trench (Plate 1-2). There is no information about what activities were associated with camouflage training at Fort Ord in the 1940s. However, it is possible that camouflage training could have involved digging and camouflaging a trench.

### 1950s Era

Review of 1950s training maps and aerial photographs indicates that the area was used for mortar practice and as a flame thrower range. An area to the north was used for mines and booby trap training in the early 1950s (OE-6). More specific information is provided below:

- On a 1951 aerial photograph, there is a cleared area (approximately 300 by 400 feet) at the southern edge of the site and a building on the western perimeter of the site.

- On a 1954 training area map, a mine and booby trap area was identified in an area just north of the site. Three mortar squares, 1, 2, and 3, were shown in the general site vicinity (*Army, 1954*).

- On a 1956 aerial photograph, in addition to the cleared area at the southern part of the site, there is a cleared square shaped area at the eastern boundary of the site. The square appears to be in the same general location as Mortar Square 2 shown on the 1954 training area map. There are two similar cleared square areas west (coincident with Mortar Square 1) and east of the site boundaries (in the same general location as Mortar Square 3). It should be noted that there is some offset in these digitized features. As discussed previously, this is a product of the attainable level of accuracy in registering and digitizing historical maps. Unpaved roads traverse the site (Plate 1-3).

- A 1957 Training Area Facilities map shows a "Flame Thrower Range" at what appears to be the former location of Mortar Square 2 (shown on the 1956 map) (*Army, 1957*).

- A 1958 Training Area Facilities map shows a "Flame Thrower Range" at what appears to be the former location of Mortar Square 1 (as identified on the 1954 map). The 1958 map shows Mortar Squares 3 and 4. These mortar squares are near features identified as Mortar Squares 2 and 3, respectively, on the 1954 map (*Army, 1958*), and appear to be the same features.

### *1960s to Present*

In the early 1960s, construction of housing began at the site. From the early 1960s to the early 1990s, the site was used for residential housing. More specific information is provided below:

- A 1961 training facilities map shows the area as a Flame Thrower Range (Plate 1-3; *U.S. Army Corps of Engineers [USACE], 1961*).
- Housing construction began in the area in 1962 (*ATC/Diagnostic Environmental, Inc. [ATC], 1994*).
- Training facilities maps from 1964 identify the area as the Marina Housing Area (*Army, 1964*). Other records indicate that the development was known as Patton Park housing (*ATC, 1994*).
- Aerial photographs from 1966 (Plate 1-4) through 1999 (Plate 1-5) show the site developed with roads and residential housing.
- The literature review (*HLA, 2000a*) indicated that for available records (late 1980s until present) there were no reports of ordnance or ordnance-related items being found in this area.

### *Proposed Future Land Use*

The site is within a parcel identified for development. The area encompassing Site OE-1 is currently designated for medium-density residential use by Fort Ord Reuse Authority Reuse Plan, 1997.

## 3.1.3 Potential Ordnance Based on Historical Use of the Area

This section identifies the types of ordnance that may have been used in this area. Based on historical information, ignition cartridges for flame throwers, mines, and booby traps may have been used in this area. These items are briefly described below. As previously discussed, mortars would not be expected because mortar squares were used only for practice of setting up and aiming of weapons (dry fire training) (*USAEDH, 1993*). Although interviews suggest that 75mm Pack Howitzers were fired from the OE-1 area, as previously discussed, no evidence was found during the archive search process and literature review to support that the area was used for Pack Howitzer artillery use. In addition, the edge of the MRA is at the maximum range of the Howitzer and the general practice for training is to use target areas at the intermediate range of the equipment (*Hall, 2003b*). Also, no evidence of Pack Howitzer use was found during OE sampling.

### 3.1.3.1 Flame Throwers

Identification of an expended M2 ignition cartridge from a flame thrower during the 1994 sampling program is consistent with the assumption of the area's use as flame thrower range. According to Headquarters Munitions Command data cards, these cartridges were produced between 1951 and 1983 and therefore, were available for training in the 1950s.

Based on Army Equipment Data Sheets for Chemical Weapons and Munitions (Army, 1982), mechanized flame throwers and/or portable flame throwers were available for use by the Army at about the time the flame thrower range was identified in training facilities maps. Pictures from a 1959 Fort Ord Yearbook show use of portable flame throwers. Descriptions of portable flame throwers potentially used at the site are provided in Attachment 1-A2.

### 3.1.3.2 Mines and Booby Traps

Site OE-1 is bordered on the north by a mine and booby trap area. The mine and booby trap area is not identified as a practice area. However, based on the proximity of the site to Highway 1, the City of Marina and barracks (which were present in the 1950s), it is expected that the area was used as a practice training area. Because this practice area is just north of Site OE-1, it is possible that a portion of Site OE-1 may have been used for mines and booby trap training. An inert M1 practice antitank mine, an inert M8 practice antipersonnel mine, and expended or inert M604 mine fuzes were found and removed from Site OE-1 and the area to the north, which is consistent with the assumption that practice mines were used at the site and vicinity.

A description of these mines is provided in Attachment 1-A2. As discussed in Attachment 1-A2, these items were produced prior to or during the time that the site was used for training (1950s). Therefore, they could be present at the site as a result of past training practices.

### 3.1.3.3 Booby Traps and Booby Trap Simulators

Booby traps and booby trap simulators may have been used at the site. Booby traps are actuated when an object is moved and triggers a firing device. Most booby traps use trip wires, which release cocked striker-type firing devices. Booby traps are actuated when a trip wire is pulled, or a plate or rod is pressed by someone or something moving through the booby-trapped area. Many triggering devices are used in booby traps. They include fuzes, igniters, and firing devices. Standard firing devices have a standard base coupling by which they may be readily attached to a variety of charges. Explosive blasting caps with detonating cords are not used with firing devices in booby trap training areas because of the risk of injury. Charges and blasting caps are only used in demolition areas (*Hall, 2003b*); and therefore, are not expected to have been used at OE-1. In training, firing devices could be attached to practice mines or simulated explosive devices to provide realistic training in setting and disarming booby traps (*Hall, 2003a*).

Booby trap simulators may also have been used in training. Explosive booby trap simulators are used during maneuvers and during training exercises to teach the installation, detection, and use of booby traps. Booby trap simulators contain pyrotechnic charges. The charges produce (1) an instantaneous explosion, flash and, sound on initiation, or (2) illumination flame, or (3) whistle.

Based on review of a 1959 Fort Ord yearbook, booby trapping of mines appears to have been taught at Fort Ord. However, there is no specific information about what booby trap firing devices or simulators were used for training at Fort Ord in the 1950s. Firing devices that may have been used as part of booby trap training in the 1950s at Fort Ord include the M5 Pressure Release Firing Device, M1A1 Pressure Firing Device, the M1 Pull Firing Device, the M3 Pull/Release Firing Device, and the M1 Pressure Release Firing Device (See FM 5-31 Boobytraps; September 31, 1965.) These firing devices contain no energetic materials (e.g., pyrotechnic charges), unless the coupling base is attached. As stated above, in training, firing devices are likely to be connected to practice mines or coupling bases and explosive booby trap simulators contain pyrotechnic charges.

### 3.1.3.4 Other OE

Recollections that the site was used for 75mm Pack Howitzer emplacement were not confirmed during the archive search process and literature review (*HLA, 2000a*). Additionally, no evidence of Howitzer use was found during OE sampling at the site (*Human Factors Applications, Inc [HFA], 1994*). One 75mm projectile was found in the Main Garrison Area, 1,500 feet southwest of the site. This was a single isolated find and was considered to be a discarded item (*Harding ESE, 2002*).

Mortar squares were used to practice setting up and aiming weapons or dry fire training (*USAEDH, 1993*). No evidence has been found that would support use of live ordnance at the mortar squares. In addition, no range fans have been identified in association with the mortar squares as would be expected if live fire occurred. Therefore, no ordnance is expected from past use of these mortar squares (*HLA, 2000a*).

### 3.1.4 History of OE Investigations

The following describes the OE investigations that have been conducted at Site OE-1.

