Final
Interim Action Ordnance and Explosives Remedial Investigation/Feasibility Study For Ranges 43-48, Range 30A, Site OE-16 Former Fort Ord, California

Prepared for

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Contract No. DACA05-96-D-0007

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ACRONYM LIST

AAR	After Action Report
APC	Armored Personnel Carrier
AR	Army Regulation
ARAR	Applicable or Relevant and Appropriate Requirements
ASR	Archives Search Report
ASTM	American Society for Testing and Materials
BIP	Blow-in-Place
BLM	Bureau of Land Management
BO	Biological and Conference Opinion
BRAC	Base Realignment and Closure
Cal-EPA	California Environmental Protection Agency
CDFG	California Department of Fish and Game
CEHND	U.S. Army Engineering and Support Center, Huntsville
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CMC	Central Maritime Chaparral
CMS	CMS Environmental
CNCC	California Natural Coordinating Council
CX	Center of Expertise
DDESB	Department of Defense Explosives Safety Board
DoD	Department of Defense
DQO	Data Quality Objective
DTSC	Department of Toxic Substances Control
EE/CA	Engineering Evaluation/Cost Analysis
EPA	Environmental Protection Agency

ESA	Endangered Species Act
GPS	Global Positioning System
Harding ESE	Harding ESE, Inc., formerly Harding Lawson Associates
HCRS	Heritage Conservation and Recreation Service
HE	High Explosive
HEAT	High Explosive Antitank
HEDP	High Explosive Dual Purpose
HFAI	Human Factors Applications, Inc.
HMP	Habitat Management Plan
HTW	Hazardous and Toxic Waste
HLA	Harding Lawson Associates, now known as Harding ESE
IA	Interim Action
IC	Institutional Control
LAW	Light Antitank Weapon
LDSP	Land Disposal Site Plan
LTRM	Long-Term Risk Management
MCX	Mandatory Center of Expertise
MRA	Multi-Range Area
MSL	Mean Sea Level
NCP	National Contingency Plan
NPV	Net Present Value
NTCRA	Non-Time-Critical Removal Action
O&M	Operations and Maintenance
OE	Ordnance and Explosives
ODDS	Ordnance Detection and Discrimination Study
OMC	Ord Military Community
POM	Presidio of Monterey Annex

QA/QC	Quality Assurance/Quality Control
RAC	Risk Assessment Code
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RR	Recoilless Rifle
SAP	Sampling and Analysis Plan
SDWA	Safe Drinking Water Act
SOP	Standard Operating Procedure
SOW	Scope of Work
TCRA	Time-Critical Removal Action
TP	Target Practice
TRADOC	Training and Doctrine Command
USACE	U.S. Army Corps of Engineers
USAESCH	U.S. Army Engineering and Support Center, Huntsville (OE Center of Expertise)
USFWS	U.S. Fish and Wildlife Service
UXB	UXB International
UXO	Unexploded Ordnance
WP	White Phosphorous
WWII	World War II

GLOSSARY

Closed Range: A military range that has been taken out of service and either has been put to new uses that are incompatible with range activities or is not considered by the military to be a potential range area. A closed range is still under the control of a Department of Defense (DoD) component. Source: (3).

Engineering Control (EC): A variety of engineered remedies to contain and/or reduce contamination, and/or physical barriers intended to limit access to property. Some examples of ECs include fences, signs, guards, landfill caps, soil covers, provision of potable water, slurry walls, sheet pile (vertical caps), pumping and treatment of groundwater, monitoring wells, and vapor extraction systems. Source: (1).

Expended: The state of an Ordnance and Explosives (OE) item in which the main charge has been expended leaving the inert carrier. Source: (2).

Feasibility Study (FS): An evaluation of potential remedial technologies and treatment options that can be used to clean up a site. Source: (2).

Institutional Control (IC): A legal or institutional mechanism that limits access to or use of property, or warns of a hazard. An IC can be imposed by the property owner, such as use restrictions contained in a deed, or by a government, such as a zoning restriction. Source: (1).

Land Use Controls: A combination of engineering and institutional controls intended to protect human health and the environment. Source: (1).

Magnetometer: An instrument for measuring magnetic field strength that is used in the field to detect buried ferromagnetic objects. Ground magnetometers sometimes measure the vertical component of the magnetic field, sometimes a horizontal component, sometimes the total field. Source: (2).

Mortar: Mortars range from approximately 1 inch to 11 inches in diameter and can be filled with explosives, toxic chemicals, white phosphorus or illumination flares. Mortars generally have thinner metal casing than projectiles but use the same types of fuzing and stabilization. Source: (1).

Multi-Range Area (MRA): The MRA consists of approximately 8,000 acres in the southwestern portion of former Fort Ord, bordered by Eucalyptus Road to the north, Barloy Canyon Road to the east, South Boundary Road to the south, and North-South Road to the west. Source: (2).

Non-OE Related Scrap: Non-munitions material found at ordnance sites. This can be banding, wire, trash, auto parts, shipping boxes, or any kind of material that has been abandoned or discarded at an OE site that was

never a component of military munitions. (Ferrous rocks that activate geophysical instruments during investigations, which are removed from the site, are classified as "other"). Source: (2).

Non-Transportable OE Item: For the purposes of addressing OE at Fort Ord, non-transportable OE items include those that are non-movable (unsafe to move under any circumstances), and moveable (may be moved by hand only within close proximity to their original position for consolidation and/or to ensure detonations are performed under the safest possible conditions).

When making a determination as to whether or not an OE item is safe to move from its encountered orientation or location, item-specific variables must be considered that may include but are not limited to: characteristics of the site, type of ordnance, position/location of the item, type of fuzing, and condition of the item and the fuze. Documents such as EP 385-1-92a, Basic Safety Concepts and Considerations for Ordnance and Explosives Operations; TM 60 series and applicable Ordnance Data Sheets are reviewed to assist in making a determination. If there is doubt as to the identity of the item, its condition, or if it can be handled, the onsite USACE UXO Safety Specialist will make the determination. Source: (2).

OE Sampling: Performing OE searches within a site to determine the presence of OE. Source: (2).

OE Scrap: OE scrap includes those items which are fragments of functioned ordnance, as designed or intentionally destroyed, and which contain no explosive or other items of a dangerous nature. OE scrap is inert and does not pose a safety risk. Source: (1).

Ordnance and Explosives (OE): Anything related to munitions designed to cause damage to personnel or material through explosive force or incendiary action including bombs, warheads, missiles, projectiles, rockets, antipersonnel and antitank mines, demolition charges, pyrotechnics, grenades, torpedoes and depth charges, high explosives and propellants, and all similar and related items or components explosive in nature or otherwise designed to cause damage to personnel or material. Source: (2).

Operating Grids: Typically, 100-foot by 100-foot parcels of land as determined by survey and recorded by GPS, marked at each corner with wooden stakes. Sites are divided into operating grids prior to the commencement of work by brush removal or OE sweep teams. A single grid may be occupied by only one team at any time, and the grid system facilitates the maintenance of safe distances between teams. They are identified sequentially using an alpha-numeric system (e.g., E-5). Source: (2).

Projectile: An object projected by an applied force and continuing in motion by its own inertia, as a bullet, bomb, shell, or grenade. Also applied to rockets and to guided missiles. Source: (4).

Remedial Investigation (RI): Exploratory inspection conducted at a site to delineate the nature and extent of chemical, and in this case OE, present at the site. Source: (2).

Removal Depth: The depth below ground surface to which all ordnance and other detected items are removed. Source: (2).

SiteStats/GridStats: Programs developed by QuantiTech for the Huntsville Corps of Engineers to predict the density of ordnance on sites with spatially random dispersal of ordnance. Source: (2).

Surface Removal: Removal of OE from the ground surface by UXO teams using visual identification aided by magnetometers. Source: (2).

Transferred Range: A military range that is no longer under military control and has been leased, transferred, or returned to another entity, including Federal entities. This includes a military range that is no longer under military control but was used under the terms of a withdrawal, executive order, special-use permit or authorization, right-of-way, public land order, or other instrument issued by the Federal land manager. Source: (3).

Transferring Range: A military range that is proposed to be leased, transferred, or returned from the Department of Defense to another entity, including Federal entities. This includes a military range that is used under the terms of a withdrawal, executive order, special-use permit or authorization, right-of-way, public land order, or other instrument issued by the Federal land manager. An active range will not be considered a "transferring range" until the transfer is imminent. Source: (3).

Transportable OE Item: For the purposes of addressing ordnance and explosives (OE) at Fort Ord, transportable OE items are those that, as determined by the OE contractor (with concurrence of the USACE UXO Safety Specialist), may be transported by vehicle from their original position to an area outside the vicinity for the purposes of storage, consolidation with other items for demolition, or for offsite destruction.

When making a determination as to whether or not an OE item is safe to move from its encountered orientation or location, item-specific variables must be considered that may include but are not limited to: characteristics of the site, type of ordnance, position/location of the item, type of fuzing, and condition of the item and the fuze. Documents such as EP 385-1-92a, Basic Safety Concepts and Considerations for Ordnance and Explosives Operations; TM 60 series and applicable Ordnance Data Sheets are

reviewed to assist in making a determination. If there is doubt as to the identity of the item, its condition, or if it can be handled, the onsite USACE UXO Safety Specialist will make the determination. Source: (2).

Unexploded Ordnance (UXO): A military munition that contains an explosive or pyrotechnic charge and has been primed, fuzed, armed, or otherwise prepared for action, and that has been fired, placed, dropped, launched, projected, and remains unexploded by design or malfunction. These can be, but are not limited to, high-explosive warheads, rocket motors, practice munitions with spotting charges, torpedoes, artillery and mortar ammunition, grenades, incendiary munitions, electroexplosive devices, and propellant-actuated devices. Fuzes with live explosive boosters or dets are classified as UXO. Some kick-outs from open detonation or open burn operations may be UXO. All UXO are potentially dangerous and cannot be released for public use without being rendered safe (neutralized, vented, detonated, decontaminated, or demilitarized). Source: (2).

Sources:

(1) Compendium of Department of Defense Acronyms, Terms, and Definitions: The Interstate Technology and Regulatory Cooperation (ITRC) Work Group (Unexploded Ordnance Work Team), December, 2000.

(2) Non-standard definition developed to describe Fort Ord-specific items, conditions, procedures, principles, etc. as they apply to issues related to the OE cleanup.

(3) Department of Defense (DoD), 1997. 32 CFR Part 178; Closed, Transferred, and Transferring Ranges Containing Military Munitions; Proposed Rule. September

(4) "Unexploded Ordnance (UXO): An Overview" October, 1996. DENIX.

1.0 INTRODUCTION

The former Fort Ord is located near Monterey Bay in northwestern Monterey County, California (Plate 1). Since 1917, portions of the former Fort Ord were used by infantry units for maneuvers, target ranges, and other purposes. Ordnance and explosives (OE) were fired into, fired upon, or used on the facility in the form of artillery and mortar projectiles, rockets and guided missiles, rifle and hand grenades, practice land mines, pyrotechnics, bombs, and demolition materials. A wide variety of conventional unexploded ordnance (UXO) items have been located at sites throughout the former Fort Ord, including pyrotechnics and explosives.

On behalf of the U.S. Army Corps of Engineers (USACE)—Sacramento District, Harding ESE, Inc. (Harding ESE; formerly known as Harding Lawson Associates [HLA]) has prepared this Interim Action Remedial Investigation/Feasibility Study (IA RI/FS) to address OE in specific areas of the former Fort Ord, California (Fort Ord) (Plate 1) in order to: (1) take quick action to protect human health and the environment from an imminent threat in the short term while a final remedial solution is being developed and (2) institute temporary measures to stabilize the site and prevent further migration or degradation. The Interim Action sites (IA sites) addressed in this report include Ranges 43-48, Range 30A, and Site OE-16. Their locations relative to neighboring communities are shown on Plate 2. This report has been prepared in accordance with USACE Scope of Work (SOW) dated March 23, 1999, Delivery Order 0056, Contract DACA05-96-D-0007.

1.1 Description of the OE RI/FS Program

The OE RI/FS program is described in detail in the Final OE RI/FS Work Plan (*Army, 2000*). Elements of the OE RI/FS program include this Interim Action RI/FS to address immediate risks (as described in Section 1.2, Rationale for Conducting an Interim Action for OE), a literature review, preparation of a Sampling and Analysis Plan (SAP) for additional OE characterization activities, evaluation of previous OE work, performance of an Ordnance Detection and Discrimination Study (ODDS), identification of Applicable or Relevant and Appropriate Requirements (ARARs), development of long-term risk management measures, evaluation of risks, a community relations plan, and a health and safety plan.

The information gathered and evaluated during the literature review and the OE RI/FS will be used to categorize all other areas of the former Fort Ord according to actions that have been taken or that are identified as necessary to mitigate OE hazards. The information that will be evaluated to form decisions will include, but not be limited to, the knowledge of the site, the quality of the available information, the work completed, and the intended future land uses. Areas will be managed during the OE RI/FS process within one of four proposed "tracks" (Tracks 0 through 3) as described in the OE RI/FS Work Plan (*Harding ESE, 2000a*).

1.2 Rationale for Conducting an Interim Action for OE

During the preparation of an RI/FS, the lead agency may determine that an interim remedial action is appropriate. An interim action is limited in scope and only addresses areas/media that will be followed by an RI/FS and Record of Decision (ROD). Reasons for taking an interim action could include the need to:

- Take quick action to protect human health and the environment from an imminent threat in the short term, while a final remedial solution is being developed; or

- Institute temporary measures to stabilize the site and/or prevent further migration or degradation.

The U.S. Army (Army), as the lead agency, has determined that an interim action is appropriate to protect human health from the imminent threat posed by UXO at Ranges 43–48, Range 30A and Site OE-16.

1.3 Report Organization

This IA RI/FS was prepared in accordance with the U.S. Environmental Protection Agency (EPA) document *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (Comprehensive Environmental Response, Compensation, and Liability Act) (*EPA, 1988*). This IA RI/FS is organized as follows:

Section 1 – Introduction. This section provides background information on the IA RI/FS and OE RI/FS processes.

Section 2 – Purpose and Objectives. This section defines an Interim Action and describes the purpose and objectives of the IA RI/FS.

Section 3 – Background. This section presents the Fort Ord OE-related history and describes the physical setting.

Section 4 – Interim Action Remedial Investigation. This section describes the IA sites and presents the Interim Action Remedial Investigation, which summarizes the site information, vegetation status, OE-related information, and conceptual site models for each of the three IA sites.

Section 5 – Interim Remedial Action Objectives and Site Selection of Interim Action Sites. This section presents the Interim Action objectives and the site selection criteria and rationale for selection of the IA sites.

Section 6 – Interim Action Feasibility Study. This section presents the Interim Action Feasibility Study, which includes the development, screening, evaluation, and comparison of Interim Action Alternatives, as well as an analysis of Applicable or Relevant and Appropriate Requirements (ARARs).

Section 7 – Selection of Preliminarily Identified Preferred Interim Action Alternatives. This section presents the selection of the Preliminarily Identified Preferred Interim Action Alternatives for each of the IA sites based on the evaluation and comparison of Interim Action Alternatives and analysis of ARARs. The Preferred Interim Action Alternatives for each of the IA sites will be presented in the Proposed Plan and selected and documented in the Record of Decision (ROD).

Section 8 – Approval Process. This section describes the approval process for the Interim Actions and presents an Implementation Process Flow Chart for Interim Action.

Section 9 – References. This section provides a list of references to pertinent documents cited in the report.

2.0 PURPOSE AND OBJECTIVES

This section defines an Interim Action and describes the purpose and objectives of the IA RI/FS.

2.1 Definition of an Interim Action

An Interim Action is a remedial action that can be implemented quickly and that, although not necessarily intended as a final remedial measure at a site, substantially reduces potential immediate, imminent, and/or substantial risks to human health or the environment. This document evaluates remedial actions to be taken at each of the IA sites.

Remedial activities conducted at the IA sites will be further evaluated under the basewide OE RI/FS to determine the adequacy of actions taken, their consistency with the long-term remedy, and the need for further action, if any. The OE RI/FS will evaluate:

- The effectiveness of the geophysical detection instruments used
- Conceptual site models vs. actual field conditions
- Completeness of IA remedial actions relative to data quality objectives for the OE RI/FS program
- Assessment of any potential residual OE risks
- The need for long-term risk management measures to address any potential residual OE risks.

2.2 Purpose

The RI/FS process as outlined in the EPA guidance (*EPA, 1988*) represents the methodology that the Superfund program has established for characterizing the nature and extent of risks posed by contaminated sites and for evaluating potential remedial options. The purpose of this IA RI/FS is to describe the site conditions and the risks posed by UXO at Ranges 43–48, Range 30A and Site OE-16, and recommend the most appropriate interim action to address OE risks based on the criteria specified in the National Contingency Plan and EPA guidance. Remedial actions at the IA sites are being evaluated on an interim basis because the OE RI/FS will not be completed until 2005, and there is a need to (1) take quick action to protect human health from an imminent threat and/or (2) institute temporary measures to stabilize the IA sites in the short term, while a final remedial solution is being developed under the OE RI/FS for these sites.

2.3 Objectives

The objectives of this IA RI/FS are to:

- Demonstrate the need for remedial action to reduce the imminent threat to human health at Ranges 43–48, Range 30A and Site OE-16
- Evaluate three-tiered alternatives at each IA site for: (1) vegetation clearance, (2) OE remedial action, and (3) OE detonation
- Select a three-tiered Preliminarily Identified Preferred Alternative for each IA site.

3.0 BACKGROUND

This section provides a summary of the former Fort Ord OE related history, a description of its physical setting, and the background of the OE RI/FS.