#### *1993 Archives Search Report*

The purpose of the Archives Search was to identify sites, gather and review historical information to determine the types of munitions used at Fort Ord, identify possible disposal areas, identify unknown training areas and recommend follow-up actions. Guidance for conducting archives searches did not exist prior to 1995. The ASR was completed based on the Scope of Work provided to the St. Louis Corps of Engineers by the Huntsville Corps of Engineers and on archive search reports completed at other military installations. The Archives Search included a Preliminary Assessment/Site Investigation (PA/SI) consisting 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 or removal actions. Requirements for preparation of an ASR are described in Section 2.0 of this report.

Site OE-1 was identified as a potential OE site in the Archive Search Report (ASR; *USAEDH, 1993*). Site OE-1 was identified as an OE site based on the presence of a flame thrower range on a 1957 map. In the ASR, the location of Site OE-1 was identified as being at the southern end of an existing fenced-in drainage area (depression) near Patton Elementary School. The estimated size was 7 acres and the site was identified as being in the vicinity of coordinate FR069590. As shown on Plate 1-3, this area is northwest and northeast of the digitized boundaries of the "Flame Thrower Range" shown on 1957 and 1958 maps, respectively. The method for determining site boundaries was not discussed in the ASR. It should be noted that the original site boundaries were identified based on less information and fewer tools (e.g., no geo-referenced aerial photographs, GIS maps, or databases) than are currently available.

#### *1994 Human Factors Application Sampling Program*

In January and February 1994, HFA sampled four approximately 100- by 100-foot grids within an approximate 7-acre area, which was identified as the site area (HFA site boundary; Plate 1-5). The grid locations are shown as blue squares on Plate 1-5. The location of these grids (from the digitized HFA map) and the 7-acre site (from the CMS resurvey; see section below) appears to be at the southeast corner of the 1997 ASR site and south of the 1993 ASR site (Plate 1-5). The scope of work for HFA indicated that OE-1 was 7 acres, located adjacent to the Patton Elementary School and Patton Park Housing Area, and referenced the ASR. It is assumed that the HFA site area was based on coordinates from the 1993 ASR as the work plan listed the grid coordinates for the site as "069590". Contract requirements for the scope of work performed by HFA are described in more detail in Section 2.0 of this report.

HFA sampling methodology is discussed in Section 3.1.6.2. As discussed in Section 3.1.6.2, the area was surveyed using a Schonstedt Model GA 52/C magnetometer along a maximum 5-foot wide search lane. 100 percent of the identified anomalies were investigated. No OE was found. However, one inert M1 practice antitank mine was found and removed. The depth and exact location that this mine was discovered is unknown. The USAEDH recommended that additional grids be sampled between Site

OE-1 and Site OE-6 (*HFA, 1994*). A summary of the sampling operations conducted at Site OE-1 is provided in Table 1-1.

The scope of work for HFA indicated that detailed accounting of all OE items/components/scrap encountered would be performed. However, grid records providing this information are no longer available. Existing information regarding items found is summarized in the text of the HFA OE Sampling and OE Removal report. The report itemized inert or expended OE-scrap found. Some non-OE scrap was removed and turned in at the end of the project.

At the request of the USAEDH Safety Specialist, on March 16, 1994, HFA established eight sample grids north of Site OE-1, designated 1-5 through 1-12. These grids are shown in lavender on Plate 1-5. It is assumed that the sample grids were 100 by 100 feet, as specified by the work plan (*HFA, 1993*). Because the area was located near the Patton Elementary School, it was designated by HFA as the Monterey Peninsula Unified School District (MPUSD) area. During the sampling program, four inert antitank landmines and one inert M8 Series practice antipersonnel mine were found and removed (*USA Environmental, Inc. [USA], 2000*). The depths and exact locations that these mines were discovered are unknown. Because the exact locations of these OE scrap items are not known, the locations of the found items are not illustrated on Plate 1-5 which shows grid locations.

### *1997 Engineering Evaluation/Cost Analysis – Phase I*

The Final Phase I Engineering Evaluation/Cost Analysis (EE/CA) listed Site OE-1 as requiring further sampling because the available geographic data were not sufficient to ensure that sampling had occurred within the site boundaries.

### *1997 CMS Site Boundary Re-Survey*

In April 1997, CMS Environmental (CMS) (now referred to as USA Environmental) resurveyed the site boundary using global positioning system (GPS) technology. Contract requirements for the scope of work performed by CMS are described in Section 2.0 of this report. This re-survey was performed to map the site boundary and survey the locations of the HFA sampling grids. No additional magnetometer sweeps or samplings were performed by CMS. The resurveyed area comprised 6-1/2 acres. The four HFA grids were resurveyed based on the locations of stakes found in the field by CMS. These grids are identified as yellow squares on Plate 1-5. As shown on Plate 1-5, the four grid areas surveyed by CMS did not overlie the grid locations shown in the HFA report, but are within the site boundary shown in the 1997 ASR. It should be noted that one of the re-surveyed grids fell within a cleared area that likely corresponded to the 1958 Flame Thrower Range (Plate 1-3). It should be noted that one of the MPUSD area grids overlapped the digitized location of the Flame Thrower Range from the 1957 maps. As previously discussed, the discrepancy between cleared areas on the aerial photograph and the digitized location of the Flame Thrower Range shown on the 1957 and 1958 maps is likely a function of the level of accuracy in registering and digitizing features from historical training maps.

There is no documentation explaining the difference between the CMS surveyed grid locations and the grids shown on the plate in the HFA report other than the reference in the EE/CA indicating that available geographic data were not sufficient to ensure that site sampling had occurred within the site boundary. Based on the discrepancies between the surveyed location of the grid stakes and the locations shown on the HFA map, it appears that the maps prepared by HFA did not accurately show grid locations. The re-survey of the grids was the attempt to resolve the differences. Attempts were made to obtain additional information from HFA; however, HFA indicated that the project data were no longer available. Based on the re-survey, it appears that the grids were more widely spaced and provided better surface coverage than was indicated on plates in the final HFA report (*HFA, 1994*).

### *1997 Archives Search Report*

This report updated information contained in the 1993 ASR report and included the HFA sampling results and EE/CA recommendations. It also indicated that the flame thrower area appeared on a historical map dated January 10, 1958, as well as on a July 15, 1957, map. The area shown on the 1958 map was suspected to be at the southern end of an existing fenced drainage area near the Patton Housing Area. The area shown on the 1957 map appeared to be south of Patton Elementary School and partially within the Patton Housing Area. The 1997 ASR shows a site boundary that differs in size, shape, and location from that identified in the 1993 ASR. It is not known why the site boundary changed. However, the expanded site boundary includes at least a portion of several cleared areas on the 1956 aerial photograph that are possible locations of the Flame Thrower Range. The 1997 ASR boundary also includes a portion (but not all of) the digitized locations of the Flame Thrower Range shown on 1957 and 1958 training maps. The method for determining site boundaries was not discussed in the 1997 ASR. USACE St. Louis personnel were interviewed about changes in OE site boundaries appearing on the various versions of the ASRs produced. This interview indicated that the site boundaries were modified using interview notes, field (site walk) notes, aerial photos, and verbal input from meeting attendees. It should be noted that the ASR site boundaries were identified based on a more limited data set than is currently available. The ASR recommended that confirmatory sampling be conducted as recommended in the EE/CA.

### *1998 CMS Sampling*

In February 1998, CMS investigated three 100- by 200-foot grids using the Site Stats/GridStats (SS/GS) program within the resurveyed CMS site boundaries. These grids are identified as black squares on Plate 1-5. A total of 128 anomalies were investigated. No OE was found during sampling. A single expended 0.30-caliber small arms round was discovered near a sidewalk in one of the grids sampled (*USA, 2000*). The remainder of the anomalies were non-OE metallic items. CMS sampling methodology is discussed in Section 3.1.6.2. As discussed in Section 3.1.6.2, the area was surveyed using a Schonstedt GA-52/Cx magnetometer along a maximum 5-foot wide search lane. It should be noted that using the SS/GS sampling approach, not all anomalies are investigated. Review of grid records indicates that approximately 32 percent of the anomalies were investigated. During the SS/GS sampling, records were kept regarding the non-OE items found which included items such as wires, bolts, etc.