3.1 Historical Use

Military training on the former Fort Ord began in approximately 1917 and continued until base closure in 1994. At its founding in 1917, the former Fort Ord served primarily as training and staging facility for infantry troops. From 1947 to 1974, the Installation was a basic training center. After 1974, the 7th Infantry Division occupied the Installation. The 7th Infantry Division was converted to a light division in 1983; light infantry troops operate without heavy tanks or armor. The former Fort Ord was selected in 1991 for base realignment and closure (BRAC), and the base was officially closed in September 1994.

In 1917, the U.S. Army (Army) bought a portion of the present-day Main Garrison and East Garrison, and nearby lands on the east south central side of the former Fort Ord to use as a maneuver and training ground for field artillery and cavalry troops stationed at the Presidio of Monterey. Before the Army's acquisition of the property, the area was agricultural, as is much of the surrounding land today. No permanent improvements were made until the late 1930s, when administrative buildings, barracks, mess halls, tent pads, and a sewage treatment plant were constructed.

In 1940, additional agricultural property was purchased for further development of the Main Garrison. At the same time, beachfront property was donated to the Army. Building construction in the Main Garrison began in 1940 and continued into the 1960s, starting in the northwest corner of the base and expanding southward and eastward. During the 1940s and 1950s, the Army constructed and maintained a small airfield within the Main Garrison in what became the South Parade Ground. In the early 1960s, when the Fritzsche Army Airfield was completed, the Main Garrison airfield was decommissioned and its facilities were redeveloped as motor pools and other facilities.

3.1.2 History of OE Use

Since 1917, portions of the Installation were used by infantry units for maneuvers, target ranges, and other purposes. OE that have been fired into, fired upon, or used on the facility include artillery and mortar projectiles, rockets and guided missiles, rifle and hand grenades, practice land mines, pyrotechnics, bombs, and demolition materials. A wide variety of conventional UXO items have been located at sites throughout the former Fort Ord, including pyrotechnics and explosives.

3.1.3 Summary of Existing OE Program

Prior to and concurrent with the preparation of the OE RI/FS, the Army had been conducting an OE cleanup that consists of implementing and documenting OE removal actions in areas with imminent OE hazards. These removal actions have not only reduced imminent OE hazards but have also provided information about the type of UXO and level of OE hazard at each of the sites for use in the OE RI/FS.

Work for the existing OE program has been conducted in accordance with the following documents:

- Time-critical removal actions have been implemented as described in the *Fort Ord Ordnance and Explosive Waste Time-Critical Removal Action Memorandum* (*Army, 1994*).

- Non-time-critical removal actions are being addressed in the *Action Memorandum, Phase 2 Engineering Evaluation/Cost*

Analysis, Ordnance and Explosives Sites, Former Fort Ord, Monterey County, California (*Army, 1999a*). The Action Memorandum, Phase 2 EE/CA identifies and describes the rationale for continuing with UXO removal actions at OE sites while the OE RI/FS is being conducted and addresses recommendations for future UXO removal actions.

- All removal actions have been implemented in accordance with the Land Disposal Site Plan (LDSP), LDSP amendments, and explosive safety submissions, which have been approved by the Department of Defense Explosives Safety Board (DDESB). These plans are required to describe the nature, extent, and types of known or suspected UXO contamination, the proposed future use of each area, and procedures for mitigating OE hazards in a manner compatible with the proposed land reuse and in accordance with Department of Defense (DoD) safety standards.

- Known or suspected OE sites have been identified and listed in the 1997 Draft Revised Archive Search Report (ASR; *USAEDH, 1997*), which is an update of previous ASRs (*USAEDH, 1993; 1994*).

- Previously identified, known, or suspected OE sites, identified at the time the ASR was issued, were listed in the Phase 1 Engineering Evaluation/Cost Analysis (Phase I EE/CA; *USAEDH, 1997*) and the Phase 2 Engineering Evaluation/Cost Analysis (Phase 2 EE/CA; *Army, 1998c*). Because past military training activities resulted in the deposition of UXO in some areas on the former Fort Ord, the Phase 1 and Phase 2 EE/CAs (*USAEDH, 1997; Army, 1998c*) were developed to describe the UXO removal and management activities for sites known or suspected to contain UXO. The Phase 1 EE/CA addressed 29 OE sites and subsites (*USAEDH, 1997*). The Phase 2 EE/CA addressed the remaining OE sites, including future sites (*Army, 1998c*). Sites for which no further removal actions were recommended in the Phase 1 EE/CA (*USAEDH, 1997*) were addressed in the *Action Memorandum 1, Phase 1 EE/CA, Twelve Ordnance and Explosives Sites* (*Army, 1998a*). The Phase 2 EE/CA established a "plug-in" evaluation process designed to address any UXO situation on the former Fort Ord (*Army, 1998c*); the Action Memorandum, Phase 2 EE/CA documents the process (*Army, 1999a*).

- The Phase 2 EE/CA process addressed additional known or suspected OE sites not evaluated in Action Memorandum 1 by developing categories for each site based on: (1) expected type of UXO present, (2) soil type, and (3) future land use of the site (*USAEDH, 1998*). Five removal alternatives were developed to address each category of site. UXO data was obtained from the Archives Search Report (ASR) prepared in December 1993, the ASR Supplement prepared in November 1994, and the Revised Draft ASR completed in 1997 (*USAEDH, 1993; 1994; 1997*). A preliminary site reconnaissance was conducted as part of the ASR to further identify/characterize potential OE sites; the results are contained in the 1997 ASR. The Phase 2 EE/CA provided a summary of the number and types of UXO and ordnance related scrap found during removal actions at OE sites on the former Fort Ord at the time the EE/CA was prepared (*Army, 1998c*). Data on UXO and ordnance related scrap identified since that time, and on an ongoing basis as removal actions are performed, will be provided in After Action Reports and in the OE RI/FS.

3.2 Physical Setting

The following sections summarize the location and general physical setting of the base, including intended land uses.

3.2.1 Location

The former Fort Ord is adjacent to Monterey Bay in northwestern Monterey County, California, approximately 80 miles south of San Francisco (Plate 1). The base consists of approximately 28,000 acres adjacent to the cities of Seaside, Sand City, Monterey, and Del Rey Oaks to the south and Marina to the north. The Southern Pacific Railroad and Highway 1 pass through the western part of the former Fort Ord, separating the beachfront portions from the rest of the base. The south and southeast of the former Fort Ord are bordered by unincorporated portions of Monterey County, and include several communities as well as the Laguna Seca Recreation Area and Toro Regional Park. Land use immediately east of the former Fort Ord is primarily agricultural.

3.2.2 General History

Beginning with its founding in 1917, Fort Ord served primarily as a training and staging facility for infantry troops. From 1947 to 1974, Fort Ord was a basic training center. After 1974, the 7th Infantry Division occupied Fort Ord. Fort Ord was selected in 1991 for decommissioning, but troop reallocation was not completed until 1993. Although Army personnel still operate the base, no active Army division is stationed at Fort Ord.

3.2.3 Land Use

The former Fort Ord consists of both developed and undeveloped land. The three principal developed areas are the East Garrison, the Fritzsche Army Airfield (FAAF), and the Main Garrison; these areas collectively comprise approximately 8,000 acres. The remaining 20,000 acres are largely undeveloped areas. Land uses in both the developed and undeveloped areas when the former Fort Ord was active are described below.

3.2.3.1 Developed Land

With up to 15,000 active duty military personnel and 5,100 civilians working onsite during its active history, the former Fort Ord's developed areas resembled a medium-sized city, with family housing, medical facilities, warehouses, office buildings, industrial complexes, and gas stations. Individual land-use categories were as follows:

- Residential areas included military housing, such as training and temporary personnel barracks, enlisted housing, and officer housing.
- Local services/commercial areas provided retail or other commercial services such as gas stations, mini-markets, and fast-food facilities.
- Military support/industrial areas included industrial operations such as motor pools, machine shops, a cannibalization yard (where serviceable parts are removed from damaged vehicles), and the FAAF.
- Mixed land-use areas combined residential, local services/commercial, and military support operations.
- Schools included the Thomas Hayes Elementary, Roger S. Fitch Middle, General George S. Patton Elementary, Marshall Park Elementary, and Gladys Stone schools. High school students attended Seaside High, outside the former Fort Ord's southwest boundary.
- Hospital facilities included the Silas B. Hayes Army Hospital, medical and dental facilities, and a helipad.
- Training areas included a central track and field, firing ranges, and obstacle courses.
- Recreational areas included a golf course and clubhouse, baseball diamonds, tennis courts, and playgrounds.

The three principal developed areas are described below:

- East Garrison: The East Garrison is on the northeast side of the base, adjacent to undeveloped training areas. Military/industrial support areas at the East Garrison included tactical vehicle storage facilities, defense recycling and disposal areas, a sewage treatment plant, and small arms ranges. The East Garrison also included recreational open space with primitive camping facilities, baseball diamonds, a skeet range, and tennis courts. Recreational open space occupied 25 of the approximately 350 acres of the East Garrison.

- Fritzsche Army Airfield (FAAF): The former FAAF is in the northern portion of the former Fort Ord, on the north side of Reservation Road and adjacent to the city limits of Marina. The primary land use was military/industrial support operations; facilities included airstrips, a motor park, aircraft fuel facilities, a sewage treatment plant, aircraft maintenance facilities, an air control tower, a fire and rescue station, and aircraft hangars.

- Main Garrison: The Southern Pacific Railroad right-of-way and Highway 1 separate the coastal zone from the former Fort Ord's Main Garrison. The Main Garrison consisted of a complex combination of the various land-use categories. Facilities included schools, a hospital, housing, commercial facilities, (including a dry cleaner and a gasoline service station), and industrial operations (including motor pools and machine shops).

3.2.3.2 Undeveloped Land

The two principal undeveloped areas are described below:

Coastal Zone: A system of sand dunes lies between Highway 1 and the shoreline. The western edge of the dunes has an abrupt drop of 40 to 70 feet, and the dunes reach an elevation of 140 feet above mean sea level on the gentler, eastern slopes. The dunes provided a buffer zone that isolated the Beach Trainfire Ranges from the shoreline to the west. Stilwell Hall (a former recreation center), numerous former target ranges, former ammunition storage facilities, and two inactive sewage treatment facilities lie east of the dunes.

Because of the presence of rare and/or endangered species and because of its visual attributes, Monterey County has designated the former Fort Ord's coastal zone an environmentally sensitive area. The California Natural Coordinating Council (CNCC) and the Heritage Conservation and Recreation Service (HCRS) have identified the dunes at the former Fort Ord as among the best coastal dunes in California because of significant features including coastal strand vegetation and the habitat of the black legless lizard (*MCPD, 1984*).

Inland Areas: Undeveloped land in the inland portions of the former Fort Ord includes the Multi-Range Area (MRA) and infantry training areas, portions of which were used for livestock grazing and recreational activities such as hunting, fishing, and camping. These undeveloped areas are primarily left in their natural state, with only minor development of facilities.

3.2.3.3 Future Land Use

The future land uses presented in this section are primarily based upon the Fort Ord Reuse Authority (FORA) March 1997 Fort Ord Base Reuse Plan (*FORA, 1997*) and the July 1995 U.S. Army Corps of Engineers (USACE) and Bureau of Land Management (BLM) Site Use Management Plan (SUMP) (*USACE, 1995*). Other sources of future land use include public benefit conveyance, negotiated sale requests, transfer documents, and the Installation-Wide Multispecies Habitat Management Plan (HMP) (*USACE, 1997*). The Reuse Plan identified approximately 20 land-use categories at Fort Ord (*FORA, 1997*) including habitat

management, open space/recreation, institutional/public facilities, commercial, industrial/business park, residential, tourism, mixed use, and others. The SUMP identified four unique future reuse designations, accounting for the entire MRA. These designations include unrestricted areas, unrestricted/BLM areas, limited-access areas, and restricted/administration areas. Anticipated future uses within each designation are described below:

- Unrestricted areas: Urban development, recreation development, and transportation
- Unrestricted/BLM areas: Construction of facilities, habitat restoration, and maintenance of access routes
- Limited-access areas: Recreation access, notification uses, and habitat restoration
- Restricted/administration areas: Habitat monitoring and habitat enhancement.

Limited-access areas include areas that are within the core of the MRA but outside of high-impact areas. These areas will be cleared of OE sufficient to support recreational uses including mountain biking, equestrian uses, and pedestrian uses (to occur on established trail systems). Existing fuelbreaks will also be cleared of OE sufficiently to allow heavy equipment to travel over fire roads for firefighting activities and annual maintenance. Limited-access areas will be transferred with land-use controls for any surface disturbance or subsurface excavation outside of established roads, trails, and fuelbreaks (*USACE, 1995*).

The HMP (*USACE, 1997*) presents the revised boundaries of the habitat reserve areas and describes special land-use controls and habitat monitoring requirements for target species within the HMP Reserve and Development Areas. The HMP confirms locations of low-intensity uses such as the HMP reserve areas; it also specifies an allowance for development within the reserve areas for public access support facilities in as much as 2 percent of the area. The HMP also confirms locations of high-intensity uses (e.g., development) outside of the MRA and reserve areas.

3.2.4 Site Features

The following section summarizes site features at the former Fort Ord.

3.2.4.1 Climate

The area's climate is characterized by warm, dry summers and cool, rainy winters. The Pacific Ocean is the principal influence on the climate at the former Fort Ord, and the source of fog and onshore winds that moderate temperature extremes. Daily ambient air temperatures typically range from 40 to 70 degrees Fahrenheit (F), but temperatures in the low 100s have occurred. Thick fog is common in the morning throughout the year. Winds are generally from the west.

The average annual rainfall of 14 inches occurs almost entirely between November and April. Because the predominant soil is permeable sand, runoff is limited and streamflow occurs only intermittently and within the very steep canyons in the eastern portion of the former Fort Ord.

3.2.4.2 Ecological Setting

The former Fort Ord is located on California's central coast, a biologically diverse and unique region. The range and combination of climatic, topographic, and soil conditions at the former Fort Ord support many biological communities. Field surveys were conducted from 1991 through 1994 to provide detailed site-specific, as well as basewide, information regarding plant communities, botanical resources, observed and expected wildlife, and biological resources of concern. Plant communities were mapped for the whole base as described in the *Draft Basewide Biological Inventory, Fort Ord, California* (*Harding ESE, 1992*).

Several of the former Fort Ord plant communities have been combined for simplification. The 12 plant communities

described at former Fort Ord sites include: coast live oak woodland (coastal and inland); central maritime chaparral; central coastal scrub; grassland; developed/landscaped and disturbed dunes; dune scrub; iceplant mats; riparian forest; wetlands (including vernal pools and freshwater marsh); and coastal strand. Central maritime chaparral is the most extensive natural community at the former Fort Ord, occupying approximately 12,500 acres in the south-central portion of the base. Oak woodlands are widespread at the former Fort Ord and occupy the next largest area, about 5,000 acres. Grasslands, located primarily in the southeastern and northern portions of the base, occupy approximately 4,500 acres. The other community types generally occupy less than 500 acres each. The remaining approximately 4,000 acres of the base are considered fully developed and not defined as ecological communities.

Special-status biological resources are those resources, including plant and wildlife taxa and native biological communities, that receive various levels of protection under local, state, or federal laws, regulations, or policies. The closure and disposal of former Fort Ord is considered a major federal action that could affect several species of concern and other rare species listed by the California Department of Fish and Game and/or the California Native Plant Society or listed as threatened or endangered under the federal Endangered Species Act (ESA). The U.S. Department of the Interior, Fish and Wildlife Service (USFWS) final Biological Opinion for the Disposal and Reuse of Fort Ord (*USFWS, 1993*) required that a habitat management plan be developed and implemented to reduce the incidental take of listed species and loss of habitat that supports these species. The HMP for former Fort Ord complies with the USFWS Biological Opinion and establishes the guidelines for the conservation and management of wildlife and plant species and habitats that largely depend on former Fort Ord land for survival (*USACE, 1997*). Of the 12 plant communities identified at the former Fort Ord, two are considered rare or declining and of highest inventory priority by the California Department of Fish and Game (*CDFG, 1997*): central maritime chaparral and valley needlegrass grassland. Special-status taxa that occur or potentially occur in the plant communities at the former Fort Ord include 22 vascular plants, 1 invertebrate, 4 reptiles, 1 amphibian, 9 birds, and 2 mammals. Table 1 contains a list of the special-status species at the IA sites.

From 1994 to the present, baseline and follow-up surveys have been conducted for habitats potentially affected by OE removal activities. These data are presented in annual monitoring reports including; *Fort Ord 1994 Annual Monitoring Report for Biological Baseline Studies at Unexploded Ordnance Sites* (*Harding ESE, 1994b*); *1995 Annual Biological Monitoring Report for Unexploded Ordnance Removal Sites at Former Fort Ord,* (*Harding ESE, 1995b*); *1996 Annual Monitoring Report Biological Baseline Studies and Follow-up Monitoring at Unexploded Ordnance Sites 10 East, 10 West, 11, 12 and 16 Presidio of Monterey Annex* (*Harding ESE, 1996*); *1997 Annual Monitoring Report Former Fort Ord,* (*Harding ESE, 1997*); and *1998 Annual Monitoring Report Biological Baseline Studies and Follow-up Monitoring at Unexploded Ordnance Sites at Former Fort Ord, Presidio of Monterey Annex, Monterey, California,* (*Harding ESE, 1998*), 1999 *Annual Monitoring Report, Biological Baseline Studies and Follow-up Monitoring at Unexploded Ordnance Sites on Former Fort Ord, Presidio of Monterey Annex, Monterey, California* (*Harding ESE, 1999b*), *2000 Annual Monitoring Report, Biological Baseline Studies and Follow-up Monitoring at Unexploded Ordnance Sites on Former Fort Ord, Presidio of Monterey Annex, Monterey, California.* (*Harding ESE, 2000a*).