In April 1998, a new site boundary was established based on the results of the Phase 1 EE/CA and the revised ASR. The revised site boundary increased the site size from 7 to 25 acres. In July 1999, four additional 100- by 100-foot grids were sampled to investigate the expanded site area. These grids are identified as green squares on Plate 1-5. The grids were investigated along maximum 5-foot wide search lanes with a Schonstedt GA-52/Cx magnetometer. All anomalies identified were investigated by excavation. A total of 936 anomalies were excavated. No OE was found. Three OE scrap items were found that comprised two inert practice mine fuzes (M604) and an inert M2 ignition cartridge from a flame thrower. These items were found in Grid LD2-M103-SE10 (Grid 11B in the USA report), the westernmost grid (*USA, 2000*). The remaining anomalies were non-OE metallic items. A summary of the sampling operations performed by CMS (referred to as USA) is presented in Table 1-1. No records were kept concerning specific non-OE scrap items found. The grid operations records do include the estimated weight in pounds of non-OE scrap; 36 pounds of non-OE scrap were removed by CMS from the four grids. Contract requirements for the scope of work performed by CMS are described in Section 2.0 of this report.

## 3.1.5 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 OE 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 OE), and exposure routes (potential scenarios that may result in contact with OE).

The CSM for Site OE-1 is based on currently available site-specific and general information including the EE/CA (*USACE, 1997*), ASR (*USAEDH, 1993*), 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. Plate 1-6 presents a site conceptual model.

### 3.1.5.1 Training Practices

Training practices that are known or suspected to have occurred at Site OE-1 are discussed below to provide information on the potential types and distribution of OE that may have been used at the site, and the potential areas of concern remaining at the site, if any. Because there was no evidence found during the archive search process that would support that the area was used for Pack Howitzer use, training involving firing Pack Howitzers is not discussed in this section.

#### *Flame Thrower Training*

Information concerning practices used for flame thrower training was obtained from *Policies and Procedures for Firing Ammunition for Training, Target Practice and Combat* (*Army, 1983*). According to the policy and procedures document, the area used for flame thrower training would have been cleared of vegetation and other combustible material. The equipment was not allowed to be fired into headwinds greater than 5 miles an hour or against sharp rising terrain or obstacles nearer than 15 meters from spectators and 6 meters from the firer. When the fuel was expended, the remaining pressure in the fuel tanks was depressurized without ignition. This was accomplished by blowing down the remaining pressure on the flame thrower range away from any fire or fuel burning on the ground. The surface danger zone for portable flame throwers was listed as 100 meters long and zones for mechanized flame throwers are 275 meters long. There are photographs showing portable flame throwers being used at Fort Ord (*Army, 1959*). It is not known if mechanical flame throwers were used for training at Fort Ord.

#### *Mine Training*

There is no available information about how specific training was performed in this area in the 1950s. According to current field manuals, practice and inert mines or explosive booby trap simulators are used in training personnel in the precautions and proper methods to be observed in the care and handling, arming, booby trapping, and disarming mines (*Army, 1997*). High explosive mines are not normally used in training, except for demonstration purposes. The 1997 training manuals indicate that live mines are used as part of current training practices, but that live mine training and simulators training will not take place concurrently at the same location in order to preclude a live mine being mistaken for an inert mine (*Army, 1997*). Because of the proximity of Site OE-1 to Highway 1, the City of Marina, and barracks, it is unlikely that high explosive mines were used at this site.

Information concerning emplacement of minefields in Army training manuals serves as a guide as to how the site vicinity may have been used for mine and booby trap training (FM20-32, Chapter 13 and DA PAM 350-38; *Army, 1997*). Current training in mine warfare tasks includes installation and removal of antipersonnel and antitank mines and anti-handling devices. Training also includes installation, recovery, or transfer of a hasty protective minefield as well as emplacement of tactical minefields, and row,

standard pattern, and scatterable minefields. Training also includes breach of minefields (including use of explosives) as well as mine awareness training.

Based on practices described in field manuals, it is likely that during training, the trainees would learn to mark mine locations as well as practice mine removal operations. It is also likely that the trainees would practice clearing a path or lane through the minefield by probing, marking, and possibly destroying the mines with explosives or grappling hooks. As previously discussed, based on the proximity of Site OE-1 to Highway 1, the City of Marina, and barracks, it is unlikely that the mines would have been destroyed with explosives during training.

### *Booby Trap Training*

No Fort Ord-specific information is available for booby trap training in the 1950s. Information presented below is based on current training manuals (*Army, 1997*) and from personal communication (*Hall, 2003a*).

Booby traps are placed in a variety of locations, some of which can include:

- In and around buildings, installations, and field defenses
- In and around road craters or any obstacle that must be cleared
- In natural, covered resting places along routes
- In likely assembly areas
- In the vicinity of stocks of fuels, supplies, or materials
- At focal points and bottlenecks in road or rail systems.

When setting booby traps, the commander establishes a control point that serves as a headquarters and material holding area. Each setting party works in a clearly defined area. Entry to these areas is strictly controlled. The locations of booby traps are recorded. The traps are inspected for safety and camouflage before they are armed.

Based on these general field practices, it would be expected that as well as setting the traps, personnel would also practice neutralizing and removing the traps.

If the training was in setting or disarming the traps, it is very likely that actual booby trap firing devices were used with a standard coupling base (sometimes referred to as a base coupling) used to provide an energetic report to indicate that the trap had been successful. Only rarely would any reason exist to connect these firing devices to explosives, blasting caps, or detonating cord, and this would have to be done in a demolition area properly sited for the explosives quantities used (*Hall, 2003a*).

If the training was in detecting/avoiding booby traps, the booby trap simulators would provide a training environment similar to that provided by the actual firing devices and could thus be used in lieu of the actual firing devices (*Hall, 2003a*). The functioning of these items is discussed in Attachment 1-A2.

### *Camouflage Training*

There is no specific information about what activities were involved in camouflage training at Fort Ord in the 1940s. However, general principals of camouflage described in a War Department Field Manual

FM5-20 (*Army, 1944*) are to use concealment and deception to promote offensive action, to surprise, mislead the enemy, and prevent the enemy from inflicting damage. Concealment includes hiding from view, making it hard to see clearly, arranging obstructions to vision, deceiving and disguising. It is expected that as part of camouflage training, troops would practice concealment of equipment or personnel positions using natural materials (vegetation, earth, sand, or gravel) or using artificial materials including shrimp nets, twine nets, chicken wire netting, cloth garnishing, smooth soft steel or iron wire, steel and glass wool garnishing, rope, wood, and steel stakes and posts. It is unlikely that camouflage training would have employed the use of OE.

#### *Mortar Square Training*

Mortar squares were used to practice setting up and aiming weapons or dry fire training (USAEDH, 1993). No evidence has been found that would support use of live ordnance at the mortar squares. In addition, no range fans have been identified in association with the mortar squares, as would be expected if live fire occurred. Therefore, no ordnance is expected from past use of these mortar squares (*HLA, 2000a*).

### 3.1.5.2 Site Features

Based on the requirement for a cleared area, the mortar squares and/or the cleared areas to the south (Plate 1-3) could have been locations for flame thrower training. The sizes of the cleared areas are about 300 by 300 feet, which appears compatible with use of portable flame throwers. The mine and booby traps could have been set up anywhere in the site vicinity and would likely be buried or camouflaged.

### 3.1.5.3 Potential Sources and Location of OE

Fuel released from the flame throwers during equipment blow down could have been discharged to surface soil. The fuels could also migrate downward in the soil profile. It is not expected that substantial quantities of fuel would have been released to surface soil in this area because the only fuel would be that discharged during equipment blow down or spilled when filling the fuel tanks. Potential contamination associated with incidental discharge of fuel will be addressed as part of the Basewide Range Assessment (*HLA, 2001*). Expended and non-expended ignition cartridges from the flame throwers could also have been discarded at the site. It would be expected that the ignition cartridge would consist of an incendiary pellet and a sparking device. These cartridges would have to be triggered to create a flame. These cartridges could have been discarded on the ground surface and could have been potentially covered with soil during site grading prior to construction of the residential housing.

Practice antipersonnel and antitank mines could still be present at the site. Some practice mines and/or their fuzes contain a pyrotechnic charge or a smoke-producing increment. These mines would likely have been buried very close to the surface, but may have been covered with additional soil when the site was graded for housing construction. Some firing devices used in booby traps or booby trap simulators could have been discarded at the site and could be present at the ground surface or potentially covered with soil during site grading operations. Firing devices do not contain energetic materials unless the coupling base is attached (*Hall, 2003a*).