3.2.4.3 Topography and Surface Waters

Elevations at the former Fort Ord range from approximately 900 feet above mean sea level (MSL) near Wildcat Ridge, on the east side of the base, to sea level at the beach. The predominant topography of the area reflects

morphology typical of the dune sand deposits that underlie the western and northern portions of the base. In these areas, the ground surface slopes gently west and northwest, draining toward Monterey Bay. Runoff is minimal because of the high rate of surface-water infiltration into the permeable dune sand; consequently, well-developed natural drainages are absent throughout much of this area. Closed drainage depressions typical of dune topography are common.

The topography in the southeastern third of the base is notably different from the rest of the base. This area has relatively well defined, eastward-flowing drainage channels within narrow, moderately to steeply sloping canyons draining into the Salinas Valley.

3.2.5 Subsurface Conditions

This section summarizes subsurface conditions at the former Fort Ord.

3.2.5.1 Geology

The former Fort Ord is within the Coast Ranges Geomorphic Province. The region consists of northwest-trending mountain ranges, broad basins, and elongated valleys generally paralleling the major geologic structures. In the Coast Ranges, older, consolidated rocks are characteristically exposed in the mountains but are buried beneath younger, unconsolidated alluvial fan and fluvial sediments in the valleys and lowlands. In the coastal lowlands, these younger sediments commonly interfinger with marine deposits.

The former Fort Ord is at the transition between the mountains of the Santa Lucia Range and the Sierra de la Salinas to the south and southeast, respectively, and the lowlands of the Salinas River Valley to the north. The geology of the former Fort Ord generally reflects this transitional condition; older, consolidated rock is exposed at the ground surface near the southern base boundary and becomes buried under a northward-thickening sequence of poorly consolidated deposits to the north. The former Fort Ord and the adjacent areas are underlain, from depth to ground surface, by one or more of the following older, consolidated units:

- Mesozoic granitic and metamorphic rocks
- Miocene marine sedimentary rocks of the Monterey Formation
- Upper Miocene to lower Pliocene marine sandstone of the Santa Margarita Formation (and possibly the Pancho Rico and/or Purisima Formations).

Locally, these units are overlain and obscured by geologically younger sediments, including:

- Plio-Pleistocene alluvial fan, lake, and fluvial deposits of the Paso Robles Formation
- Pleistocene eolian and fluvial sands of the Aromas Sand
- Pleistocene to Holocene valley fill deposits consisting of poorly consolidated gravel, sand, silt, and clay
- Pleistocene and Holocene dune sands
- Recent beach sand
- Recent alluvium.

The geology of the former Fort Ord is described in detail in Volume II of the Basewide RI, Basewide Hydrogeologic Characterization (*Harding ESE, 1995a*).

3.2.5.2 Hydrogeology

Recent studies of the former Fort Ord hydrogeology concluded that the base straddles two distinct groundwater basins, the Salinas and Seaside basins (*GTC, 1984; SGD, 1987*). The former Fort Ord includes the southwestern edge of the Salinas basin and the eastern portion of the smaller Seaside basin. The Salinas basin underlies the northern and southeastern portions of the base, and the Seaside basin underlies the

southern and southwestern areas. Basewide RI/FS sites with recognized groundwater contamination are limited to the Salinas groundwater basin at the former Fort Ord; therefore, only the Salinas basin is described herein.

The Salinas groundwater basin is relatively large and extends well beyond the boundaries of the former Fort Ord. At the former Fort Ord, the Salinas basin is composed of relatively flat-lying to gently dipping, poorly consolidated sediments. Although relatively simple structurally, the sediments are stratigraphically complex, reflecting a variety of depositional environments. Aquifers within the Salinas basin at the former Fort Ord, from top to bottom, include the unconfined A-aquifer, the confined Upper 180-foot aquifer, the confined and unconfined Lower 180-foot aquifer, and the confined 400-foot and 900-foot aquifers. These aquifer names reflect local historical water levels and are not directly correlated to present water levels at the former Fort Ord.

Groundwater extraction by the City of Marina, by the former Fort Ord, and by irrigation wells in the Salinas Valley have historically induced seawater intrusion into the Lower 180-foot and the 400-foot aquifers. Seawater intrusion continues to affect these aquifers. Intrusion into the Upper 180-foot aquifer appears to be limited to the vicinity of the beach at the former Fort Ord (*Harding ESE, 1999a*).

3.3 OE RI/FS Background

Since the base was selected for Base Realignment and Closure (BRAC) in 1991 and was officially closed in September 1994, OE removal actions have been performed and documented in preparation for transfer and reuse of the former Fort Ord property. The Ord Military Community (OMC), located within the Main Garrison portion of the former Fort Ord, will be retained by the Army. Since base closure in September 1994, lands outside the OMC have been subject to the reuse process. Some of the property on the Installation has been transferred. A large portion of the Inland Training Ranges was assigned to BLM. Other areas on the Installation have been or will be disposed to federal, state, local, and private entities through economic development conveyance, public benefit conveyance, negotiated sale, or other means.

The expanded reuse of the former Fort Ord increases the possibility of the public being exposed to OE hazards. In November 1998, the Army agreed to evaluate OE at the former Fort Ord in an OE RI/FS consistent with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The OE RI/FS, which the Army is preparing to address OE hazards on the former Fort Ord, will include input from the community and will require regulatory agency review and approval. The OE RI/FS will evaluate past removal actions as well as recommend future remedial actions deemed necessary to protect human health and the environment under future uses.

The Army has been conducting OE sampling and removal actions at identified OE sites and will continue these actions to mitigate imminent OE hazards to the public while gathering data about the type of OE and level of OE hazard at each of the sites for use in the OE RI/FS. The Army is the lead agency delegated in Executive Order 12580 for OE removal activities at the former Fort Ord. However, regulatory agencies (U.S. Environmental Protection Agency [EPA] and the Department of Toxic Substances Control [DTSC] under the California Environmental Protection Agency) have been and will continue to be involved and provide input during OE removal and remedial activities. The Army is performing its activities in compliance with the detailed process described in the National Contingency Plan (NCP) for conducting a CERCLA remedial action. A Federal Facility Agreement (FFA) was signed in 1990 by the Army, EPA, and California Department of Health Services (now known as DTSC). The FFA established schedules for performing remedial investigations and feasibility studies and requires that remedial actions be completed as expeditiously as possible. In April 2000, an agreement was signed between the Army, EPA,

and DTSC to evaluate OE at the former Fort Ord subject to the provisions of the FFA. The OE RI/FS will contain a comprehensive evaluation of all OE-related data for the entire former Fort Ord and will evaluate long-term response alternatives for cleanup and risk management of OE.

4.0 INTERIM ACTION REMEDIAL INVESTIGATION

This section presents the Interim Action Remedial Investigation and summarizes general site information, vegetation status, OE-related information, and conceptual site models for each of the three IA sites. Their locations relative to neighboring communities are shown on Plate 2.

Typical Physical Characteristics

The predominant topography of the IA sites reflects morphology typical of dune sand deposits that underlie the sites. The IA sites are characterized by low rolling hills with elevations ranging from approximately 400 feet MSL to approximately 900 feet MSL. Surface and near-surface soil consists primarily of older dune sands and occasional exposures of the Aromas Sand Formation. Generally the ground surface slopes gently west and northwest with drainage toward Monterey Bay. Runoff is minimal because of the high rate of surface water infiltration into the permeable dune sand. Well-developed natural drainages are absent from the IA sites. Dominant vegetation in the IA sites is central maritime chaparral with patches of non-native grassland. Vegetation in portions of the IA sites is dense, which obscures the presence of OE.

Typical OE–Related Characteristics

The IA sites include Ranges 43-48, Range 30A, and Site OE-16 (Plates 3 through 10). Ranges 43-48 and 30A are part of the former Fort Ord MRA. Ranges 43-48 have been in use since the 1940s and were used for firing rockets, mortars, and various other projectiles. Range 30A was constructed in 1990 as a 40mm grenade range. The ranges typically consist of a firing line with firing positions with fixed and/or moving targets positioned down range. Targets are positioned at intervals specified in the particular range's Standard Operating Procedures (SOP). The targets include fixed silhouettes, truck-mounted moving targets, automobiles, trucks, tanks, and armored personnel carriers (APCs). Site OE-16 is a former World War II (WWII)-era 2.36-inch rocket and rifle grenade range. Even though no OE-related activities have been conducted at the IA sites in eight years, significant potential OE hazards have not become less significant with the passage of time. Many of the UXO items remaining have sensitive fuzing, are in deteriorating condition and are present on the ground surface, making conditions extremely hazardous.

Interim Action Sites at Fort Ord

The remedial investigations for each of the three IA sites are provided in the following sections as follows:

- **General Site Information**: Location, reuse, topography and geology, population, proximity and access, and history of use
- **Vegetation Status**: Type, density, and habitat designation
- **OE-Related Information**: Type, distribution, and quantity
- **Conceptual Site Model**: The basis for investigation design and identification of potential release and exposure routes.

4.1 Ranges 43–48

The Remedial Investigation for Ranges 43–48 is presented in the following section.

4.1.1 General Site Information

General site information for Ranges 43-48 is summarized below.

4.1.1.1 Location

Ranges 43-48 cover approximately 483 acres to the south of Eucalyptus Road in the south-

central portion of the former Fort Ord (Plate 3). The area is within the MRA, and includes several former firing ranges and a portion of Site OE-15MOCO.2. Former firing ranges established in this area at the time of base closure included Ranges 43, 44, 45, 46, 47, and 48. Other historic use of the area included a "Company Problems" training area.

The size of the IA site at Ranges 43-48 was originally proposed in the Draft IA RI/FS as 555 acres, including 72 acres planned for development. Upon review of the OE sampling data gathered from the development area, the USACE OE Safety Specialist determined vegetation within the 72 acres (Site OE-15SEA.4 and most of Site OE-15MOCO.2) could be safely be removed through mechanical methods. Therefore, the definition of the IA site at Ranges 43-48 has been revised as described above to include the remaining 483 acres.

4.1.1.2 Reuse

The majority of the IA site (472 acres) is designated as habitat reserve and will remain undeveloped (portions of BLM Parcels F1.4.2, F1.4.10.1, F1.4.10.2, F1.8, F1.9.1, F1.9.2, F1.10, F1.11.1, and F1.11.2). The remainder of the IA site (11 acres) includes the southern portion of Site OE-15MOCO.2 and contains the firing points for Ranges 44 and 45. Site OE-15MOCO.2 was identified based on a transfer parcel boundary and coincides with Transfer Parcel E21b.3. Future reuse of Transfer Parcel E21b.3 is development.

4.1.1.3 Topography and Geology

Elevations at Ranges 43-48 range from approximately 400 feet MSL near the firing point at Range 45 to approximately 550 feet MSL down range of Range 48 in the southwestern corner of the IA site. The topography of Ranges 43-48 is dominated by rolling terrain formed by Pleistocene-age dune deposits that may be up to 250 feet thick. These dune deposits cover the majority of the MRA. The mature plant communities described in Section 4.1.2 largely stabilize these widespread, unconsolidated deposits. This soil type is identified as "sand" in the Phase 2 EE/CA (*Army, 1998c*).

4.1.1.4 Population, Proximity, and Access

The area is adjacent to (less than 4000 feet from) residential neighborhoods (Fitch and Marshall Park) on the Ord Military Community and near the City of Seaside. The Fitch and Martin Luther King Jr. Middle Schools are located within 1 mile of Ranges 43-48. Ranges 43-48 were part of the Fort Ord MRA. The MRA is fenced and posted with signs warning of the dangers associated with unexploded ordnance. Existing access deterrents such as four-strand barbed-wire fencing with one to two rolls of concertina wire behind it that surrounds the MRA, chain link gates reinforced with concertina wire, and warning signs posted approximately every 500 feet along the fencing discourage, but do not prevent entry into the area. Several instances of unauthorized access by persons into the Range 43-48 IA site have been documented in the last few years. In 1999, there were two documented cases of children entering the fenced MRA at Ranges 44 and 45, and collecting and removing 40mm practice grenades found on the surface of the IA site. Although no one was injured in these incidents, it substantiates the premise that fences posted with warning signs deter, but do not prevent entry.

Personnel from the Army, BLM and USACE routinely check the MRA fences to ensure that they remain in good condition and to identify/complete needed repairs in a timely manner. The fences are maintained through an inter-service support agreement with BLM (*Army, 2001b*). Plate 2 shows the location of the IA site relative to surrounding communities and schools.

4.1.1.5 History of Use

The area included in this IA site contains several former firing ranges, some of which have been used for live fire exercises since at least the 1940s (Plate 3). The ranges were part of the Fort Ord range complex known as the MRA. Training facilities maps indicate that the ranges were used for a variety of different purposes and were active from the 1940s through the 1990s. In the 1940s the area included a Company Problems training area and a mortar range. In the 1950s, additional firing ranges were added including night firing and field firing ranges. In the 1960s, a rifle grenade range was added. The range configurations have remained roughly the same in this area since the mid-1960s. A description of the ranges in place in the area at the time of base closure, including information on ordnance use, is summarized below.

4.1.1.5.1 Ranges 43, 44, 45, 46, 47, and 48

- Range 43, located in the northeastern portion of the IA site, was in use as a platoon live fire course at the time of base closure. Troops fired and maneuvered down range using a trench system. Prior to this use, the range was used for mortar training. Records and recent field investigations indicate that the ammunition used or found at this range included 4.2-inch (high explosive [HE], white phosphorous [WP]), 60mm (training practice [TP], illumination), and 81mm (HE, WP, TP, illumination) mortars, 40mm grenades (HE, smoke, practice), 37mm low explosive (LE), 75mm (HE, shrapnel), 57mm (HE), 105mm (smoke, HE), and 155mm (smoke) projectiles, 66mm light antitank weapon (LAW), small arms, and fragmentation hand grenades.

- Range 44 was in use as an antitank weapons range at the time of base closure. The firing point for Range 44 was located within Site OE-15MOCO.2 with target sites located down range toward the southwest. Records and recent field investigations indicate that the ammunition used or found at this range included 35mm LAW sub-caliber, 66mm LAW high explosive antitank (HEAT), 66mm incendiary, 90mm recoilless rifle (RR) rounds (HE), 84mm incendiary, 40mm grenades (HE, practice), Dragon guided missiles (practice, HEAT) and practice anti-personnel mines. The former range fans and former target locations for all ranges located within this area are presented on Plate 3.

- Range 45 was in use as a grenade launcher range at the time of base closure. Range 45 was located adjacent to Range 44 and configured in roughly the same manner. Records and recent field investigations indicate that the ammunition used or found at this range included 40mm grenades (practice, HE, smoke, illumination), 35mm sub-caliber, 66mm LAW (HEAT from Range 44), 66mm incendiary, 14.5 sub-caliber, 22mm sub-caliber, 60mm mortars (HE, practice), hand grenades (illumination, smoke, practice), and practice anti-personnel mines.

- Range 46 was used as a small arms range from the late-1950s up to the time of base closure. The firing point for Range 46 was located within Site OE-15SEA.4 with target sites located to the southeast in front of an earthen berm. Records and field investigations indicate that the ammunition used at this range was restricted to small arms (pistols and rifles).

- Range 47, located in the western portion of the IA site just south of Site OE-15SEA.4, was established in and used through the 1960s as a 40mm grenade range. Firing was from the northwest toward the southeast. No field investigations have been conducted at this range. Records indicate that ammunition used at this range would have included 40mm grenades (HE).

- Range 48 was in use as a light antitank weapons range at the time of base closure. Range 48 was located on the western side of

the IA site. The firing point for Range 48 was located within Site OE-15SEA.4 (north of the IA site) with target locations located down range to the south. According to records the range was in use since the 1940s. The range was used for various purposes including weapons familiarization, and as a sniper range, mortar range, and machine gun range. Records and recent field investigations indicate that the ammunition used or found at this range included 4.2-inch (HE), 60mm (HE, TP, illumination), and 81mm (HE, WP, TP, illumination) mortars, 22mm sub-caliber, 57mm (HE), 75mm (HE), 84mm antitank (practice, HEAT), 40mm grenades (HE), 105mm (smoke, illuminating) and 155mm (smoke) projectiles, 2.36-inch (practice), 35mm (practice), 3.5-inch (practice), 66mm LAW (HEAT), and 66mm incendiary rockets, Dragon guided missiles (HEAT), rifle grenades (practice), antitank (practice) and practice anti-personnel mines, 106mm RR, illumination signals, small arms, and fragmentation hand grenades.

4.1.2 Vegetation Status

To maintain compliance with habitat management and monitoring requirements presented in the *Installation-Wide Multispecies Habitat Management Plan for Former Fort Ord, California* (HMP) (*USACE, 1997*), biological resources within habitat reserve areas containing central maritime chaparral (CMC) are monitored after OE cleanup activities have been completed. The HMP identifies species and habitats of concern on the Installation and specifies mitigation measures to monitor the successful regeneration of species and habitat following OE Remedial Action. As part of the mitigation, follow-up monitoring would be conducted for a period of 5 years following OE Remedial Action to document effects of cleanup. Since the inception of the OE cleanup program, the Army has elected to augment the monitoring program, where feasible, to include the collection of baseline data prior to OE Remedial Action. In addition, annual reports are prepared to identify baseline habitat data and to document the success of the recovery of sensitive habitats.

Special-status species are considered to be those taxa that are listed, or are proposed for listing, as threatened or endangered under the state and federal Endangered Species Acts (ESAs), or are designated by state and federal agencies as species of concern. Table 1 provides a list of HMP species found at Fort Ord and their associated status.