### 3.1.5.4 Potential Exposure Routes

Potential exposures to OE, although unlikely, could result from encountering unexpended flame thrower ignition cartridges, practice mines, and mine fuzes, coupling bases from firing devices, and booby trap simulators. It should be noted that the items found at OE-1 during sampling (flamethrower ignition cartridge and practice mines) have all been inert or expended. It is unlikely that these OE items are still

present on the ground surface at the site because they would have likely been discovered during site development or while the area was occupied by families. No incident reports have been found in EOD records from the late 1980s through the 1990s that document that OE items were found by persons living at the Patton Park Housing. Any OE items present, therefore, are likely to be beneath the ground surface and have been present at the site for over 40 years.

A brief discussion of the potential injuries that could result from contact with OE found at the site as well as OE that may potentially be present is provided below. These items were selected for discussion because a flame thrower ignition cartridge, M604 antitank practice mine fuze, and M8 and M8A1 practice antipersonnel mines were found during sampling, and firing devices and their coupling bases (M1, M1A1, M3, and M5) and booby trap simulators (M117 flash, M118 illuminating, and M119 whistling explosive) may potentially be present at the site. Additional details regarding these items are provided in Attachment 1-A2.

For each of the OE 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. Additional information on these items is provided in Attachment 1-A2.

**Flame Thrower Ignition Cartridges – Ignition System for the M2-2 Flamethrower.** The ignition cartridge for the M2-2 flamethrower consisted of a plastic cylinder loaded with five patches of incendiary material. It was designed to generate a flame, which would last for about 6 seconds, to light the stream of fuel coming out of the nozzle of the flamethrower. It was functioned when the operator pulled the trigger on the front handle, which would activate a match-mixture-coated pin, which would ignite one of the incendiary patches (*Army, 1994a*). It is very unlikely that an unspent ignition cartridge could be caused to function without the friction match that is a part of the flamethrower. It is possible, although highly improbable, that one would be able to ignite the incendiary material by incidental contact or by scratching one of the incendiary patches in the cartridge with a sharp object like a pin. It is very unlikely that the ignition cartridge would function by picking it up, kicking, or throwing it. If caused to function, the type of injury that could be sustained could include burns from the flame produced by the incendiary patch.

**Summary:** It is unlikely that a person would be able to ignite a cartridge through casual contact if one were found at the site and sustain a burn injury, because the cartridge: (1) would have to be intact, loaded, and unfired, (2) could only be ignited in a very precise manner to function properly, and (3) would have been exposed to moisture, degradation, and weathering for over 40 years, which could decrease the effectiveness of the components that cause it to function.

**Booby Trap Firing Devices.** The firing devices shown in the table below are all issued with a coupling base firing device consisting of a metal or plastic body and an internal percussion primer (similar to the primer in a small arms cartridge), and are designed to be used to set up booby-traps. They could also be used as a secondary firing device (booby-trap) for most anti-personnel and antitank mines. The firing devices could be set up to fire if a trip wire was pulled, pressure was released as in a weight being removed, or if a line under tension were cut. In each case, triggering the device would cause the spring-loaded firing pin to strike the percussion primer initiating the explosive train (*Army, 1994b*). As these items were used in training, no high explosives were used. The percussion primer provided sufficient noise to denote a detonation for training. It is unlikely that a set up booby trap, which includes one or more of the above firing devices, would remain in operational condition after many years of exposure. These devices are not sealed units. They are designed to be set up in the field quickly to provide temporary area denial or separation of forces. Many booby trap firing devices require trip wires to activate them, which are composed of a thin wire that will not survive long exposure to the elements. The firing devices themselves are not sealed to protect them from exposure to the environment. In the

unlikely event that one of these armed devices were made to function, they would likely produce a shock, noise, and flash. They are not likely to cause injury by themselves.

| Nomenclature | Type by function | Lbs. Required to function |
|---|---|---|
| Firing Device, M1 | Pull | 3 to 5 |
| Firing Device, M1 | Pressure Release | 3 |
| Firing Device, M1 and M1A1 | Pressure | 20 |
| Firing Device, M1 | Chemical Delay | 6 to 1130 minute delay |
| Firing Device, M3 | Pull or Release | 6 to 10 of Pull & any release of tension |
| Firing Device M5 | Pressure Release | Approx. 5 |
| Coupling Base, Firing Device, M2 | Non-metallic | NA |
| Coupling Base, Firing Device | Metallic | NA |

**Summary:** It is unlikely that a person through casual contact could cause an armed booby trap firing device fitted with a coupling base to function if one were found at the site, and be exposed to the shock, noise, and flash of the coupling base. Booby trap firing devices were designed to be functioned by a thin trip wire or release of pressure that would release a cocked spring loaded firing pin. These small, unsealed, metal parts have been exposed to moisture, degradation, and weathering for many years, which could decrease their effectiveness.

**Simulator, Explosive Booby-trap: Flash, M117; Illuminating, M118; Whistling, M119.** The booby-trap simulators are designed to be used as safe booby traps during maneuvers and in troop training to teach the installation, detection and use of booby traps, and to instill caution in troops exposed to traps set by an enemy. They consist of a cylindrical outer tube (made of Kraft paper), and a flat metal nailing bracket extending from one end of the tube. Located within the outer tube are an initiating charge assembly and an inner tube containing a pyrotechnic charge. Running through the initiating assembly is a length of pull cord. One end of the cord is covered with a friction composition, the other end is a coiled strip of tape. The M117 simulator has a dimple in the mounting bracket for additional identification at night. Issued with each simulator is a spool of trip wire, an extension spring, three staples, and four nails for booby trap installation. They are nailed against trees with a trip wire attached to the pull cord. It is functioned when a soldier applies pressure to the trip wire pulling the cord through the ignition composition assembly, which produces a flash. The flash is transmitted through a flash tube, which ignites the pyrotechnic charge (*Army, 1994c*). It is unlikely that a paper-bodied simulator would survive years of exposure in the field. In the unlikely event that an unfired simulator was discovered and functioned, the type of injuries that would be sustained would be burns and lacerations to the hand from the exploding pyrotechnic charge, if it was being held when it functioned.

Summary: It is unlikely that a person could cause a booby trap simulator to function through casual contact if one were found at the site and be burned or lacerated, because it was made from paper that would have been exposed to moisture, degradation, and weathering for many years, which could decrease its effectiveness.

**Fuze, Mine, Antitank, Practice: M604.** The fuze, mine, antitank, practice (M604) was designed for use in the M12, M12A1, and the M20 antitank practice mines. The fuze is an instantaneous, mechanical, pressure-activated type fuze consisting of a steel body containing the firing pin assembly, cover assembly, primer and smoke charge and a safety fork. The fuze is issued separately and assembled to the mine in the field. After it is fired and the mine is recovered, a new fuze can be installed and the mine reused. A minimum force of 140 to 240 pounds depressed the pressure plate that caused the Belleville spring to snap into reverse, driving the firing pin into the primer. The primer ignites the smoke composition, which flashes emitting a cloud of smoke and creating a noise. The primer contains 1.62 grains of primary explosive and 2.96 grains of black powder, and the smoke composition weighs 262.3 grains or 0.6 ounces (*Army 1994d*). The mine was designed to be triggered by the weight of a vehicle, and would require more weight than a large person can apply by just stepping on the pressure plate to trigger it. If caused to function, the type of injuries that could be sustained would be a burn injury from the 262.3 grains of smoke composition.

Summary: It is highly unlikely that a person would be able to trigger a fuze through casual contact if one were found at the site and sustain a burn injury, because the fuze: (1) was designed to be triggered by the weight of a vehicle, and (2) 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.

**Mine, Antipersonnel, Practice: M8 and M8A1.** The mine, antipersonnel, practice, M8 and M8A1 was designed to simulate the M2 (bounding) series of antipersonnel mines. They were used for training in the proper methods and precautions to be observed in the care, handling, laying, booby-trapping, arming and disarming of the M2 and M15 series mines. The fuze firing mechanism is activated by applying pressure (8 to 20 pounds) on any of the three prongs on the M10 or M10A1 combination fuze, or a pull of 3 to 10 pounds of pressure on the trip wire. The fuze firing train ignites the delay element in the projectile and also propels it about 2 meters into the air. The delay initiates the spotting charge, which explodes with a loud report and emits smoke. The M8A1 mine with the M10A2 fuze functions in the same manner except that the fuze firing train ignites the yellow smoke pellets through a 4 to 5 second delay and expels a plastic plug into the air, allowing the yellow smoke to be emitted from the top of the container (*Army 1994d*). Assuming that a mine was left emplaced and armed, and that it survived many years of degradation from exposure, it could be functioned by incidental contact by applying sufficient pressure to any of the prongs or trip wire on the M10, M10A1, or M10A2 combination fuze by stepping upon the fuze or tripping on the trip wire. If caused to function, the type of injury that could be sustained from the M8 mine would be burns from the 170-grain black powder spotting charge, and possible injury from falling parts. If caused to function, the M8A1 would propel a plastic plug into the air allowing yellow smoke to be emitted from the container. Because the spotting charge is black powder, it will function if it dries out after being exposed to moisture.

Summary: It is unlikely that a person would be able to trigger the practice antipersonnel mine through casual contact if one were found at the site and be burned or exposed to smoke or falling parts, because the mine: (1) would have to contain a live fuze, and (2) these components would have been exposed to moisture, degradation, and weathering for many years, which could decrease their effectiveness.

## 3.1.6 Site Evaluation

The available data (e.g., archival and reconnaissance data) regarding Site OE-1 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 1-A1. 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.

### 3.1.6.1 Literature Review

#### *Type of Training and OE Expected*

As discussed in Section 3.1.2, the general site area was identified as a Camouflage Area on a 1945 map. This area was later identified as a Flame Thrower Range on historical maps ranging from 1957 through 1961. The site vicinity also contained three mortar squares. The area north of the site was identified as a mine and booby trap area on a 1954 training map. Because the site was identified as a flame thrower range, it is possible that flame thrower ignition cartridges were used. Information gathered to date indicates that the practice mortar squares were used for practice purposes only and would not have included the use of OE. Practice or training mines and associated firing devices and fuzes may have been used for mine and booby trap training. Because the boundary of the mines and booby trap training area (OE-6) may overlap into Site OE-1, mines, fuzes, firing devices, coupling bases, and booby trap simulators may be present at the site. Although there is no information concerning what activities were associated with camouflage training at Fort Ord in the 1940s, it is expected that training would have involved concealing equipment or personnel with natural or artificial materials. It is therefore unlikely that OE would have been used during camouflage training. There was no evidence found during the literature search to indicate that the site was used as an impact area.

#### *Subsequent Use of the Area*

Patton Park housing construction began in this area in 1962. There is no documentation that the site was cleared of OE prior to construction. No incident reports have been found in EOD files from the late 1980s to early 1990s documenting the discovery of OE by residents of Patton Park. It should be noted that incident reports prior to the 1980s were not retained by the EOD. The nearby City of Marina farmland/residential area and Highway 1 were present prior to the use of the site as a training area. Reuse as housing suggests that the area would have been cleared of potential OE prior to construction of the housing.

#### *Establishment of Site Boundaries*

Historical aerial photographs show cleared areas and mortar squares that can be used to identify potential locations of flame thrower training. The current digitized boundary does not directly coincide with these cleared areas on the 1956 aerial photograph (Plate 1-3). The exact location of the mines and booby trap area cannot be identified from aerial photographs. The digitized area identified as the mines and booby trap area (OE-6) is north of Site OE-1. However, expended or inert practice mines and associated fuzes have been found in the area identified as Site OE-1 and in the area between Sites OE-1 and OE-6, suggesting that the sites overlap or the boundary digitized from the circa 1954 map may be inaccurate.

### *Summary of Literature Review Analysis*

It appears that the site vicinity was used for camouflage training, mines and booby trap training, flame thrower training, and mortar square training. Based on the ASR and subsequent review of historical maps and aerial photographs, there was sufficient historical evidence to warrant sampling of this site.

## 3.1.6.2 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 OE sampling programs.

### *Sampling Results (Items Found)*

Sampling was conducted at Site OE-1 by HFA in 1994 and by CMS in 1998. Table 1-2 lists OE found at the site during previous sampling. No OE (i.e., live items) were found during the sampling events. The following OE scrap items were found and removed during the 1994 and 1998 sampling:

- One M1 practice mine (depth not reported)
- Four inert scrap antitank land mines (found in the area between OE-1 and OE-6; depth not reported)
- One inert practice antipersonnel mine, M8 Series (found in the area between OE-1 and OE-6; depth not reported)
- One expended 0.30-caliber small arms round (found at a depth of 4 inches)
- Two expended practice mine fuzes (M604) (found at a depth of 1 and 3 inches)
- One expended M2 ignition cartridge from a flame thrower (found at a depth of 3 inches).

Discovery of an expended M2 ignition cartridge supports previous data indicating that the area was historically used for flame thrower training. Because practice mines and fuzes were found, it appears that the area identified by previous contractors as Site OE-1 was also used for mines and booby trap training. As indicated in Attachment 1-A2, these OE items were produced prior to or during the time period (1950s) that the site was used for training. This supports that these items were present at the site as a result of past training practices. During sampling, there was no evidence discovered that the training at this site involved the use of high explosive or low explosive items. Practice mines, like those found during sampling, are sometimes equipped with smoke charges, which can be considered pyrotechnic or low explosive devices (*Army, 1977*).

### *Site Boundaries Review*

Three HFA grids, a portion of two other HFA grids, and all seven of the CMS grids were located within the 1997 ASR site boundary (Plate 1-5). Based on the location of the initial four HFA sampling grids, practice mines were found just north of the site and within the 1997 ASR digitized site boundary. Mine fuzes and one ignition cartridge for a flame thrower were found in the northwestern corner of the site. This suggests that the area sampled was used for both flame thrower training and mines and booby trap training. Because practice mines and fuzes were found within the boundaries of Site OE-1, it appears that the boundaries of the mine and booby trap area (OE-6) overlap the area identified by previous contractors

as Site OE-1. Comparison of digitized features from historical training maps and cleared areas on aerial photographs suggests that two of the designated areas for flame thrower training were just outside of the ASR boundaries of Site OE-1 (Plate 1-3). However, when digitized grid locations are placed on the 1956 aerial photograph, it appears that one of the re-surveyed HFA sampling grids is located in a former cleared area that was the likely location of the 1958 Flame Thrower Range. Another grid overlaps the digitized feature identified as the Flame Thrower Range on a 1957 training map, but appears to be located just north of the cleared area on the 1956 aerial photograph that may be a potential Flame Thrower Range.

Although there were issues raised concerning the site boundary and the survey control of the HFA grids, the CMS grids and the actual positions of the HFA (based on the re-survey) provide good coverage of the site as shown in the 1997 ASR.

### *Equipment Review*

Schonstedt GA-52/C or GA-72/Cv magnetometers were used by HFA in the 1994 survey and sampling effort. CMS used Schonstedt GA-52/Cx during their 1998 sampling program. The Schonstedt instruments are passive dual flux-gate magnetometers that are highly sensitive magnetic locators that detect ferrous (iron) metal objects; however, they cannot detect non-ferrous metal objects (e.g., lead, brass, copper, and aluminum). 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 magnetometers actually detect 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 performance of the Schonstedt GA-52/C, GA-52/Cx, and GA-72/Cv magnetometers were evaluated as part of the Ordnance Detection and Discrimination Study (ODDS) (*Parsons, 2001*). As part of ODDS, studies were performed to evaluate:

- Signatures of inert OE items suspended in air at varying orientations and distances from the geophysical sensor (static tests)
- The ability of various geophysical instruments to detect and discriminate between different OE items buried at various depths (seeded tests).
- Geophysical instrument performance at actual OE sites (field trial site testing).

The Schonstedt tools were not evaluated during the static tests; therefore, only the seeded test results and the field trial tests are discussed herein. It is recognized that the ODDS study areas may not represent the same field conditions as Site OE-1; therefore, differences in field conditions, if applicable, should be considered when using information from the ODDS.