Vegetation at Ranges 43 – 48 consists of central maritime chaparral (CMC) habitat sporadically interspersed with annual grassland habitats. Based upon species composition, CMC is divided into three successional stages: (1) mature habitat, (2) intermediate-age habitat, and (3) disturbed habitat.

Based upon field observations, a general pattern regarding successional stages of chaparral habitat was observed. These observations may not hold true for all of the ranges, as access to some areas was limited because of potential OE explosive hazards. In general, disturbed habitat was most often found between Ranges 42 and 45 and along old access roads. Mature and intermediate-age habitat appeared evenly distributed throughout the remainder of the ranges. As expected, intermediate-age chaparral was often found adjacent to grassland meadows transitioning toward mature as distance from the grassland meadow increased. However, tall, dense stands of mature chaparral habitat were frequently found adjacent to old access roads. A brief description of these successional habitats is provided below.

Mature Habitat

Dominant shrub species observed in mature habitat at Ranges 43–48 include shaggy-barked manzanita, chamise, and sandmat manzanita. Mature habitat typically supports the least diversity of shrubs, herbaceous species, bare ground, and grassland habitat. HMP annual herbaceous species are also typically the least prevalent in this successional stage of chaparral habitat. However, the seed bank underlying

chaparral shrub species does contain HMP annual herbaceous species that would be expected to regenerate and be observed following a burn. The central maritime chaparral community that occurs at Fort Ord is similar to other California chaparral associations, having herbaceous and shrub plant species which are considered dependent on fire for reproduction. Reproductive strategies that relate to the occurrence of fire include the release of dormancy by heating (Wright 1931); and the reduction or alteration of chemicals either on the seed coat or in the soil, which inhibit reproduction (*Muller 1966; Christensen and Muller 1975*). Several of these plant species are either uncommon or endemic to the Monterey Peninsula, and are subject to management provisions of the HMP. HMP shrub species observed in mature habitat include sandmat manzanita, Monterey ceanothus, and Eastwood's goldenbush. HMP herbaceous species observed in areas of bare ground within mature habitat include federally endangered and state threatened sand gilia, federally threatened Monterey spineflower, and state endangered Seaside bird's-beak.

Intermediate-Age Habitat

Dominant shrub species observed in intermediate-age habitat include shaggy-barked manzanita, sandmat manzanita, chamise, Monterey ceanothus, black sage, and dwarf ceanothus. Areas supporting bare ground and grassland habitat are also found in this successional stage, however, they are typically less prevalent than in disturbed habitat. HMP annuals typically are observed in areas of bare ground and grassland habitat. However, the seed bank underlying chaparral shrub species does contain HMP annual herbaceous species that would be expected to regenerate and be observed following a burn. The central maritime chaparral community that occurs at Fort Ord is similar to other California chaparral associations, having herbaceous and shrub plant species which are considered dependent on fire for reproduction. Reproductive strategies that relate to the occurrence of fire include the release of dormancy by heating (*Wright, 1931*); and the reduction or alteration of chemicals either on the seed coat or in the soil, which inhibit reproduction (Muller 1966; Christensen and Muller 1975). Several of these plant species are either uncommon or endemic to the Monterey Peninsula, and are subject to management provisions of the HMP. HMP shrub species observed in intermediate-age habitat include sandmat manzanita, Monterey ceanothus, and Eastwood's goldenbush. HMP herbaceous species observed in areas of bare ground within intermediate-age habitat include federally endangered and state threatened sand gilia, federally threatened Monterey spineflower, and state endangered Seaside bird's-beak.

Disturbed Habitat

Dominant shrub species observed in disturbed habitat include sandmat manzanita, shaggy-barked manzanita, chamise, and Monterey ceanothus. Areas of bare ground are typically most abundant in disturbed habitat. Disturbed habitat also typically has a larger component of HMP annual herbaceous plant species and grassland than intermediate-age or mature habitat. HMP annuals typically are observed in areas of bare ground and grassland habitat. In addition, the seed bank underlying chaparral shrub species does contain HMP annual herbaceous species that would be expected to regenerate and be observed following a burn. The central maritime chaparral community that occurs at Fort Ord is similar to other California chaparral associations, having herbaceous and shrub plant species which are considered dependent on fire for reproduction. Reproductive strategies that relate to the occurrence of fire include the release of dormancy by heating (*Wright, 1931*); and the reduction or alteration of chemicals either on the seed coat or in the soil, which inhibit reproduction (*Muller 1966; Christensen and Muller, 1975*). Several of these plant species are either uncommon or endemic to the Monterey Peninsula, and are subject to management provisions of the HMP. HMP shrub species observed in disturbed habitat include sandmat manzanita and Monterey ceanothus. HMP herbaceous species observed in disturbed habitat

include federally endangered and state threatened sand gilia, federally endangered Monterey spineflower, and state endangered Seaside bird's-beak.

4.1.2.1 Vegetation Type

Vegetation at the ranges consists of central maritime chaparral habitat occasionally interspersed with small areas of annual grassland. Central maritime chaparral habitat is divided into the following successional stages (categories): (1) disturbed habitat, (2) intermediate-age habitat, and (3) mature habitat as described below based on the 2000 Annual Monitoring Report (*Harding ESE, 2000a*). Sandmat manzanita was observed to be the dominant species in disturbed habitat, providing approximately one-half of overall vegetative cover. Shaggy barked manzanita and chamise dominate the remaining vegetative cover in disturbed habitat. Sandmat manzanita, chamise, and shaggy-barked manzanita were also observed to be the dominant species in intermediate-age chaparral habitat. Together, these three species provide approximately 75 percent of overall vegetative cover. Shaggy-bark manzanita provides over 60 percent of overall vegetative cover in mature chaparral habitat. Shrub species diversity was approximately the same for all three categories. However, abundance of species varies between successional stages and is typically greater in disturbance and intermediate-age stands of chaparral as compared with mature stands. The diversity and abundance of herbaceous plant species is also typically higher in disturbed stands of chaparral, followed by intermediate-age and mature stands, respectively. Additionally, bare ground is typically most abundant in disturbed stands followed by intermediate-age and mature stands, respectively.

4.1.2.2 Vegetation Density

The substrate over much of the ranges is composed of loose, sandy soils. Vegetation is often densely knitted together, and the composition, texture, thickness, and resistance of the vegetation vary by species, community composition, and area. In some areas the vegetation is a dense knit of small but stiff stems; in other areas the shrubs are dominated by large stems with a canopy of leaves held well above the ground.

4.1.2.3 Habitat Designation

Two distinct areas have been delineated for inclusion as an IA site at Ranges 43–48: Habitat Reserve and Development Areas as described below.

4.1.2.3.1 Habitat Reserve Areas (Ranges 43, 44, 45, 46, 47, and 48)

The Habitat Reserve Area includes approximately 472 acres designated for habitat reserve out of the total 483-acre site (Plate 3). The need for interim action within this area was determined based on the presence of live, sensitively fuzed 4.2-inch, 57mm, 60mm, 75mm, 81mm, and 84mm HE projectiles, 40mm HE projectiles, and 66mm HEAT rockets. A detailed list of the UXO and ordnance scrap items found and removed from the Habitat Reserve Area during sampling is provided in Table 2. The sample grid locations are presented on Plate 4.

4.1.2.3.2 Development Areas (OE-15MOCO.2 and OE-15SEA.4)

Approximately 11 acres of Development Area lie within this IA site (Plate 3). The 11-acre area includes the portions of Ranges 44 and 45 that extend outside of the 472-acre Habitat Area. The cleanup in the remainder of the Development Area (72 acres) is being considered for completion under a different program and is not part of this IA. A detailed list of the UXO and ordnance scrap items found and removed from the development area during sampling is provided in Table 2. The sample grid locations are presented on Plate 4.

4.1.3 OE-Related Information

The following sections provide a summary of OE-related information for Ranges 43-48.

4.1.3.1 Site Characterization Activities

Information used to characterize this area was collected during several field investigation activities. Sampling in the IA site included grid sampling, fuel break clearance, trail clearance, road clearance, range clearance, and site-specific grid sampling conducted as part of the OE-15SEA group and OE-15MOCO.2 sampling. Most of the field investigations were conducted along roads and behind firing lines where the threat from explosive hazards was less than in the vicinity of the targets. Additionally, a portion of OE-15SEA.4 (associated with Range 46) was cleared of OE in support of remediation of spent small arms ammunition and lead contaminated soil. The locations of the sample grids associated with this activity are shown on Plate 4. The investigation and remediation of small arms ranges was conducted as part of the Basewide RI/FS (*Harding ESE, 1995a*) and is not addressed as part of the OE cleanup program. Following the sampling and clearance activities, a Time Critical Removal Action (TCRA) was conducted at Ranges 43-48. The TCRA, which included the removal of only surface UXO and OE scrap, was completed to reduce the threat to public safety posed by the presence of UXO at the IA site. Details of the site-specific OE characterization activities are described below. A detailed list of the UXO and ordnance scrap items (including the number found and removed) found during sampling, grouped by investigation activity, is provided in Table 2.

4.1.3.2 Summary of Field Activities Completed to Date

Grid sampling was performed within selected areas in the MRA to collect data regarding the type, depth, and distribution of OE present in areas behind the firing lines to support the OE investigation (Plate 4). Grid sampling is a method whereby all geophysical anomalies identified within a designated grid (here 100-by 100-foot grids) are investigated. Within the Ranges 43-48 area originally identified as an IA site, six 100 by 200 Grid Stat/Site Stat grids were sampled as part of the MRA sampling effort (G-1, G-2, G-3, G-13, G-14 and, G-15). The grids were investigated to a depth of four feet (Plate 4). Two UXO items including a HEAT guided missile and a WP smoke mortar (G-15) and numerous ordnance scrap items including practice 40mm grenades (G-1), practice 3.5-inch rockets (G-2), and a 81mm training mortar (G-15) were found and removed during this sampling activity.

Road clearances were performed within selected portions of the MRA to facilitate travel during field sampling activities. Maverick Road was included in the MRA road clearance. The Maverick Road clearance was composed of contiguous 15- by 110-foot grids cleared to a depth of four feet. Numerous UXO and ordnance scrap items were found during the Maverick Road clearance during sampling activities, including practice, high explosive, illuminating and smoke mortars and projectiles, practice rockets, fuzes and practice anti-personnel mines.

A 30-foot wide fuel break composed of contiguous 30- by 110-foot grids along the southern boundary of Sites OE-15MOCO.2 and OE-15SEA.4 were subjected to a complete removal to a depth of four feet over each grid (Plate 4). A portion of the fuel break was to include areas with known heavy concentrations of ordnance items associated with firing Ranges 44 and 45. For safety reasons the fuel break clearance was moved to the south. A 15-foot wide trail to the south was cleared to a depth of four feet to reach the western most extent of the relocated fuel break. The relocated fuel break was composed of contiguous 30- by 100-foot grids extending to the east and then to the north to Site OE-15MOCO.2 (Plate 4). UXO and ordnance scrap items found during this removal activity included practice,

illuminating, HE, HEAT, shrapnel, and smoke mortars and projectiles, practice and HEAT rockets, a HEAT guided missile, a practice antitank mine, practice hand and rifle grenades, fuzes and illumination signals.

Fuel breaks were also placed along the western and southern margins of the IA site and along the south side of Eucalyptus Road. The fuel break on the south side of Eucalyptus Road was comprised of 15x100-foot grids and the fuel break completed along the western and southern perimeter of the IA site was comprised of 50x100-foot grids `(Plate 4). No UXO or ordnance scrap items were found within the fuel break on the south side of Eucalyptus Road. Clearance of the fuel break along the western and southern perimeter resulted in the finding of numerous UXO and ordnance scrap items including HE, practice, illuminating, and WP smoke mortars and projectiles, HEAT guided missiles, practice and HEAT rockets, and fuzes.

Subsequent to the removal along the fuel break, site-specific grid sampling was performed within Sites OE-15MOCO.2 and OE-15SEA.4. Site-specific grid sampling at Site OE-15MOCO.2 included the sampling of twenty six (26) 100 foot by 100 foot grids throughout the site. Site-specific grid sampling within the portion of Site OE-15SEA.4 located on the north side of the IA site included the sampling of ten (10) 100- by 100-foot grids. UXO as well as ordnance scrap items including practice, shrapnel, HE and LE mortars and projectiles, practice rockets, hand grenade and projectile fuzes, a practice anti-personnel mine, illumination signals and practice, illuminating, and smoke hand grenades were found during the site-specific grid sampling at Site OE-15MOCO.2 and Site OE-15SEA.4.

Additional work was completed within two of the former ranges (44 and 45). The sampling at Range 44 included the clearance of a 15-foot wide trail to a depth of four feet. The trail was cleared to allow safe entry of personnel conducting soil characterization activities and equipment. One (1) 100- by 100-foot grid was established and sampled in Range 44. Sampling was performed on the surface only within the Range 44 grid. Surface sampling was also completed within a portion (11.5 acres) of Range 45 (Plate 4). The portion of the range cleared included the area around former target locations. Over one hundred UXO items including HE and smoke projectiles, HEAT, incendiary and practice rockets, illumination signals, fuzes, and an incendiary hand grenade, as well as over 1500 expended 40mm practice projectiles, were found during the sampling at Range 44 and 45.

A portion of Site OE-15SEA.4 was cleared of OE during site preparation in support of the remediation of spent small arms ammunition and lead contaminated soil at Range 46. The area cleared included a small arms target area and a staging area for crews and equipment, and access and egress routes. A total of twenty-five (25) 100- by 100-foot grids were cleared to a depth of four feet in the vicinity of Range 46 (Plate 4). One UXO item (smoke grenade) and two OE scrap items (practice grenade and projectile fuze) were found during the grid sampling in support of the Range 46 lead remediation.

A TCRA was conducted at Ranges 43-48 to remove surface ordnance easily accessible to trespassers. For safety reasons, ordnance crews were limited to accessing areas with little or no vegetation and no vegetation was removed as part of this removal action. Thousands of UXO and OE scrap items were found and removed during the TCRA, including high explosive, high explosive antitank, practice, and incendiary rockets, high explosive, illuminating, and practice mortars, high explosive, high explosive antitank, shrapnel, practice, illuminating, and smoke projectiles, fuzes, flares, practice missiles, and smoke and illuminating hand grenades.

The results of the limited sampling and removal activities completed to-date indicate that ordnance is distributed throughout the IA site. Additional information regarding the distribution of ordnance at the site will be generated during the interim action.

4.1.4 Conceptual Site Model

Conceptual site models (CSMs) are developed during preliminary site characterization phases to provide a basis for investigation design and identification of potential release 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 contaminant (in this case OE/UXO), and exposure routes (potential scenarios that may result in contact with OE/UXO).

The CSM for Ranges 43–48 is based on currently available site-specific and general information including literature reviews, sampling results, aerial photos, maps, technical manuals, and field observations, and the information shown on Plate 5. After the completion of the Interim Action at Ranges 43-48, data collected will be used to further refine the CSM, which will be included in the basewide Ordnance and Explosives Remedial Investigation/Feasibility Study (basewide OE RI/FS).

Ranges 43–48 are categorized as firing ranges, where personnel were trained in the use of live and practice OE. Firing ranges are areas that were intentionally constructed and/or were used for training personnel in the use of live ordnance and small arms (Plate 5). Firing ranges usually consist of a firing line, firing points, and the target area. The firing line is the line from which weapons are fired and no one is permitted forward of the firing line during the firing of weapons. The firing points are numbered positions to which personnel are assigned. The target area is the point or location at which the weapon is fired. Depending on the historical use of the firing range, it may contain surface and subsurface UXO (including high explosives and pyrotechnics) that may present an explosive hazard to the public. The hazard level would be influenced directly by the type of UXO, the proximity of the UXO to the surface, the accessibility of the site to the public, and the activities the public may engage in when trespassing onto the site.

4.1.4.1 Site Features

For the purposes of this IA RI/FS, the conceptual site model for Ranges 43- 48 is discussed here as a single area of concern because of the similarity of ordnance types, the overlapping range fans, the likelihood that similar types of OE/UXO are distributed throughout the site, and potential access/exposure routes to receptors. Only Range 46 appears to have been used exclusively for small arms training throughout its existence. However, because it is flanked and overlapped by adjacent ranges that have been used for training with high explosives, it is also expected to contain UXO. Targets on Ranges 43-48 were either placed in specified patterns or randomly placed and consisted of armored personnel carriers (APCs), trucks, dumpsters, and steel silhouettes (Plate 3). Distance to existing targets from the firing lines at each range depended on the type of training performed at the time of base closure. Placement of targets varies from rows and groupings of targets (Range 45) to vehicles placed in front of, behind, and on top of ridges (Range 48).

4.1.4.2 Potential Sources and Location of OE/UXO

Ranges 43–48 had been used for live fire exercises from at least the 1940s to base closure. Available information indicates the ranges were used for training with a variety of different ordnance including mortars, rockets, rifle and hand grenades, projectiles, practice mines, and missiles. The range configurations have remained roughly the same in this area since the mid-1960s. Information regarding the past use of individual ranges is presented in Section 4.1.3. Training was performed using indirect and direct fire weapons. In general, indirect fire is long range fire from weapons such as artillery and mortars at targets that may or may not be visible within the range. Direct fire is generally shorter in distance and usually consists of firing at visible targets using ordnance such as 40mm grenade launchers, bazookas, and LAW rockets. Because

Ranges 43- 48 were used for a variety of direct and indirect fire weapons, UXO is known or expected to be distributed throughout the ranges on the surface and in the subsurface. UXO could be located as close as targets used for thrown hand grenades and as far as 2,400 meters or more for ordnance such as mortars. Other potential sources of OE/UXO could include firing lines and burial pits, which have yet to be evaluated.

4.1.4.3 Potential Exposure Routes

Access to Ranges 43-48 is currently restricted to authorized personnel only. Potential exposure to OE/UXO by unauthorized persons has occurred and could occur through trespassing incidents. An Ordnance and Explosives Site Security Program Summary (*Army, 2001b*) to mitigate such incidents is currently being implemented by the Army. However, the Army has determined that a threat to human health (public safety) or welfare exists at the sites for the following reasons:

- Areas in and around the former firing ranges contain large quantities sensitively fuzed, highly dangerous UXO such as 40mm, 57mm, 60mm, 66mm, 81mm, and 84mm HE and HEAT projectiles and mortars, present on the ground surface or predominantly within the uppermost one foot of soil.

- Existing access deterrents such as barbed-wire fencing, concertina wire, and chain link gates posted with warning signs discourage, but do not prevent entry into the sites. Trespassers may knowingly or unknowingly come in contact with these items and cause them to detonate.

- Recent exposures (without injuries) have been documented through instances of unauthorized access into the MRA by persons, including children, who have removed training items and ordnance related scrap. In the last three years, five incidences of persons trespassing into the Range 43-48 area occurred.

- OE workers will have direct contact through physical disturbance of OE/UXO during remediation operations. Trespassers may have contact through intentional disturbance such as removal of an item, or unintentional contact through ground pressure as they walk over the item.

4.2 Range 30A

The Remedial Investigation for Range 30A is presented in the following section.

4.2.1 General Site Information

General site information for Range 30A is summarized below.

4.2.1.1 Location

Range 30A includes approximately 388 acres located in the southeastern portion of the MRA, approximately 1,500 feet north of South Boundary Road and to the west of Barloy Canyon Road (Plate 6). Range 30A lies adjacent to former Firing Ranges 29, 30, and 31. This IA site consists of approximately 400 acres of land that includes the former 30A Firing Range. The IA site was delineated based on the presence of 40mm HE projectiles and is designated as habitat reserve.

4.2.1.2 Reuse

As part of the closure of Fort Ord, the MRA will be transferred to the BLM and most of the MRA will remain undeveloped as habitat reserve. The HMP for Former Fort Ord (*USACE, 1997*) presents the revised boundaries of the habitat reserve areas and describes special land restrictions and habitat management requirements for habitat management target species within the HMP reserve areas. Management of the habitat reserve area will fall under the jurisdiction of BLM.

4.2.1.3 Topography and Geology

Elevations at Range 30A range from approximately 900 feet MSL near the Range 30A firing points to approximately 550 feet MSL at the northwest end (down range) of the IA site. The topography dips gently toward the northwest and contains a small closed drainage depression trending generally from southeast to northwest. The rolling topography is typical of terrain formed by Pleistocene-age dune deposits that may be up to 250 feet thick. These dune deposits cover the majority of the MRA. The mature plant communities described in Section 4.2.2 largely stabilize these widespread, unconsolidated deposits. This soil type is identified as "sand" in the Phase 2 EE/CA (*Army, 1998c*).

4.2.1.4 Population, Proximity, and Access

The Range 30A IA site is located in close proximity (approximately 2,200 feet north) to the Laguna Seca residential area and Laguna Seca Golf Course, and less than a mile from the Laguna Seca Raceway as shown on Plate 2. South Boundary Road, located approximately 2,000 feet to the south, is open to vehicular traffic during events at Laguna Seca Raceway and is always open to the public for jogging, hiking, and biking. Range 30A is part of the Fort Ord MRA. The MRA is fenced and posted with signs warning of the dangers associated with unexploded ordnance. Existing access deterrents such as four-strand barbed-wire fencing with one to two rolls of concertina wire behind it that surrounds the MRA, chain link gates reinforced with concertina wire, and warning signs posted approximately every 500 feet along the fencing discourage, but do not prevent entry into the area. Several instances of unauthorized access by persons including children trespassing into the MRA within thousands of feet of Range 30A have been documented. Personnel from the Army, BLM and USACE routinely check the MRA fences to ensure that they remain in good condition and to identify/complete needed repairs in a timely manner. The fences are maintained through an inter-service support agreement with BLM (*Army, 2001b*). Plate 2 shows the location of the IA site relative to surrounding communities and schools.

4.2.1.5 History of Use

Range 30A was constructed in 1990 as a 40mm machine gun range and was in use until 1993. This range included four firing lanes with targets spaced at 400, 600, 800, 1,100, and 1,500 meters from the firing points. According to the Fort Ord Training Ranges Standard Operating Procedure (SOP), the only weapon authorized for use at Range 30A from 1991 and 1992 was the MK19 40mm machine gun, Mod 3. Ammunition authorized for use at Range 30A included HE and TP. The MK19 has a maximum range of 2,200 meters.

Additionally, helicopter firing points were located to the east of Range 30A. The direction of fire from the helicopter firing points was from east to west with some of the targets being located in the vicinity of Range 30A. Because some of the helicopter targets were located near Range 30A, the possibility exists that ordnance fired from the helicopters (typically 40mm projectiles) may have landed within the Range 30A IA site.

4.2.2 Vegetation Status

The dominant shrub species observed at Range 30A are the same as or similar to those found at Ranges 43-48 as described in Section 4.1.2. The following species are dominant at Range 30A and in general, are distributed throughout mature, intermediate-aged, and disturbed habitat: (1) shaggy-barked manzanita, (2) chamise, (3) sandmat manzanita, and (4) Monterey ceanothus. Table 1 provides a list of HMP species found at Fort Ord and their associated status.

4.2.2.1 Vegetation Type

Baseline chaparral data has not been collected at Range 30A. Vegetation type and density at Range 30A is based upon a review of aerial photographs and the results of the *Annual Monitoring Report for Biological Baseline Studies at Unexploded Ordnance Sites* (*USACE, 1994*). Range 30A appears to be dominated by mature chaparral habitat. Mature chaparral habitat is evenly distributed over approximately 90 percent of the site. A few areas of bare ground are also located on this site. The largest area of bare ground is located parallel to the existing access road. HMP herbaceous annual species are most likely to be found in the bare ground area located on Range 30A. Baseline surveys conducted in the vicinity of the IA site (*Harding ESE, 2001a*) observed that disturbed habitat was often found along unused access roads.

4.2.2.2 Vegetation Density

Based on aerial photographs and the results of the *Annual Monitoring Report for Biological Baseline Studies at Unexploded Ordnance Sites* (*USACE, 1994*), the most dominant shrub species at Range 30A include shaggy-barked manzanita and chamise. It is estimated that these two species provided over 60 percent of the overall vegetative cover at Range 30A. The density estimates of species in disturbed habitat are not available for this site. Maps provided by Jones & Stokes Associates, Inc. from 1996 show a low density of Monterey spineflower exists on Range 30A.

4.2.2.3 Habitat Designation

Range 30A is located in BLM Parcels F1.11.1 and F1.7.1. The HMP identifies Range 30A as a habitat reserve area, which will be maintained as an open space area that will not be used for development. Habitat reserve areas support plant and animal species that require implementation of mitigation measures identified in the HMP to ensure compliance with the ESA and to minimize potential adverse impacts to listed species.

4.2.3 OE-Related Information

This section provides a summary of OE-related information.

4.2.3.1 Site Characterization Activities

To date, only limited OE sampling has occurred within the Range 30A IA site. Limited OE data was collected as part of the MRA grid sampling and during the establishment of a fuel break around the perimeter of the range. The TCRA, which included the removal of only surface UXO and OE scrap, was completed to reduce the threat to public safety posed by the presence of UXO at the IA site. A detailed list of UXO and ordnance scrap items (including the number found and removed), grouped by investigation activity, is provided in Table 3.

4.2.3.2 Summary of Field Activities Completed To-Date

Within the Range 30A IA site, two grids were sampled as part of the MRA sampling effort (G-3 and G-40). The grids were sampled to depths of four feet and every discovered anomaly was investigated (Plate 6). Neither MRA grid was located within the range fan associated with Range 30A. Several OE scrap items (37mm and 57mm TP projectiles, and 76mm projectile canisters) were found and removed from Grid G-40. No ordnance items were found within Grid G-3.

Additional OE data was gathered as part of the clearance of a fuel break around the perimeter of Range 30A. UXO items found within the fuel break included HE, LE, shrapnel, smoke, and illumination projectiles, and smoke grenades. OE scrap items found included 60mm and 81mm HE, illumination, WP, and smoke mortars, 37mm HE and LE, practice and armor piercing training projectiles, 40mm practice and smoke projectiles, 8-inch, 75mm, 105mm, and 155mm shrapnel and high explosive projectiles,

projectile fuzes, flares, and WP and smoke hand grenades.

A Time Critical Removal Action (TCRA) was conducted at IA Site Range 30A to remove surface ordnance easily accessible to trespassers. No vegetation was cut for this action. For safety reasons, ordnance crews were limited to accessing areas with little or no vegetation. UXO and ordnance scrap items found and removed during the TCRA included high explosive and practice mortars, and high explosive and shrapnel projectiles.

Because of the limited sampling performed at Range 30A little information is known concerning the distribution of ordnance at this site. It is anticipated that heavy concentrations of UXO and ordnance scrap are present within Range 30A. Additional information regarding the distribution of ordnance at the IA site will be generated during the OE Remedial Action process.

4.2.4 Conceptual Site Model

This section presents the conceptual site model (CSM) for Range 30A, which is based on currently available site-specific and general information including literature reviews, sampling results, aerial photos, maps, technical manuals, field observations, and the information shown on Plate 7. Depending on the vegetation clearance alternative chosen to support the OE remedial action at Range 30A, portions of other ranges to the south such as Range 28, 29, and 30 may or may not need to be incorporated into the area of remediation. Information regarding the past use of the range is also presented in Section 4.2.1.

A discussion of the process for developing a CSM and the types of information that are incorporated has been provided in Section 4.1.4. As described earlier, conceptual site models (CSMs) are developed during preliminary site characterization phases to provide a basis for investigation design and identification of potential release and exposure routes. As described in Section 4.2.3, limited sampling has been conducted in the vicinity of, but not within Range 30A. Therefore, the CSM for this range is based largely on available information resulting from analysis of literature, aerial photos, maps, technical manuals, range design drawings, and field observations. After the completion of the Interim Action at Range 30A, data collected will be used to further refine the CSM, which will be included in the future basewide ordnance and explosives remedial investigation/feasibility study (OE RI/FS). Information regarding the adjacent ranges is provided below to supplement the CSM. The hazard level would be influenced directly by the type of UXO, the proximity of the UXO to the surface, the accessibility of the site to the public, and the activities the public may engage in when trespassing onto the site.

4.2.4.1 Site Features

Range 30A was constructed in 1990 and used as an MK19 machine gun range from 1990 through 1993. Based on drawings from available files, the range consisted of a firing line with four firing points and dumpster/steel silhouette target groups for each firing point located at distances of 400, 600, 800, 1,100, 1,500, and 2,100 meters from the firing line. Recent field investigations identified two additional target groups outside the boundaries of the IA site. The range is situated such that firing occurred from the firing line positioned on an approximately east-west trending ridge toward targets within the broad flat valley to the northwest (Plate 7).

Range control maps and files show seven helicopter firing points and up to six targets in the vicinity of Range 30A as early as 1982. Firing generally occurred from the east side of the MRA toward the center or High Impact Area. SOPs for this area also indicate that instructional areas for practice mine and demolitions training (labeled “Minefield Training Area” on some diagrams), were available. This training area was described as a sandy area that could be used for practice mine placement and clearing. Several of the helicopter range fans overlap the area. Although only one of the helicopter targets is within

Range 30A, the range fans associated with the helicopter firing points overlap Range 30A suggesting that UXO from those training activities may be found within the area of concern.

Ranges 28, 29, and 30 to the west were used primarily as small arms ranges with some use of subcaliber LAW and 40mm target practice ammunition.

4.2.4.2 Potential Sources and Location of OE/UXO

Range 30A had been used for live fire exercises from 1990 to 1993. Available information indicates the range was used for training with the MK19 machine gun, which fired 40mm TP, HE, and high explosive dual purpose (HEDP) projectiles. UXO is known or expected to be distributed throughout the range on the surface and in the subsurface. Other potential sources of OE/UXO could include firing lines and burial pits, which have yet to be evaluated.

Adjacent Ranges 28, 29, and 30 likely contain UXO in the form of undetonated practice rounds such as the sub-caliber LAW items mentioned above, which contain spotting charges. Based on available records, no high explosive ammunition was authorized on Ranges 28, 29, and 30. However, because of the variety of historical range use at former Fort Ord, the presence of other UXO items in these ranges cannot be discounted.

The presence of at least one helicopter target within Range 30A and multiple helicopter range fans overlapping Range 30A suggests that UXO from those training activities is also likely to be within the area of concern. The records indicate that 40mm, 20mm, and 7.62mm ammunition was authorized.

4.2.4.3 Potential Exposure Routes

Access to Range 30A and adjacent Ranges 28, 29, and 30 is currently restricted to authorized personnel only. Potential exposure to OE/UXO by unauthorized persons has occurred and could occur through trespassing incidents. An Ordnance and Explosives Site Security Program (*Army, 2001b*) to mitigate such incidents is currently being implemented by the Army. However, the Army has determined that a threat to human health (public safety) or welfare or the environment exists at the sites for the following reasons:

- Areas in and around the former Range 30A are known to contain sensitively fuzed, highly dangerous UXO in the form of 40mm HE and HEDP projectiles. Because of their light-weight and low trajectory, they are expected to be present on the ground surface or predominantly within the uppermost one foot of soil.

- Existing access deterrents such as barbed-wire fencing, concertina wire, and chain link gates posted with warning signs discourage, but do not prevent entry into the sites. Trespassers may knowingly or unknowingly come in contact with these items and cause them to detonate.

- Recent exposures (without injuries) have been documented through instances of unauthorized access by persons including children into the MRA and removal of ordnance scrap. In 2001 alone, two incidences of damaged fencing that may have been caused by trespassers occurred within 2,000 feet of Range 30A (near Range 30), and three other incidences of fence damage were reported within 4,000 feet of the range (near Range 29). In addition, two known incidences of persons trespassing into Range 27A occurred within 8,000 feet of Range 30A in the last two years.

- OE workers will have direct contact through physical disturbance of OE/UXO during remediation operations. Trespassers may have contact through intentional disturbance such as removal of an item, or unintentional contact through ground pressure as they walk over the item.

4.3 Site OE-16

The Remedial Investigation for Site OE-16 is presented in the following section.

4.3.1 General Site Information

General site information for Site OE-16 is summarized below.

4.3.1.1 Location

Site OE-16 includes approximately 80 acres located adjacent to and to the north of the MRA, between Eucalyptus and Parker Flats roads and bounded by Watkins Gate Road to the east (Plate 8). This IA site consists of Site OE-16, including approximately 80 fenced acres of land located to the north of Eucalyptus Road, bounded by Parker Flats Road to the north and Watkins Gate Road to the East (Plate 8). Site OE-16 is a former WWII-era 2.36-inch rocket range. The IA site was delineated based on the presence of HE rockets and rifle grenades and is designated as habitat reserve.

4.3.1.2 Reuse

The land that includes Site OE-16 will be transferred to the BLM. This area will become habitat reserve and will remain undeveloped. The HMP for Former Fort Ord (*USACE, 1997*) presents the revised boundaries of the habitat reserve areas and describes special land restrictions and habitat management requirements for habitat management target species within the HMP reserve areas. Management of the habitat reserve area will fall under the jurisdiction of BLM.

4.3.1.3 Topography and Geology

Elevations at Site OE-16 range from approximately 420 feet MSL near the western end to approximately 450 feet MSL at the eastern end of the IA site. The western end of the IA site is relatively flat sloping gently upward to the west and north. This gently rolling terrain is typical of the Pleistocene-age dune sand deposits in this area. These dune deposits may be as much as 250 feet thick. The mature plant communities described in Section 4.3.2 largely stabilize these widespread, unconsolidated deposits. This soil type is identified as "sand" in the Phase 2 EE/CA (*Army, 1998c*).

4.3.1.4 Population, Proximity, and Access

Site OE-16 is located adjacent to the MRA and land that has been transferred to the BLM. The BLM land (immediately adjacent) is open to the public for hiking, biking, jogging, and horseback riding. The IA area (Site OE-16) is surrounded by a temporary 6-foot high chain linked fence posted with signs warning of the dangers associated with unexploded ordnance. The area is in close proximity (approximately one mile) to a residential neighborhood (Fitch Park) on the former Fort Ord. Existing access deterrents such as temporary 6-foot high chain linked fence and a chain link gate posted with warning signs approximately every 500 feet along the fencing discourage, but do not prevent entry into the area. Several instances of unauthorized access by persons into the adjacent MRA have been documented. Personnel from the Army, BLM and USACE routinely check the MRA fences to ensure that they remain in good condition and to identify/complete needed repairs in a timely manner. The fences are maintained through an inter-service support agreement with BLM (*Army, 2001b*). Plate 2 shows the location of the IA site relative to surrounding communities and schools.

4.3.1.5 History of Use

Site OE-16 is a WWII-era rocket range. The area is identified as a "bazooka practice" area on Fort Ord Training Facilities maps dating from 1945 and 1946. Available training maps after 1946 do not identify the bazooka practice area. According to Fort Ord Range Control, this range was probably used as an antitank rocket range

during and shortly after WWII (*Harding ESE, 1994a*). The antitank range was reported to cover an area approximately 400 meters long and 300 meters wide. A portion of a narrow gauge railroad track used to carry moving targets is present on the western end of the range. Other training sites in this area identified on later training maps include a "squad tactics" site (1954 through 1958), a "recoilless rifle training area" (1964 through 1972), a "bivouac area" (1964 through 1984), "concurrent mortar training area" (1972 through 1976), and an "anti-armor training area" (1978 through 1987). According to a range control officer, "concurrent training" referred to "dry fire" (nonfiring) exercises performed prior to conducting live fire training in the MRA, south of Eucalyptus Road.