For the purpose of evaluating the geophysical equipment used at this site, it is assumed that ignition cartridges and mines potentially discarded or left at Site OE-1 would be at the surface or potentially buried at depths of up to 2 feet below ground surface (bgs) due to grading activities associated with housing construction. Mines and ignition cartridges were not specifically evaluated as part of the ODDS. However, other non-penetrating items (signal flares and hand grenades [ODDS Type I]) were evaluated as were penetrating items (2.36-inch and 3.5-inch rockets, rifle grenades, and 14.5 mm projectiles [ODDS Type II]). Therefore, the Type I and II seeded test results were used for comparison purposes in evaluating the performance of the geophysical equipment used at this site.

During the seeded tests, the Schonstedt Model GA-52/Cx located between 67 (search radius of 1.6 foot and lane width of 5 feet) and 78 (search radius of 3.3 feet and lane width of 5 feet) percent of the Type I items buried at depths ranging from just below the ground surface to 1 foot bgs, the Schonstedt Model GA-52/C located between 56 (search radius of 1.6 foot and lane width of 5 feet) and 59 (search radius of 3.3 feet and lane width of 5 feet) percent of the Type I items, and the Schonstedt Model GA-72/Cv located between 63 (search radius of 1.6 foot and lane width of 5 feet) and 78 (search radius of 3.3 feet and lane width of 5 feet) percent of the Type I items. The detection rate for Type II items ranged from 64 (search radius of 1.6 foot and lane width of 5 feet) to 74 (search radius of 3.3 feet and lane width of 5 feet) percent for the Schonstedt Model GA-52/Cx, from 44 (search radius of 1.6 foot and lane width of 5 feet) to 49 (search radius of 1.6 foot and lane width of 5 feet) percent for the Schonstedt Model GA-52/C, and from 41 (search radius of 1.6 foot and lane width of 5 feet) to 51 (search radius of 1.6 foot and lane width of 5 feet) percent with the Schonstedt Model GA-72/Cv.

Although not evaluated in the ODDS, practice mines that may contain energetic material generally contain a larger amount of ferrous material than the Type II items evaluated in the ODDS. This should result in a detection rate that would equal or exceed the detection rate for the Type II items. The detection rate percentages presented in the ODDS varied according to the search radius, which ranged from 1.6 to 3.3 feet and the search lane width which was 3 to 5 feet wide. A 5-foot wide search lane was used during the OE sampling programs at the site. Results for the 3-foot wide search lanes were not included in the detection percentages presented above because 3-foot search lanes were not used during the site investigations. A standard search radius for investigation anomalies was not specified in work plans or reports, therefore, the detection range for the different search radii are presented above. The anomalies were excavated until a metal object was found.

The seeded test detection rates are considered conservative because 1 foot was added to the item's calculated penetration depth to allow for soil deposition over time. Because the field conditions at the seeded test site and orientation of the subsurface item may not be comparable to Site OE-1 conditions, the results should only be used as an indication that the equipment is capable of detecting the same types of items at depths that are the same as used in the seeded tests.

Results of the ODDS Field Trial Sites (FTS) were also reviewed for potential use in evaluating instrument performance at the site. Detection rates were calculated for four of the six test sites; the remaining sites did not have enough OE detected to allow calculation of site statistics. The calculated detection rates for the combined sites ranged from 97 to 100 percent for the Schonstedt Model GA-52/Cx, 52 to 96 percent for the GA-52/C, and 64 to 98 percent for the Schonstedt Model GA-72/Cv, depending on the search radius used for the calculation. As previously discussed, results for the 3-foot wide search lanes were not included in the detection percentages presented above because 3-foot search lanes were not used during the site investigations. The lower detection rates were for a 1.6-foot search radius and the higher detection rates were for a 3.3-foot search radius. It should be noted that the ODDS field trial sites were selected to represent areas with high OE density. In comparison, Track 1 sites, such as OE-1, are expected to have very low densities of OE scrap. Therefore, the field trial results may not be applicable to Site OE-1.

Results of the ODDS field trials for the field test site (FTS-3) that was closest in OE item density to Site OE-1 were also reviewed. Five OE items were located at FTS-3 and no additional items were found during sifting of 10 percent of each grid (final quality control sampling). This indicates that it is unlikely that OE items would remain at FTS-3 within the grids sampled. Similar results could be expected at other sites such as OE-1, after survey and clearance using the Schonstedt magnetometers.

Although not directly comparable to Site OE-1, the results of the ODDS indicate that the Schonstedt Models GA-52//Cx and –72/Cv are capable of detecting the ferrous surface and subsurface OE expected

at this site. It should be noted that plastic practice mines, if used, would not be detected. It should be noted that based on the mass of iron in a M2 ignition cartridge, there is a low probability that a Schonstedt GA-52/Cx could detect a M2 ignition cartridge or similar small explosive-filled components at 2 feet bgs).

### *Sampling Methods Discussion*

According to the work plan, prior to sampling, the center of the site and the outer boundary of the site were located and marked. Four survey grids were randomly located and marked within the original 7-acre site boundary (Plate 1-5). An additional 8 grids were also marked in the area north of the original Site OE-1 boundary (MPUSD grids; Plate 1-5). The grid dimensions were 100- by 100-feet and were separated by at least 200 feet. Each grid was given a 100 percent visual surface and subsurface survey using a Schonstedt Model GA-52/C magnetometer along a maximum 5-foot wide search lane. Surface item locations were plotted on a map and then the items were removed. Subsurface contacts and anomalies were marked with yellow flags for excavation and identification. Subsurface contacts were uncovered using hand tools (*HFA, 1993* and *1994*). The general approach to investigation of the anomalies was to dig down to metal, remove the metal, and check the excavated area with the Schonstedt. If Schonstedt indicated no ferrous metal anomalies, no further digging was performed. If the Schonstedt continued to indicate buried ferrous items, the area was excavated to at least 4 feet bgs. All anomalies identified were investigated. Four inert antitank mines and one inert antipersonnel practice mine were found.

The first phase of sampling by CMS was performed using SS/GS. SS/GS is a computer program that is used to statistically estimate the ordnance density of a site or grid during field investigations. It estimates the number of ordnance items at a given site or grid and can be used to assess whether a site has been characterized adequately. The program was designed so that there were equal chances of finding OE and non-OE items.

When using SS/GS, the first step is to divide the site into homogeneous sectors with the same ordnance characteristics, terrain, and past ordnance 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 37 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 same investigative approach was used by CMS as was used by HFA (e.g., digging down to metal, removal, re-scanning with the Schonstedt, and digging until the Schonstedt indicated no ferrous metal was present or a depth of 4 feet was reached).

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 that 1) 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 OE 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 OE at the site.

The original 7-acre area was grided out and sampled using SS/GS protocols. The SS/GS program indicated that based on the size of site, six 100- by 100-foot grids should be sampled or 60,000 square feet. CMS sampled three 100- by 200-foot grids, which equaled the square-foot coverage specified by the program. Based on the program, approximately 32 percent of the anomalies in each of the grids were investigated; 128 anomalies were investigated. No OE or OE scrap was found. A single 0.30-caliber blank small arms round was found. Because no OE was found, the expected number of OE items for the site calculated by the SS/GS program was zero. It should be noted that because some anomalies were not excavated using the SS/GS investigative approach, some buried OE or OE scrap may still be present within the sampling grids.

The second phase of sampling by CMS consisted of 100 percent grid sampling in four 100- by 100-foot grids in the northern portion of the site after it was expanded to 25-acres. In 100 percent grid sampling, the number and size of the grids were selected such that 10 percent of the OE site was covered by grids. In 100 percent 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*). During the 100 percent grid sampling, 936 anomalies were excavated. No OE was found. Two expended mine fuzes and an expended ignition cartridge from a flame thrower were found (*USA, 2000*).

It should be noted that the sampling was performed in areas adjacent to residential housing and therefore, did not include areas underlying existing buildings. Grid locations were selected specifically in open areas where there were no buildings.

## *Quality Assurance/Quality Control*

The QA/QC procedures used by HFA and CMS during sampling are described below.