4.3.2 Vegetation Status

The dominant shrub species observed at Site OE-16 are the same as or similar to those found at Ranges 43-48 as described in Section 4.1.2. The following species are dominant at Site OE-16 and in general, are distributed throughout mature, intermediate-aged, and disturbed habitat: (1) shaggy-barked manzanita, (2) chamise, (3) sandmat manzanita, (4) Monterey ceanothus, and (5) black sage. Table 1 provides a list of HMP species found at Fort Ord and their associated status.

4.3.2.1 Vegetation Type

Baseline conditions for Site OE-16 are documented in the 1996 Annual Monitoring Report (*Harding ESE, 1996*). Vegetation at the site in 1996 consisted primarily of mature chaparral habitat. Along the southern edge of Site OE-16, portions of the site contain grassland habitat. Intermediate-age chaparral habitat has been documented to frequently occur adjacent to grassland meadows transitioning toward mature habitat. A review of aerial photographs indicates many of the access roads are overgrown with vegetation. Baseline surveys conducted in the in the vicinity of the IA site (*Harding ESE, 2001a*) showed that disturbed habitat was often found along unused access roads. Species composition and density is not collected in grassland habitats. The HMP does not require vegetation monitoring for grassland habitats.

4.3.2.2 Vegetation Density

Dominant shrub species observed in mature habitat at Site OE-16 include shaggy-barked manzanita, chamise, Monterey ceanothus, tooth-leafed ceanothus, and sandmat manzanita. These species contributed approximately 63 percent of the overall vegetative cover. Reviews of aerial photographs show that the density of mature habitat has increased. HMP shrub species observed at this site included Monterey ceanothus (11.16 percent), Hooker's manzanita (0.72 percent) and sandmat manzanita (9.18 percent). Bare ground (13.91 percent) and herbaceous cover (9.55 percent) were high at this site. The *Fort Ord 1994 Annual Monitoring Report for Baseline Studies at Unexploded Ordinance Sites* (*USACE, 1994*) states that Monterey spineflower is known to exist. Surveys for HMP herbaceous annual species conducted at Site OE-16 in 1996 identified low densities of Monterey spineflower at the edges of coast live oak woodland and grasslands and in openings in coastal scrub and chaparral (*Harding ESE, 1996*)

4.3.2.3 Habitat Designation

Site OE-16 is located in Transfer Parcel F1.3. The HMP identifies Site OE-16 as a habitat reserve area, which will be maintained as an open space area that will not be used for development. Habitat reserve areas support plant and animal species that require implementation of mitigation measures identified in the HMP to ensure compliance with the ESA and to minimize potential adverse impacts to listed species.

4.3.3 OE-Related Information

This section provides a summary of OE-related information for Site OE-16.

4.3.3.1 Site Characterization Activities

Limited sampling activities have occurred at Site OE-16. Information used to characterize the site was generated during fire training and fuel break clearance activities, and during field trials conducted as part of the Ordnance Detection and Discrimination Study (ODDS; *USACE, 2001*). The TCRA, which included the removal of only surface UXO and OE scrap, was completed to reduce the threat to public safety posed by the presence of UXO at the IA site. A detailed list of the UXO and ordnance scrap items (including the number found and removed), grouped by investigation activity is provided in Table 4.

4.3.3.2 Summary of Field Activities Completed to Date

Limited sampling activities have occurred at Site OE-16. Initial OE-related information for Site OE-16 was generated during wildland fire-fighting training activities that occurred near there in 1991. During a controlled burn of land immediately adjacent (to the northeast) of Site OE-16, numerous 2.36-inch rockets and rifle grenades were found, some of which contained high explosive filler. On the basis of this discovery, a recommendation was made to perform an OE clearance over the burned area. Approximately 1,000 rockets were removed as a result of the clearance.

In 1998 a 30-foot wide fuel break composed of contiguous 30- by 110-foot grids placed around the perimeter of the site were subjected to a complete removal to a depth of four feet over each grid (Plate 8). Numerous UXO and ordnance scrap items including, HE and practice 2.36-inch rockets, practice antitank mines, HEAT, practice, and smoke projectiles (37mm and rifle grenades), grenade fuzes, and illumination signals, were found during this removal activity (Table 4).

A portion of Site OE-16 was investigated as part of the Field Trial Sites phase of the ODDS (*USACE, 2001*). Four 100- by 100-foot grids were investigated within Site OE-16, including the area around the narrow gauge railroad track (Plate 9) (*USACE, 2001*). Several UXO items including, four HEAT rifle grenades, one rifle grenade fuze, and one HE 2.36-inch rocket, as well as hundreds of ordnance scrap items (predominantly practice 2.36-inch rockets) were found and removed (Table 4).

A Time Critical Removal Action (TCRA) was conducted at IA Site OE-16 to remove surface ordnance easily accessible to trespassers. No vegetation was cut for this action. For safety reasons, ordnance crews were limited to accessing areas with little or no vegetation. UXO items found and removed during the TCRA included a high explosive antitank rocket, a practice rocket, antitank missile launching simulators, and an artillery simulator. Two expended practice rockets were also removed.

4.3.4 Conceptual Site Model

This section presents the CSM for Site OE-16. Information regarding the past use of the site is also presented in Section 4.3.1.5. A discussion of the process for developing a CSM and the types of information that are incorporated has been provided in Section 4.1.4. As described earlier, CSMs are developed during preliminary site characterization phases to provide a basis for investigation design and identification of potential release and exposure routes. As described in Section 4.3.3, limited site data has been collected, primarily during fuel break construction and the completion of the ODDS (*USACE, 2001*). Therefore, the CSM for this site is based largely on available information resulting from analysis of literature, aerial photos, maps, technical manuals, range control files, and field observations, and the information shown on Plate 10.

After the completion of the Interim Action at Site OE-16, data collected will be used to further refine the CSM, which will be included in the basewide OE RI/FS. The hazard level would be influenced directly by the type of UXO, the proximity of the UXO to the surface, the

accessibility of the site to the public, and the activities the public may engage in when trespassing onto the site.

4.3.4.1 Site Features

Site OE-16 was identified on historical training facilities maps (circa 1945) as a practice bazooka (2.36-inch rocket) range. Features identified on a 1949 aerial photo include what appears to be six firing points and five targets in a row down range with an additional single target further down range (Plates 8 and 10). Disturbed vegetation patterns forming streaks from the firing points to and beyond the targets indicate that low angle firing and/or vegetation clearance for target visibility occurred in that area. Although maps showing the configuration of range fan(s) and direction of fire are not available, features on the aerial photo and the locations of UXO and ordnance scrap indicate firing was to the north. Evidence at the site shows that both practice and HEAT rockets were used at the site. Practice and HE antitank rifle grenades have also been found at the site and appear to be of the same general period (WWII and Korean War era). However, available information does not indicate in which direction the rifle grenades were fired.

As described in Section 4.3.1.5, post-1946 maps do not indicate a bazooka range in this location. Subsequent uses of the area or portions thereof have included squad tactics, recoilless rifle training, bivouac, and concurrent mortar training. The term "concurrent mortar training" indicates non-firing practice. The recoilless rifle training area indicated on maps from approximately 1964 through 1972 is expected to have been for concurrent training based on conversations with the USACE OE Safety Specialist (the area is too small for live fire) and the lack of UXO/ordnance scrap suggesting live recoilless rifle fire in the area.

It appears that the last use of the area before base closure was as an anti-armor training area (Plate 9). Range control diagrams and aerial photos show numerous obstacles, berms, entanglements, and other mock-battlefield structures designed to train troops in moving in the vicinity of and attacking armored vehicles. Several practice antitank mines have been found on the site, which is consistent with this type of training. A portion of a narrow gauge track approximately 90 feet long is present in the western portion of the site. It appears that the track extended further to the east based on the berm extending beyond the existing track. The track was originally thought to have been part of the bazooka range mentioned above. However, during the recent removal of the tracks, the OE contractor discovered hundreds of buried 2.36-inch practice rockets beneath the tracks, which indicates the tracks were installed after use as a bazooka range and were likely part of the anti-armor training course.

4.3.4.2 Potential Sources and Location of OE/UXO

Available information indicates Site OE-16 had been used for training and live fire exercises with practice and HE rockets and rifle grenades in the 1940s and possibly the early 1950s. The site was later used for a portion of time as an anti-armor training area based on available documentation and the presence of training structures and practice landmines. UXO is known or expected to be distributed throughout the site on the surface and in the subsurface. Other potential sources of OE/UXO could include firing lines and burial pits, which have yet to be evaluated. Documentation regarding the use of the eastern portion of the site is limited, but correspondence and edited maps indicate that numerous rifle grenades may have been found there in the early 1990s.

4.3.4.3 Potential Exposure Routes

Site OE-16 is currently enclosed by a chain link fence and access is restricted to authorized personnel only. Potential exposure to OE/UXO by unauthorized persons has occurred and could occur through intentional trespassing incidents. An Ordnance and Explosives Site Security Program (*Army, 2001b*) to mitigate such

incidents is currently being implemented by the Army. However, the Army has determined that a threat to human health (public safety) or welfare or the environment exists at the site for the following reasons:

- The area within Site OE-16 is known to contain sensitively fuzed, highly dangerous UXO in the form of 2.36-inch rockets and rifle grenades. Because of their light weight and low trajectory, they are expected to be present on the ground surface or predominantly within the uppermost one foot of soil.

- Existing access deterrents such as temporary 6-foot high chain link fencing and a chain link gate posted with warning signs approximately every 500 feet discourage, but do not prevent entry into the site. Trespassers may knowingly or unknowingly come in contact with UXO and cause it to detonate.

- Recent exposures (without injuries) have been documented through instances of unauthorized access by persons, including children, into the adjacent MRA and removal of ordnance scrap. In 2001, an incidence of persons trespassing within the MRA adjacent to Site OE-16 was reported. In addition, five incidences of trespassing into the MRA adjacent to Site OE-16 occurred within the last three years.

- OE workers will have direct contact through physical disturbance of OE/UXO during remedial activities. Trespassers may have contact through intentional disturbance such as removal of an item, or unintentional contact through ground pressure as they walk over the item.

5.0 INTERIM REMEDIAL ACTION OBJECTIVES AND SELECTION OF INTERIM ACTION SITES

This section discusses the Interim Remedial Action Objectives and Interim Action site selection process, and summarizes the site-specific rationale for development of Interim Action Alternatives for the three IA sites: Ranges 43–48, Range 30A, and Site OE-16.

5.1 Interim Remedial Action Objectives

The primary purposes for developing Interim Remedial Action Objectives (RAOs) are to reduce risks to human health and the environment associated with OE. Current risk from OE and cleanup goals related to the Interim Remedial Action Objectives are discussed below.

5.1.1 Current Risk from Ordnance and Explosives

Evaluation of risk from contact with OE cannot be quantitatively estimated based on current information. However, qualitative discussion of overall risk due to OE is valuable in evaluating various OE related factors that lead to adverse human health outcomes. Evaluation of OE risk is best discussed in terms of the likely contact of humans with OE items and the type of OE items. The greater the likelihood of contact, the greater the risk. In general, risks from contact with OE are acute and potentially catastrophic in nature, and may result in crippling injuries or death.

OE-related factors that must be considered in the discussion of OE risk include:

- Size and type of OE (the smaller the item, the more tempting it is to pick it up)
- Type of fuze (some fuzes are more sensitive than others)
- Amount of OE present in an area (the more OE present, the more likely some will be found)
- Accessibility of any area containing OE to human activities (the more easily accessible the area, the more likely people will use it; also the greater the population in close proximity to a site, the more people will use an area).

All three IA sites evaluated under this IA RI/FS are in close proximity to residential areas. Although these sites are fenced to limit access to authorized personnel only, trespassing incidents have been recorded. Many types of OE items have been found at the ranges, but chief among these are highly portable items containing extremely sensitive fuzes, such as 40 mm grenades, bazooka rockets, and various HE projectiles and mortar rounds. Because of the nature of the ordnance used on these ranges, much of it is on the surface and is readily accessible to unauthorized personnel. The surface and shallow subsurface OE items represent the greatest risk.

5.1.2 Cleanup Goals

An Interim Action is a remedial action that can be implemented quickly and that, although not necessarily intended as a final remedial measure at a site, substantially reduces potential immediate, imminent, and/or substantial risks to human health and is consistent with long term goals. The cleanup goals for Interim Action at Ranges 43-48, Range 30A, and Site OE-16 are to take OE Remedial Action at these sites to minimize OE risks.

Remedial activities conducted at the IA sites will be further evaluated under the basewide OE RI/FS to determine adequacy of actions taken and the need for further action, if any. The OE RI/FS will evaluate:

- The effectiveness of the geophysical detection instruments used
- Conceptual site models vs. actual field conditions
- Completeness of IA remedial actions relative to data quality objectives for the OE RI/FS program
- Assessment of any potential residual OE risks
- The need for long-term risk management measures to address any potential residual OE risks.

5.2 Selection of Interim Action Sites

Ranges 43–48, Range 30A, and Site OE-16 were selected for Interim Action based on the site eligibility criteria and rationales presented below.

5.2.1 Site Eligibility Criteria

The site eligibility criteria for Interim Action at these OE areas include the presence of an imminent threat/OE hazard due to:

- The presence of highly dangerous OE (sensitive fuzing and high explosives) on or near ground surface.
- Areas in close proximity to the public. The locations of the Interim Action sites relative to neighboring communities are shown on Plate 2.
- Dense vegetation that obscures the presence of sensitive OE on the ground.
- Existing access deterrents such as barbed-wire fencing, concertina wire, chain link fencing and chain link gates posted with warning signs discourage, but have not prevented entry into these areas.

5.2.1.1 Imminent Threat and OE-Related Hazards

Imminent threats and OE hazards were described in Section 4.0 and are summarized below. In general, these sites are eligible for Interim Action because each of the IA sites contains high explosives on or near ground surface in areas that are near the public and imminent threats from OE present at these sites must be mitigated to protect human health and the environment.

IA remedial activities will be performed in accordance with Title 40, Code of Federal Regulations, Part 300, Section 430 and as described in this report. Title 40, Code of Federal Regulations, Part 300, Section 430 provides in part that at any release, regardless of whether the site is included on the National Priorities List, the lead agency (the Army) may take any appropriate action to abate, prevent, minimize, stabilize, mitigate, or eliminate the release or the threat of release [Subsection (b)(1)].

5.3 Rationale

The following sections summarize the site-specific rationale for conducting Interim Action at each of the IA sites. In general, each of the IA sites contains high explosives on or near ground surface in areas that are near the public and potential access to OE at these areas must be mitigated to protect human health and the environment.

5.3.1 Ranges 43–48

The rationale for conducting an Interim Action at Ranges 43–48 is that highly dangerous OE is present in ranges that are adjacent to residential areas and schools with heavy vegetative cover that obscures the presence of OE as summarized below.

- **Population, Proximity, and Access:** This IA site is adjacent to residential neighborhoods on the former Fort Ord (Fitch and Marshall Park) and near the City of

Seaside. The Fitch and Martin Luther King Jr. Middle Schools are located less than a mile from Ranges 43-48. These ranges were part of the Fort Ord MRA and are categorized as firing ranges where personnel were trained in the use of live OE. The MRA is fenced and posted with signs warning of the dangers associated with unexploded ordnance. Existing access deterrents such as barbed-wire fencing, concertina wire, and chain link gates posted with warning signs discourage, but do not prevent entry into the ranges. Several instances of unauthorized access by persons into the Range 43-48 IA site have been documented.

- **Vegetation Status:** Over the majority of the ranges, vegetation is often densely knitted together, and the composition, texture, thickness, and resistance of the vegetation vary by species, community composition, and area. In some areas the vegetation is a dense knit of small but stiff stems; in other areas the shrubs are dominated by large stems with a canopy of leaves held well above the ground. In general, dense vegetation at the ranges obscures the presence of OE on the ground surface in these areas and may even contain OE in aboveground branches and brush.

- **Presence and Type of OE:** Areas in and around the former firing ranges contain large quantities of sensitively fuzed, highly dangerous UXO such as 40mm, 57mm, 60mm mortar, 66mm, 81mm mortar, and 84mm HE and HEAT projectiles, and dragon guided missiles present on the ground surface or predominantly suspected to occur within the uppermost one foot of soil.

5.3.2 Range 30A

The rationale for conducting an Interim Action at Range 30A is that highly dangerous OE is present in areas at the ranges that are adjacent to residential areas with heavy vegetative cover that obscures the presence of OE as summarized below.

- **Population, Proximity, and Access:** The Range 30A IA site is located in close proximity (approximately 2,200 feet north) to the Laguna Seca residential area, the Laguna Seca Golf Course and less than a mile from the Laguna Seca Raceway. South Boundary Road, located approximately 2,000 feet to the south, is open to vehicular traffic during events at Laguna Seca Raceway and is always open to the public for jogging, hiking, and biking. Range 30A is part of the Fort Ord MRA. The MRA is fenced and posted with signs warning of the dangers associated with unexploded ordnance. Existing access deterrents such as four-strand barbed-wire fencing, concertina wire, and chain link gates posted with warning signs discourage, but do not prevent entry into the area. Instances of unauthorized access by persons including children into the MRA have been documented.