### Field Sampling QA/QC

#### HFA Sampling

Specific information concerning operational procedures was not documented in the HFA final report. The following describes field procedures specified in the work plan. According to the HFA work plan, equipment was to be inspected by the Senior UXO Supervisor (SUXOS) and Quality Control/Site Safety Officer (QC/SS) prior to placing it in service. Magnetometers were to be inspected and tested daily on a buried piece of ordnance (test source) to ensure that the magnetometers were operating within specification. The buried test source (inert ordnance item) was to be magnetically similar to a 2.36-inch rocket and buried at a depth of 3 feet. Information in the final report indicated that a solid steel 81mm mortar, buried at 4 feet bgs was used. The magnetometers were to be tested before starting OE operations in the morning and when operations resumed after lunch. Magnetometers that failed the inspection and test were determined to be in need of repair and were to be immediately removed from service. Random checks were to be performed by the QC/SS and/or the SUXOS during daily operations. The QC/SS was to inspect all records bi-weekly to ensure that they were kept and maintained. After surface and subsurface clearance of each grid and prior to removal of grid markers, the QC/SS was to perform the standard minimum 10 percent QC check. If OE was detected during the QC check, the grid was searched again to ensure that there was no other OE present. All grids were to be left in place until the Army Corps of Engineers Huntsville Division (CEHND) Safety Specialist completed his QA. No QA records for this sampling effort are available. QC reports that included descriptions and results of the QC checks were to be completed daily.

CMS Sampling

Throughout operations, CMS performed daily operational checks and QC inspections. Because of the nature of the SS/GS sampling, QA/QC was limited to inspections of operational activities and documentation. No deficiency reports were written during inspections. The four grids that were 100 percent grid sampled were also QC inspected in accordance with the work plan (*CMS, 1995*). In accordance with the work plan, all instruments requiring maintenance and/or calibration were to be checked prior to the start of each workday. 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 the various sites to ensure that personnel perform the work as specified in the work plan. The QC Specialist also was to conduct a quality audit of completed sites after work was completed. The audits were to be performed by scanning at least 10 percent of each search grid with a magnetometer. If any OE was encountered, the grid was to be reworked. The QC specialist audited logs prepared by contract personnel (*CMS, 1995*). All grids passed QC inspection. Each grid also received a QA inspection by a USACE OE Safety Specialist. Every grid in Site OE-1 passed the initial QA inspection (*USA, 2000*). Based on comments concerning use of the program (*NERL, 2000*), statistical evaluation of the adequacy of the sampling at this site was not performed.

## Data Management QA/QC

Parsons, the current OE contractor, performed a 100 percent QC review of the data associated with the site. This review followed guidelines presented in the Standard Operating Procedures provided as Appendix A of this document. This evaluation included a review of field grid records (if available) and the database created by the OE 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 as Appendix B of this report. The purpose of the data review was to complete a 100 percent check of all available grid records to identify discrepancies between the after action reports 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 this site, the following conclusions can be made regarding the quality of the data:

### HFA Sampling

- The data collected by HFA were useful in providing information concerning the type of OE items present at the site.
- There appears to be poor survey control for the grid locations. However, the grids were resurveyed by CMS and found to be located within the 1997 ASR site boundary. One of the grids also appears to be coincident with a former cleared area (on 1956 aerial photograph) that may be the location of flame thrower training.
- Coordinate data were not collected for locations and depths of found items.
- The instruments utilized by HFA cannot be used to find non-metallic practice mines and may not be effective in finding buried items such as flame thrower ignition cartridges because they are generally made out of non-ferrous, non-sparking material like brass, plastic, or aluminum to prevent accidental

ignition of incendiary patches. However, the instruments should be effective in detecting ferrous OE items such as practice mines that may contain energetic material.

- No QA records for this sampling effort are available.

**CMS Sampling**

- Grids were surveyed and the grids were located within the 1997 ASR site boundary.
- There was coordinate and depth information concerning found OE scrap items.
- The data collected are useful in providing information concerning the type of OE items present at the site.
- Because some anomalies were not excavated using the SS/GS investigative approach, some subsurface OE or OE scrap may still be present within the sampling grids.
- Review of the SS/GS methodology indicated that the statistical procedures used were vague and not well documented, conclusions about site homogeneity were not consistent, stopping rules were faulty, and the methodology was not able to identify potential OE clusters.
- The instruments used cannot be used to find non-metallic practice mines and flame thrower ignition cartridges. However, the instruments should be effective in detecting ferrous OE items such as practice mines that may contain energetic material.

## 3.1.7 Conclusions and Recommendations

This section presents conclusions and recommendations for Site OE-1 that are based on review of historical information and sampling data collected from the site.

### 3.1.7.1 Conclusions

#### *Site Use and Development*

- Based on the literature review and site sampling results, the site appears to have been used for camouflage training, mine and booby trap training, non-firing mortar training, and flame thrower training. Currently it is partially occupied by residential housing.
- Based on historical use of the site, subsequent reuse as residential housing, and materials found at the site, it is unlikely OE is present at the site. However, the following OE items, if present at the site, are considered to pose an acceptable risk if encountered for the following reasons:
  - **Flame Thrower Ignition Cartridges – Ignition System for the M2-2 Flamethrower.** It is unlikely that a person would be able to ignite a cartridge through casual contact if one were found at the site and sustain a burn injury, because the cartridge: (1) would have to be intact, loaded, and unfired, (2) could only be ignited in a very precise manner to function properly, and (3) would have been exposed to moisture, degradation, and weathering for over 40 years, which could decrease the effectiveness of the components that could cause it to function.
  - **Booby Trap Firing Devices.** It is unlikely that a person through casual contact could cause an armed booby trap firing device fitted with a coupling base to function if one were found at the

site, and be exposed to the shock, noise, and flash of the coupling base. Booby trap firing devices were designed to be functioned by a thin trip wire or release of pressure that would release a cocked spring loaded firing pin. These small, unsealed metal parts have been exposed to moisture, degradation, and weathering for many years, which could decrease their effectiveness.

- **Simulator, Explosive Booby-trap: Flash, M117; Illuminating, M118; Whistling, M119.** It is unlikely that a person could cause a booby trap simulator to function through casual contact if one were found at the site and be burned or lacerated, because it was made from paper that would have been exposed to moisture, degradation, and weathering for many years, which could decrease its effectiveness.

- **Fuze, Mine, Antitank, Practice: M604.** It is highly unlikely that a person would be able to trigger a fuze through casual contact if one were found at the site and sustain a burn injury, because the fuze: (1) was designed to be triggered by the weight of a vehicle, and (2) would have been exposed to moisture, degradation, and weathering for many years, which could decrease the effectiveness of the components that could cause it to function.

- **Mine, Antipersonnel, Practice: M8 and M8A1.** It is unlikely that a person would be able to trigger the practice antipersonnel mine through casual contact if one were found at the site and be burned or exposed to smoke or falling parts, because the mine: (1) would have to contain a live fuze, and (2) these components would have been exposed to moisture, degradation, and weathering for many years, which could decrease their effectiveness.

- The site is within a parcel recommended for development as residential housing.

### *Sampling Adequacy and Data Quality*

- SS/GS and 100 percent grid sampling methodology were used for the site. There have been problems identified with SS/GS sampling (*NERL, 2000*); however, the data are useful in identifying the potential presence of OE. In addition, because not all of the anomalies are investigated using the SS/GS sampling approach, some buried OE or OE scrap may still be present within the sampling grids. The 100 percent grid sampling method is probably more effective on assessing the potential OE presence at a site.

- Schonstedt GA-52/C and GA-72/Cv magnetometers were used by HFA and Schonstedt GA-52/Cx were used by CMS during previous investigations. The instruments were evaluated as part of the ODDS, and with the exception of flame thrower ignition cartridges at depth of 2 feet bgs and non-metallic mines, they are capable of detecting the type of ferrous OE items expected at this site. A numerical value of detection of items cannot be calculated for an individual site.

- The site boundary changed throughout the OE sampling program. The reasons for the boundary changes are not well documented. The current site boundary only includes a portion of the areas identified on historical maps and aerial photographs as locations of flame thrower training.

- The literature review results suggests that likely locations of past flame thrower training were not sampled completely during previous investigations. These areas are now covered by residential housing.

- Sampling and evaluation of previous work followed published work plans and SOPS.

- The data collected by HFA were useful in providing information concerning the type of OE-items present at the site; however, there appears to be poor survey control for the grid locations, coordinate data were not collected for locations and depths of found items, and the instruments used by HFA cannot be used to find non-metallic practice mines and may not be effective in finding buried items such as flame thrower ignition cartridges. However, the instruments used should be effective in detecting ferrous OE items such as practice mines that may contain energetic material.