- **Vegetation Status:** Over the majority of the range, vegetation is often densely knitted together, and the composition, texture, thickness, and resistance of the vegetation vary by species, community composition, and area. In some areas the vegetation is a dense knit of small but stiff stems; in other areas the shrubs are dominated by large stems with a canopy of leaves held well above the ground. In general, dense vegetation at Range 30A obscures the presence of OE on the ground surface in these areas and may even contain OE in aboveground branches and brush.

- **Presence and Type of OE:** Range 30A was used for live fire exercises from 1990 to 1993. Available information indicates the range was used for training with the MK19 machine gun, which fired 40mm TP, HE, and High Explosive Dual Purpose (HEDP) projectiles. Highly dangerous UXO is known or expected to be distributed throughout the range on the surface and in

the subsurface. Other potential sources of OE/UXO could include firing lines and burial pits, which have yet to be evaluated. Adjacent Ranges 28, 29, and 30 likely contain UXO in the form of undetonated practice rounds such as the subcaliber LAW items mentioned above, which contain spotting charges. Based on available records, no high explosive ammunition was authorized on Ranges 28, 29, and 30. However, because of the variety of historical range use at former Fort Ord, the presence of other UXO items in these ranges cannot be discounted.

5.3.3 Site OE-16

The rationale for conducting an Interim Action at Site OE-16 is that highly dangerous OE is present in areas at the site that are adjacent to residential areas with heavy vegetative cover that obscures the presence of OE as summarized below.

- **Population, Proximity, and Access:** Site OE-16 is located adjacent to the MRA and land that has been transferred to the BLM. The BLM land is open to the public for hiking, biking, jogging, and horseback riding. IA Site OE-16 is surrounded by a temporary 6-foot high chain linked fence posted with signs warning of the dangers associated with UXO. The area is in close proximity to a residential neighborhood (Fitch Park) on the former Fort Ord. Existing access deterrents such as temporary 6-foot high chain link fencing and chain link gates posted with warning signs discourage, but do not prevent entry into the area. Several instances of unauthorized access by persons into the adjacent MRA have been documented.

- **Vegetation Status:** Over the majority of the site, vegetation is often densely knitted together, and the composition, texture, thickness, and resistance of the vegetation vary by species, community composition, and area. In some areas the vegetation is a dense knit of small but stiff stems; in other areas the shrubs are dominated by large stems with a canopy of leaves held well above the ground. In general, dense vegetation at Site OE-16 obscures the presence of OE on the ground surface in these areas and may even contain OE in aboveground branches and brush.

- **Presence and Type of OE:** Available information indicates that Site OE-16 had been used for training and live fire exercises from approximately the 1940s until the time the base was officially closed in 1994. The site was used for a portion of the time as an anti-armor training area based on available documentation and the presence of numerous whole and partial 2.36-inch rockets, antitank rifle grenades, and abundant fragmentation on the ground surface. Evidence from the site indicates that both practice and HEAT rounds were used. UXO is known or expected to be distributed throughout the site on the surface and in the subsurface. Other potential sources of OE/UXO include firing lines and burial pits, which have yet to be evaluated.

6.0 INTERIM ACTION FEASIBILITY STUDY

This section presents the Interim Action Feasibility Study for the IA sites at Fort Ord, including:

- Section 6.1 – Development and Screening of Interim Action Alternatives
- Section 6.2 – Applicable or Relevant and Appropriate Requirements (ARARs)
- Section 6.3 – Evaluation and Comparison of the Interim Action Alternatives.

As outlined in EPA guidance for Interim Action RI/FSs (*EPA, 1988*) and specified in the National Contingency Plan for CERCLA sites, the development and screening of remedial alternatives is performed in this section based on the nine EPA evaluation criteria described below. Based on the results of the screening, the alternatives are retained or eliminated from further consideration in Section 6.1; ARARs for the retained alternatives are described in Section 6.2; and a more detailed analysis and comparison of the alternatives based on the evaluation criteria is presented in Section 6.3. Section 7.0 presents the selection of the Preliminarily Identified Preferred Interim Action Alternatives for each of the IA sites based on the evaluation, comparison, and ARARs analysis; Section 8.0 summarizes the approval process for the IA sites. The Preferred Interim Action Alternatives for each of the IA sites will be selected and documented in the ROD.In order to perform comprehensive OE-related actions at these sites, a three-tiered approach to developing Interim Action Alternatives for the three different components of the actions must be considered. Interim Action Alternatives for each of the three IA sites will include the following components:

- **Vegetation Clearance Alternatives** address site preparation procedures to clear vegetation to bare ground or approximately 6 inches above ground surface to allow for proper operation of UXO detection equipment and to provide the required ground surface visibility for the safety of OE workers at the IA sites.
- **OE Remedial Action Alternatives** address remedial procedures to mitigate threats associated with the presence of OE at the IA sites.
- **OE Detonation Alternatives** address detonation procedures in areas where UXO is identified during remedial activities at the IA sites.

Descriptions and applicable methods for carrying out each of these alternatives at the IA sites are described in the following section. In addition, this section presents the development of site-specific three-tiered Interim Action Alternatives for each of the IA sites, which are then subjected to an analysis of ARARs in Section 6.2 and evaluated and compared in Section 6.3 based on the CERCLA criteria of effectiveness, implementability, and cost.

6.1 Development and Screening of Interim Action Alternatives

The three-tiered Vegetation Clearance, OE Remedial Action, and OE Detonation Alternatives are described below and screened for applicability based on general site conditions at the IA sites and their ability to achieve the EPA evaluation criteria described below.

The screening and evaluation of alternatives are based on the nine criteria specified in the U.S. Environmental Protection Agency's (EPA) *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (*EPA, 1988*) (RI/FS Guidance). These nine criteria are:

1. Overall Protection of Human Health and the Environment
2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) (see Section 6.2 and Table 5)
3. Long-Term Effectiveness and Permanence
4. Reduction of Toxicity, Mobility, or Volume Through Treatment
5. Short-Term Effectiveness
6. Implementability
7. Cost
8. State Acceptance
9. Community Acceptance.

These criteria for remedial action are addressed below in a parallel format for vegetation clearance.

6.1.1 Vegetation Clearance Alternatives

A range of vegetation clearance methods identified as potentially applicable for clearing vegetation at the IA sites are described and evaluated in Appendix A (Screening Evaluation of Vegetation Clearance Methods), which provides a screening and evaluation of vegetation clearance methods. The methods evaluated include: (1) No Action, (2) Manual and Mechanical Clearing, (3) Prescribed Burning (with and without pre-treatment by herbicide application or crushing), (4) Animal Grazing, and (5) Herbicide Application. Based on the screening and evaluation of vegetation clearance methods presented in Appendix A, the following methods were retained for further consideration for all three IA sites:

- No Action
- Prescribed Burning
- Mechanical Methods
- Manual Methods.

This section presents a summary of the three vegetation clearance methods listed above, which were retained for further consideration as Vegetation Clearance Alternatives herein.

6.1.1.1 No Action

The No Action Alternative is provided, as required under CERCLA and the National Contingency Plan (NCP), as a baseline for comparison to the other proposed alternatives. This alternative assumes no action would be taken to clear vegetation prior to remedial activities. There are no capital or operation and maintenance costs associated with the No Action Alternative.

6.1.1.2 Prescribed Burning

Prescribed burning is the use of fire under a specific set of conditions to burn vegetation. Prescribed burning is used in a large number of plant communities in California to achieve a range of objectives. Most commonly, the objectives for which a prescription is developed are one or more of the following: fuel hazard reduction and control; range improvement; agricultural land clearing; commercial forest stand improvements; slash reduction or removal (tree cutting operations); and habitat maintenance or enhancement.

The following parameters would be associated with conducting prescribed burning for purposes of vegetation clearance.

Impacts to the Public

Conducting a prescribed burn within the IA sites is not expected to have adverse impacts on the public because it would include informing and offering support to affected residents and coordinating relocation efforts during and for a period after the burn. Prior to the burn, Army personnel will coordinate relocation efforts and ensure the public is informed of the planned burn through a notice in a local newspaper, public meetings, and other avenues of

communication as appropriate. The prescribed burn would be conducted under optimal climatic conditions to minimize smoke and control the burn within the IA sites. After the burn was completed, air monitoring would continue until after the smoke had cleared and the return of relocated residents would be coordinated. Smoke would be generated for approximately two days during each of the three burns at the three IA sites and residual smoke from burning may remain in the air for several days thereafter.

Burns may have impacts on the public under most meteorological conditions, however, development of the burn prescription would include assessment of meteorological conditions and design of the prescription to minimize potential impacts to the public. Relocation of individuals during the burn to minimize risks would have an impact on the public in terms of the inconvenience involved. Prior public notification, smoke management while conducting the burn, and temporary relocation of individuals from areas affected by smoke to unaffected areas would minimize potential impacts of the emissions.

An assessment of OE-related air emissions that may be associated with conducting a burn was conducted in the Air Emissions Technical Memorandum (see "Air Emissions" subheading below), which indicated air pollutant emissions from incidental OE detonation during a prescribed burn in Ranges 43 through 48 (also applicable to burning of CMC habitat at the other IA sites) would be minor compared to emissions contributed directly by biomass burning, and would result in pollutant concentrations well below health-protective regulatory screening levels..

The possibility exists for any vegetation clearance method applied at the IA sites to detonate UXO. Mitigation of potential public exposure to flying fragments or blast debris from accidental detonation of UXO during vegetation clearance activities would be addressed in the site health and safety plan for individual areas. In addition, a community safety plan would be provided to present information regarding accidental and intentional detonation of UXO. In general, potential public exposure would be prevented by: (1) conducting a pre-field analysis of the type, size, and orientation of the UXO known or expected to be present in a given area and its proximity to the public,
(2) calculation of the maximum distance flying fragments or blast debris would travel based on the type and size of UXO, and
(3) implementation of mitigation measures if necessary to prevent public exposure. Potential emissions from detonated UXO are expected to be insignificant and not of concern in terms of human health.

How the Method is Carried Out in the Field

The major elements of prescribed burning for purposes of vegetation clearance include the following:

- Preparation of a burn prescription/burn plan outlining the objectives of the burn, the burn area, and the range of environmental conditions (temperature, humidity, wind speed/direction, fuel load, and fuel moisture) under which the burn will be conducted. The burn plan also describes the manpower and equipment resources required to ignite, manage, and contain the fire, and establishes the communication procedures for the fire crew and to the public and other affected agencies.

- Site preparation, including establishment and maintenance of primary, secondary, and tertiary containment lines, staging areas, and escape routes.

- Conducting the burn within the window of environmental conditions established in the burn prescription.

- Follow-up operations to ensure that the fire is fully contained and does not escape the perimeter of the burn area.

Worker Exposure to UXO

Burning of vegetation would be conducted using aerial methods (e.g., via helicopter), which would isolate workers from direct exposure to UXO that is potentially present in areas being cleared. Although some ground crews would be present in fuel break areas and air sampling or meteorological stations will be placed in areas that have been previously cleared of UXO, proper worker awareness, protective equipment, and care would reduce worker exposure to injury.

Accidental Detonation of UXO

In the case of accidental detonation of UXO, prescribed burn workers would not be likely to be exposed to flying fragments or blast debris depending on distance to and the type and size of the UXO. In general, the possibility exists for any vegetation clearance method applied at the IA sites to detonate UXO. The burn would be conducted by personnel located outside the burn area containing UXO, which would minimize exposure. Mitigation of potential public exposure to flying fragments or blast debris from accidental detonation of UXO during vegetation clearance activities would be addressed in the site health and safety plan for individual areas. In addition, a community safety plan would be provided to present information regarding accidental and intentional detonation of UXO.

In general, potential public exposure would be prevented by: (1) conducting a pre-field analysis of the type, size, and orientation of the UXO known or expected to be present in a given area and its proximity to the public, (2) calculation of the maximum distance flying fragments or blast debris would travel based on the type and size of UXO, and (3) implementation of mitigation measures if necessary to prevent public exposure.

Duration of the Vegetation Clearance Method

For a typical IA site, vegetation clearance using prescribed burning would include preparing and relocating affected residents, conducting the burn, and allowing the smoke to clear and continuation of air sampling and monitoring.

Air Emissions

Smoke would be generated for two days during the burn and residual smoke from burning may remain in the air for several days thereafter. However, prior public notification, smoke management while conducting the burn, and temporary relocation of individuals from areas affected by smoke to unaffected areas would minimize potential impacts of the emissions. Potential emissions from detonated UXO are expected to be insignificant and not of concern in terms of human health, the environment, and worker safety. The Army conducted an assessment of OE-related air emissions that may be associated with conducting a burn. The results are presented in the Technical Memorandum, Air Emissions from Incidental Ordnance Detonation During a Prescribed Burn on Ranges 43 through 48, Former Fort Ord (*Harding ESE, 2001c*) (Air Emissions Technical Memorandum) prepared in cooperation with and under review by the regulatory agencies.

The intense fire associated with prescribed burn conditions may result in the detonation of surface or near-surface OE items. Detonation of OE has the potential to release air pollutants to the atmosphere. These air emissions may potentially include combustion products, volatile or semivolatile organic compounds, unburned or incompletely burned energetic material, and particulate metals and metal compounds from chemical components of the OE items. At issue is whether the type or quantity of air emissions from incidental detonation of OE in Ranges 43-48 is significant in comparison to air emissions from prescribed burning of vegetation (biomass) in the same area, or is significant in absolute magnitude.

A Technical Memorandum, Air Emissions from Incidental Ordnance Detonation During a Prescribed Burn on Ranges 43-48, Former Fort Ord (*Harding ESE, 2001c*) (Air Emissions Technical Memorandum) was prepared to (1) quantify a reasonable upper bound estimate

of air emissions from incidental detonation of OE in Ranges 43-48, (2) compare those emissions with those expected from burning of biomass, and (3) compare screening level estimates of pollutant concentrations from OE to health-protective regulatory screening values. Data from this investigation may also be used to guide the development of an appropriate ambient air monitoring program to be implemented during a prescribed burn at Ranges 43-48 if such a prescribed burn is performed. The Air Emissions Technical Memorandum does not address the issue of possible human health effects from biomass burning.

The results of this investigation reveal that reasonable upper bound estimates of air emissions from incidental OE detonation for combustion products and volatile organic compounds are much less than 0.1 percent (i.e., one one-thousandth) of the corresponding emissions from biomass burning in Ranges 43-48. The only exception is for dioxin/furan toxicity equivalent emissions for which the reasonable upper bound OE contribution is about 1percent (i.e., one one-hundredth) of that from biomass. Reasonable upper bound emissions of all particulate metals except Beryllium from incidental OE detonation are equal to or less than 10% (i.e., one-tenth) those from biomass burning. For all pollutants evaluated in this investigation, including Beryllium and those pollutants for which there are no corresponding biomass emissions for comparison, screening model estimates of pollutant concentrations are much less than health-protective regulatory screening values.

The conclusion of this investigation is that air pollutant emissions from incidental OE detonation during a prescribed burn in Ranges 43-48 will be minor compared to emissions contributed directly by biomass burning, and will result in pollutant concentrations well below health-protective regulatory screening levels.

Erosion

Vegetation clearance using prescribed burning may result in some surface disturbance or erosion on slopes in the short term, since fire reduces most of the vegetation to bare mineral soil. However, revegetation of burned areas is likely to proceed rapidly following the start of the next rain season, thus minimizing further erosion potential. In the long term, burning would have a beneficial impact on the health and growth of the plants and their stability.

Impacts to Protected and Other Natural Resources

Burning would have beneficial impacts on rare, threatened and endangered plants present at the IA sites in the long term because chaparral communities in California are adapted to periodic wildfires and the CMC habitat present at the IA sites has evolved to be dependent on fire for its health and functioning. Vegetation that is cleared by burning not only recovers, but flourishes and provides an opportunity for a greater diversity of native plants to grow. Plants and animals at the IA sites have survived, become dependent on, and adapted to a cycle of occasional fire that recycles nutrients and exposes minerals in the soil while stimulating the germination of seeds that accumulate in between fires. This natural succession allows the plant community to rejuvenate itself and enhances the natural diversity of the unique habitat containing rare, threatened and endangered plants at the IA sites. Preliminary observations made during monitoring of habitat recovery after vegetation clearance at Fort Ord (conducted under the HMP monitoring program) support burning as a favorable method for vegetation clearance for the following reasons:

- Seedlings of HMP shrubs were common in burned areas after clearance activities. A preliminary evaluation indicated HMP shrub regeneration occurred in densities over 3,000 seedlings per acre after burning (as compared to only 29 seedlings per acre occurred after cutting).

- Species diversity is generally higher in burned areas.

- More native herbaceous species were observed in burned areas.

In addition, because CMC habitat contains protected species at the IA sites, resource management measures are required by the USFWS as detailed in the Biological and Conference Opinion (BO), memoranda, and other correspondence between USFWS and the Army (*USFWS, 1993, 1997 2001*; *Army, 1998b; 2000*) and in accordance with the HMP (*USACE, 1997*). The intent of the USFWS is that "the Army would primarily use prescribed fire to clear vegetation in support of OE removal actions in areas designated as habitat reserves [and] . . . to preserve, protect, and enhance populations and habitat of listed species and to protect candidate and sensitive species to the extent needed to preclude the need for future listings. Consequently, methods of vegetation clearance in maritime chaparral that do not involve burning are not consistent with the habitat and species preservation and protection goals of the HMP" (*USFWS, 2001*).

There is a risk of escaped fires or wildfires involved in burning vegetation. In 1997, a prescribed burn intended to clear 100 acres jumped the fuel break and spread, burning a total of approximately 400 acres. The intended 100 acres was located between BLM Trails 16 and 103, to the East of Henneken's Ranch Road. The Fire jumped Trail 103 and spread Southeast. The fire's extent spread South to Crescent Bluff Road and East to BLM Trail 22. However, as summarized under the subheading below (Use at Fort Ord or Other Sites and Under What Conditions), many prescribed burns have been successfully conducted without escaping.