- The data collected by CMS were useful in providing information concerning the type of OE items present at the site. In addition, there is accurate survey data for grid locations, and there was coordinate and depth information concerning items found. The instruments used by CMS cannot be used to find non-metallic practice mines and may not be effective in finding subsurface OE-items such as flame thrower ignition cartridges. However, the instruments used should be effective in detecting ferrous OE items such as practice mines that may contain energetic material.

- Although the previous OE sampling efforts performed at Site OE-1 are not consistent with requirements in place today, the quantity and quality of available information is sufficient to make an informed decision regarding the site. The entire site was not sampled, however, the sampling methods were sufficient to confirm the types of OE items used. Additionally, because the OE-items used at Site OE-1 are items that are considered to pose an acceptable risk (see Section 3.1.5.4), and there was no OE found in previous investigations at OE-1, further effort to refine the site boundaries or conduct 100 percent sampling of the site would not add significantly to the understanding of the site or change the conclusions of this report.

### 3.1.7.2 Recommendations

Based on the review of existing data:

- It is not anticipated that OE will be found at Site OE-1. However, there is potential for OE to be present at the site because OE were used throughout the history of Fort Ord.

- This site qualifies as a Track 1, Category 3 site because it was used for training, and OE items that potentially remain pose an acceptable risk based on site-specific evaluations conducted in the RI/FS.

- No further OE-related investigation is recommended.

These conclusions and recommendations are based on the following:

- The literature review and sampling provide no evidence that high explosives (HE) were used at the site or that the site was used as an impact area.

- No live OE was found during the OE sampling programs. OE items found were those used for training purposes only and were inert or expended.

- The site has been occupied by residences for 40 years and no OE incident reports have been found indicating that OE was discovered at the site. It should be noted that the reports reviewed were EOD records from the late 1980s and early 1990s; earlier records were not available for review.

The U.S. Army Corps of Engineers completed ordnance investigations at Site OE-1. The Army, with regulatory oversight from the U.S. Environmental Protection Agency (USEPA) and the California Department of Toxic Substance Control (DTSC), conducted a systematic investigation and no explosive material was found. The investigation was specifically designed to assess the nature of the past military training activities at the site. Even though no actionable risk was identified through the remedial

investigation process, in the interest of safety the Army recommends reasonable and prudent precautions be taken when conducting intrusive operations at the site. Construction personnel involved in intrusive operations at the site should attend the Army's "ordnance recognition and safety training" to increase their awareness of and ability to identify OE items. Trained construction personnel will contact an appropriate local law enforcement agency if a potential OE item is encountered. The local law enforcement agency will arrange a response by the Army. To accomplish that objective, the Army will request notice from the landowner of planned intrusive activities, and in turn will provide ordnance recognition and safety training to workers prior to the start of intrusive work. Additionally, while these intrusive activities are ongoing, the Army will conduct weekly site visits and provide refresher education as appropriate.

Upon approval of the proposed remedy for Site OE-1 (no further OE-related investigation), Site OE-1 will be incorporated into the Basewide OE RI/FS 5-year review schedule. The purpose of the 5-year review is to determine whether the remedy at Site OE-1 continues to be protective of human health and the environment. The 5-year review will also document any newly identified site-related data or issues identified during the review, and will identify recommendations to address them as appropriate. At the time of the next 5-year review, the Army will assess whether the education program should continue. If experience indicates that no explosive items have been found in the course of development or redevelopment of the site, it is anticipated that the education program may, in consultation with the regulatory agencies, be discontinued, subject to reinstatement if an explosive item is encountered in the future.

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**Table1-1. Sampling Operations, Site OE-1**
**Track 1 Ordnance and Explosive Remedial Investigation/Feasibility Study**
**Former Fort Ord, California**

| Site | Grid ID | Operation Type | Contractor | Instrument | Grid Completion Date |
|---|---|---|---|---|---|
| OE-01 -- Flame Thrower Range | D2H4F0-01 | Sampling | HFA | SCHONSTEDT GA-72CV or GA-52C | Not available |
| OE-01 -- Flame Thrower Range | D2H4G0-01 | Sampling | HFA | SCHONSTEDT GA-72CV or GA-52C | Not available |
| OE-01 -- Flame Thrower Range | D2H5F1-01 | Sampling | HFA | SCHONSTEDT GA-72CV or GA-52C | Not available |
| OE-01 -- Flame Thrower Range | D2H5F1-02 | Sampling | HFA | SCHONSTEDT GA-72CV or GA-52C | Not available |
| OE-01 -- Flame Thrower Range | D2H5F1-03 | Sampling | HFA | SCHONSTEDT GA-72CV or GA-52C | Not available |
| OE-01 -- Flame Thrower Range | D2I4A8-01 | Sampling | HFA | SCHONSTEDT GA-72CV or GA-52C | Not available |
| OE-01 -- Flame Thrower Range | D2I4F8-01 | Sampling | HFA | SCHONSTEDT GA-72CV or GA-52C | Not available |
| OE-01 -- Flame Thrower Range | LD2-MI03-SE10 | Sampling | USA | SCHONSTEDT GA-52CX | 7/19/1999 |
| OE-01 -- Flame Thrower Range | LD2-MI03-SE10 | Sampling | USA | SCHONSTEDT GA-52CX | 7/20/1999 |
| OE-01 -- Flame Thrower Range | LD2-MI04-SE03 | Sampling | USA | SCHONSTEDT GA-52CX | 7/19/1999 |
| OE-01 -- Flame Thrower Range | LD2-MI04-SE10 | Sampling | USA | SCHONSTEDT GA-52CX | 7/15/1999 |
| OE-01 -- Flame Thrower Range | LD2-MI05-SE02 | Sampling | USA | SCHONSTEDT GA-52CX | 7/15/1999 |
| OE-01 -- Flame Thrower Range | LD2-MI05-SE02 | Sampling | USA | SCHONSTEDT GA-52CX | 7/19/1999 |
| OE-01 -- Flame Thrower Range | OE-01 | Sampling | HFA | SCHONSTEDT GA-72CV or GA-52C | Not available |
| OE-01 -- Flame Thrower Range | OE-01_G 12 | SS/GS | USA | SCHONSTEDT GA-52CX | 2/4/1998 |
| OE-01 -- Flame Thrower Range | OE-01_G 16 | SS/GS | USA | SCHONSTEDT GA-52CX | 2/4/1998 |
| OE-01 -- Flame Thrower Range | OE-01_G 16 | SS/GS | USA | SCHONSTEDT GA-52CX | 2/5/1998 |
| OE-01 -- Flame Thrower Range | OE-01_G 19 | SS/GS | USA | SCHONSTEDT GA-52CX | 2/5/1998 |

Site = OE Site Number
Sampling = 100 percent of the anomalies detected were excavated to a minimum depth of 4 feet. Deeper anomalies were investigated if directed by the USACE.
SS/GS = Sitestats/Gridstats sampling was performed, selected anomalies were excavated.
HFA = Human Factors Applications, Inc.
USA = USA Environmental, Inc.
Note: Fields with annotation of "not available" is a void field in the OE database.

**Table 1-2. OE Scrap Found During Sampling, Site OE-1**
**Track 1 Ordnance and Explosive Remedial Investigation/Feasibility Study**
**Former Fort Ord, California**

| Site | Grid ID | OE Items | Status | Depth (in) | Quantity |
|---|---|---|---|---|---|
| OE-01 -- Flame Thrower Range | LD2-MI03-SE10 | Cartridge, ignition, M2 series | Inert | 1 | 1 |
| OE-01 -- Flame Thrower Range | LD2-MI03-SE10 | Fuze, mine, antitank, practice, M604 | Inert | 3 | 1 |
| OE-01 -- Flame Thrower Range | LD2-MI03-SE10 | Fuze, mine, antitank, practice, M604 | Inert | 1 | 1 |
| OE-01 -- Flame Thrower Range | OE-01 | Mine, antitank, practice, M1 | Inert | Not available | 1 |

Site = OE Site Number
Grid = Grid in which item was found.
Status = Condition of itme, either live or inert. Inert indicates no OE hazard.
Depth = inches below ground surface that item was found.
Quantity = Number of like items found.

Note: Fields with annotation of "not available" is a void field in the OE database.