Prior to the burn, Army personnel will coordinate relocation efforts and ensure the public is informed of the planned burn through a notice in a local newspaper, public meetings, and other avenues of communication as appropriate. In addition, vegetation and UXO clearance personnel would maintain and prepare fuel breaks surrounding the burn area and forming a containment line. The breaks would be pre-treated immediately before conducting the burn with a fire suppressant foam. In addition, meteorological profiling would be conducted prior to and during the burn. Prescribed burning would be conducted using an operator to pilot the helicopter equipped with a torch to initiate the burn, and several people located at high elevations outside the burn area observing the burn's progress telescopically. A coordination crew of several people would also be involved in planning and monitoring the burn and assessing meteorological conditions and air samples would be collected and analyzed offsite. Fire suppressant crews would stand by during the burn and emergency fire crews from local jurisdictions would be on notice in case the fire traveled in an unplanned manner.

Use at Fort Ord or Other Sites and Under What Conditions

Prescribed burning has been used extensively at former Fort Ord for decades because of military training activities, and has also been used to clear CMC vegetation from OE sites similar to the IA sites to support removal actions at the former Fort Ord since 1994. Prescribed burns are conducted in close coordination with federal, state, and local regulatory agencies. Prescribed burns consist of using fire under optimal climatic conditions to clear vegetation from OE Sites, and is the primary vegetation clearance method for extensive use in designated HMP CMC habitat that exists at the IA sites.

Prescribed burns from 1994 – 1998 resulted in one escape in 1997. An escape is defined as fire outside the control lines that is unmanageable with onsite resources. The Army had originally planned to burn 100 acres. However, this fire resulted in 400 acres being burned. The following table summarizes prescribed burns conducted at Fort Ord.

Year	Acres Burned	OE Site
1994	100	OE-5, OE-47
1995	140	OE 10A, OE-19
1996	0*	N/A
1997	400	OE-10B
1998	215	OE-10A, OE-44

* No burning was conducted in 1996 because vegetation clearance activities were not required.

Availability of Equipment and Personnel

Prescribed burning has been used extensively at the former Fort Ord and the equipment and personnel necessary to implement burning would be available for use at the IA sites under the stringent time constraints associated with a high priority OE Remedial Action.

Deposition of Vegetation

Depending on the provisions of the burn prescription and the occurrence of suitable conditions, the burn would clear or consume the majority of top growth on shrubs, consume the leaf litter, and burn a portion of the standing woody stems. The extent to which woody material would be consumed is directly related to fuel moisture and ambient conditions at the time of the burn. Under relatively cool, moist conditions, very little woody material would be consumed. Under low-humidity, low-fuel moisture conditions, woody vegetation up to 2 inches in diameter may burn.

Visibility of Ground Surface

Safety procedures require the vegetation be cleared to bare ground or approximately 6 inches above ground surface to allow for proper operation of UXO detection equipment and prevent the accidental detonation of UXO on the surface. This level of clearance would be achievable using burning. Fire clears the vegetation and leaves the range in a condition that typically provides OE workers with a clear, unobstructed view of the ground surface.

Regrowth of Vegetation and Maintenance Requirements

Prescribed burning would consume the majority of the vegetation; however, additional cutting may be necessary in certain areas to achieve clearance to bare ground or approximately 6 inches above ground surface depending on the fire conditions. Such additional cutting may only occur after a surface clearance of UXO has been conducted. Protocols for the long-term maintenance of burned areas have been established in the HMP and include five years of monitoring the recovery of the vegetation.

Level of Effort in Terms of Personnel

Prior to the burn, Army personnel will coordinate relocation efforts and ensure the public is informed of the planned burn through a notice in a local newspaper, public meetings, and other avenues of communication as appropriate. In addition, vegetation and OE workers would clear and maintain fuel breaks surrounding the burn area and form a containment line. The breaks would be pre-treated immediately before conducting the burn with a fire suppressant foam. An air sampling and monitoring program would be developed and coordinated by air quality personnel, and air monitoring stations would be set up. In addition, meteorological profiling would be conducted prior to and during the burn. Prescribed burning would be conducted using an operator to pilot the helicopter equipped with a torch to initiate the burn, and personnel would be located at high elevations outside the burn area observing the burn's progress telescopically. A coordination crew would also be involved in planning and monitoring the burn and assessing meteorological conditions. Air samples would be collected and analyzed offsite. Fire suppressant crews would stand by during the burn and emergency fire crews from local jurisdictions would be on notice in case the fire traveled in an unplanned direction. After the burn was completed, air monitoring would continue until after the smoke had cleared and the return of relocated residents would be coordinated.

6.1.1.3 Mechanical Methods

Mechanical clearing is conducted by an operator situated on self-propelled equipment in the work area being cleared. An example would be a worker operating a tractor from inside the cab.

Impacts to the Public

Operation of heavy equipment within the IA sites during mechanical vegetation clearance activities is not expected to have impacts on the public. However, the possibility exists for any vegetation clearance method applied at the IA sites to detonate UXO. Mitigation of potential public exposure to flying fragments or blast debris from accidental detonation of UXO during vegetation clearance activities would be addressed in the site health and safety plan for individual areas. In addition, a community safety plan would be provided to present information regarding accidental and intentional detonation of UXO. In general, potential public exposure would be prevented by: (1) conducting a pre-field analysis of the type, size, and orientation of the UXO known or expected to be present in a given area and its proximity to the public, (2) calculation of the maximum distance flying fragments or blast debris would travel based on the type and size of UXO, and (3) implementation of mitigation measures if necessary to prevent public exposure. Potential emissions from detonated UXO are expected to be insignificant and not of concern in terms of human health.

How the Method is Carried Out in the Field

This method consists of using human-operated equipment in three basic configurations to cut vegetation: tractor-pulled, track-carriers with booms, and skid-steer. These types of equipment are designated by product names such as the Brush Hog, Hydro-Ax, TAZ, and Brontosauraus and are described below. Equipment operators maneuver the equipment onto the OE sites to clear the vegetation.

Worker Exposure to UXO

Mechanically cutting vegetation would expose workers to UXO that is potentially present in areas being cleared. If accidentally detonated, undetected UXO could cause serious injury or death. Although the machinery being operated could potentially separate the workers from direct contact with UXO and proper worker awareness, protective equipment, and care could reduce worker exposure to injury, the type of UXO present at the IA sites is extremely sensitive and, in some cases, is from the HEAT armor piercing ammunition class, which is designed to destroy any heavy equipment that may be present.

Accidental Detonation of UXO

In the case of accidental detonation of UXO, mechanical cutting would directly expose the equipment operator or other workers to flying fragments or blast debris depending on distance to and the type and size of the UXO. In general, the possibility exists for any vegetation clearance method applied at the IA sites to detonate UXO. Mechanical cutting has a high likelihood of causing serious injury or death of workers because they would only be separated from direct contact by components of the heavy equipment. Some types of UXO, such as high explosive antitank armor piercing ammunition, is designed specifically to destroy heavy equipment.

Mitigation of potential public exposure to flying fragments or blast debris from accidental detonation of UXO during vegetation clearance activities will be addressed in the site health and safety plan for individual areas. In addition, a community safety plan would be provided to present information regarding accidental and intentional detonation of UXO. In general, potential public exposure would be prevented by: (1) conducting a pre-field analysis of the type, size, and orientation of the UXO known or expected to be present in a given area and its proximity to the public, (2) calculation of the maximum distance flying fragments or blast debris would travel based on the type and size of

UXO, and (3) implementation of mitigation measures if necessary to prevent public exposure.

Duration of the Vegetation Clearance Method

Mechanical vegetation clearance of the large amount of acreage present at each of the IA sites, even using numerous crews, would be difficult to implement in a timely manner to coincide with the intention of clearing vegetation as soon as possible to prepare the IA sites for OE Remedial Action. In addition, two passes (one pass to clear to 2 feet and a second pass to clear to bare ground or approximately 6 inches above ground surface), would be required in most circumstances, which would double the potential for exposure of workers to OE.

Air Emissions

Potential emissions from mechanically operated equipment or accidentally detonated UXO are believed to be insignificant and not of concern in terms of human health, the environment, and worker safety.

Erosion

Mechanical vegetation clearance has the potential to cause surface disturbance and erosion in the short term due to cutting equipment scalping the surface and equipment tires or tracks that could create ruts that lead to erosion. Mechanically cutting vegetation could also cause erosion in the long term because it has a severe impact on the health and growth of the plants and their stability.

Impacts to Protected and Other Natural Resources

Cutting would have impacts on rare, threatened and endangered plants present at the IA sites during and after implementation. Cutting would not be protective of the environment in terms of the health and functioning of the habitat containing rare, threatened or endangered species. Preliminary observations made during monitoring of habitat recovery after vegetation clearance at Fort Ord (conducted under the HMP monitoring program) indicate the following:

- Seedlings of HMP shrubs were rarely seen in cut areas after clearance activities. A preliminary evaluation indicated HMP shrub regeneration of only 29 seedlings per acre occurred after cutting (as compared to 3,000 seedlings per acre after burning).
- Species diversity is generally lower in cut areas.
- Fewer native herbaceous species were observed in cut areas.
- Cutting and placing cut vegetation in windrows and mulch piles on the ground surface appears to interfere with chaparral revegetation by occupying habitat and shading the understory and reducing germination by shrub and herbaceous species.

In addition, some mechanical methods cause damage to the soil topography by creating ruts and increasing the threat of erosion. If CMC vegetation is cleared by cutting, it likely will not grow back as diversely or as healthily and may result in converting CMC habitat to a more common habitat type. In addition, because CMC habitat contains protected species at the IA sites, resource management measures are required by the USFWS. Implementation of cutting in areas greater than 50 acres in size would not be consistent with the Biological and Conference Opinion (*USFWS, 1993, 1997)* issued by USFWS in accordance with the Endangered Species Act.

Use at Fort Ord or Other Sites and Under What Conditions

Mechanical vegetation clearance has been used extensively at the former Fort Ord in development areas and on a limited basis where burning cannot be conducted. Mechanical vegetation clearance was used previously in limited portions of the IA sites behind the firing lines, to support OE investigation. Two

mechanized methods that have been used at Fort Ord include the Brush Hog and TAZ. Vegetation would be trimmed only to the extent necessary to allow safe access for sweep teams.

Availability of Equipment and Personnel

Equipment necessary for mechanical cutting may be readily available; however, the large acreage present at each of the IA sites would require mobilization and long-term operations and maintenance of numerous crews to clear the IA sites of vegetation.

Deposition of Vegetation

Vegetation that is cut, chipped or shredded would fall onto the ground, covering UXO and reducing visibility. Recovery of many rare, threatened, or endangered species could be inhibited by a thick layer of woody cuttings, thus inhibiting germination.

Visibility of Ground Surface

Safety procedures require the vegetation be cleared to bare ground or approximately 6 inches above ground surface to allow for proper operation of UXO detection equipment and to prevent the accidental detonation of UXO on the surface. This level of clearance may be achievable using mechanical methods; however, the cuttings generally fall to the ground where they could obscure or cover UXO.

Regrowth of Vegetation and Maintenance Requirements

Vegetation cleared by mechanical methods would not likely require additional cutting if each area has an OE Remedial Action immediately following vegetation clearance; however, standards for long-term maintenance of mechanically cleared vegetation are not known and have not been established. Recovery of vegetation would be inhibited because the ground would be covered, thus preventing germination of rare, threatened or endangered species.

Level of Effort in Terms of Personnel

Mechanical clearance would require coordination of numerous labor crews and UXO specialists working with vegetation clearance teams.

6.1.1.4 Manual Methods

Manual clearing is conducted by an operator who is on foot and in the work area being cleared while operating the equipment. Examples would be a worker using pruning shears or a handheld trimmer fitted with a brush blade.

Impacts to the Public

Operation of manual equipment within the IA sites during mechanical vegetation clearance activities is not expected to have impacts on the public. However, the possibility exists for any vegetation clearance method applied at the IA sites to detonate UXO. Mitigation of potential public exposure to flying fragments or blast debris from accidental detonation of UXO during vegetation clearance activities would be addressed in the site health and safety plan for individual areas. In addition, a community safety plan would be provided to present information regarding accidental and intentional detonation of UXO. In general, potential public exposure would be prevented by: (1) conducting a pre-field analysis of the type, size, and orientation of the UXO known or expected to be present in a given area and its proximity to the public, (2) calculation of the maximum distance flying fragments or blast debris would travel based on the type and size of UXO, and (3) implementation of mitigation measures if necessary to prevent public exposure. Potential emissions from detonated UXO are expected to be insignificant and not of concern in terms of human health.

How the Method is Carried Out in the Field

This method involves cutting and clearing of vegetation using motorized chainsaws, power chippers, mowers, weed eaters, and non-

motorized hand tools such as clippers and loppers. Small diameter or short shrubs could be cut and hand-carried to a staging or stockpiling area for chipping or disposal. Large diameter shrubs and trees could be "limbed up" to allow access under the canopy by OE workers. This method is effective at selectively removing vegetation.

Worker Exposure to UXO

Manually cutting vegetation would expose workers to UXO that is present in areas being cleared, which if accidentally detonated, could cause serious injury or death. Proper worker awareness, protective equipment, and care could reduce worker exposure to injury. The type of UXO present at the IA sites is extremely sensitive and highly dangerous, and could potentially be suspended in the branches of the vegetation being cleared, where it could cause serious injury or death to workers.

Accidental Detonation of UXO

In the case of accidental detonation of UXO, manual cutting would expose workers to flying fragments or blast debris depending on the distance to and the type and size of the UXO. In general, the possibility exists for any vegetation clearance method applied at the IA sites to detonate UXO. Manual cutting has a high likelihood of causing serious injury or death of workers.

Mitigation of potential public exposure to flying fragments or blast debris from accidental detonation of UXO during vegetation clearance activities would be addressed in the site health and safety plan for individual areas. In addition, a community safety plan would be provided to present information regarding accidental and intentional detonation of UXO. In general, potential public exposure would be prevented by: (1) conducting a pre-field analysis of the type, size, and orientation of the UXO known or expected to be present in a given area and its proximity to the public, (2) calculation of the maximum distance flying fragments or blast debris would travel based on the type and size of UXO, and (3) implementation of mitigation measures if necessary to prevent public exposure.

Duration of the Vegetation Clearance Method

Manual vegetation clearance of the large amount of acreage present at each of the IA sites, even using numerous crews, would be difficult to implement in a timely manner to coincide with the intention of clearing vegetation as soon as possible to prepare the IA sites for OE Remedial Action.

Air Emissions

Air emissions from manual clearing and potential emissions from accidentally detonated UXO are believed to be insignificant and not of concern in terms of human health, the environment, and worker safety.

Erosion

Manual vegetation clearance could be used on slopes where equipment access is not possible. Manual clearance would cause a minimum of surface disturbance in the short term and would remove only plant material that interferes with visibility and access; however, cutting vegetation could cause erosion in the long term because it has a severe impact on the health and growth of the plants and their stability.

Impacts to Protected and Other Natural Resources

Cutting would have impacts on rare, threatened and endangered plants present at the IA sites during and after implementation. If CMC vegetation is cleared by cutting, it likely will not grow back as diversely or as healthily and may result in converting CMC habitat to a more common habitat type. Cutting would not be protective of the environment in terms of the health and functioning of the habitat containing rare, threatened and endangered species. Preliminary observations made during monitoring of habitat recovery after vegetation clearance at Fort Ord (conducted under the HMP monitoring program) indicate the following:

- Seedlings of HMP shrubs were rarely seen in cut areas after clearance activities. A preliminary evaluation indicated HMP shrub regeneration of only 29 seedlings per acre occurred after cutting (as compared to 3,000 seedlings per acre after burning).
- Species diversity is generally lower in cut areas.
- Fewer native herbaceous species were observed in cut areas.
- Cutting and placing cut vegetation in windrows and mulch piles on the ground surface appears to interfere with chaparral revegetation by occupying habitat and shading the understory and reducing germination by shrub and herbaceous species.

In addition, because CMC habitat contains protected species at the IA sites, resource management measures are required by the USFWS. Implementation of cutting in areas greater than 50 acres in size would not be consistent with the Biological and Conference Opinion (*USFWS, 1993, 1997*) issued by USFWS in accordance with the Endangered Species Act.

Use at Fort Ord or Other Sites and Under What Conditions

Manual vegetation clearance has been used extensively in development areas and on a limited basis at the former Fort Ord under special circumstances where burns cannot be conducted or terrain is extremely steep. OE contractors typically use a manual brush clearance team consisting of a UXO supervisor and several laborers. Vegetation would be trimmed only to the extent necessary to allow safe access for sweep teams.

Availability of Equipment and Personnel

Equipment necessary for manual cutting may be available; however, the large acreage present at each of the IA sites would require mobilization and long-term operations and maintenance of numerous crews to clear the IA sites of vegetation.

Deposition of Vegetation

Vegetation that is cut would typically be hauled to a staging area onsite where it would be chipped or shredded, which would require these areas first be cleared of vegetation and UXO. Recovery of many rare, threatened, or endangered species could be inhibited by a thick layer of woody cuttings, thus inhibiting germination.

Visibility of Ground Surface

Safety procedures require the vegetation be cleared to bare ground or approximately 6 inches above ground surface to allow for proper operation of UXO detection equipment and prevent the accidental detonation of UXO on the surface while providing clear enough ground surface visibility for OE workers. This level of clearance could be achieved using manual methods; however, the smaller cuttings generally fall to the ground where they may obscure or cover UXO. The larger cuttings could be gathered and hauled to a staging area for chipping or disposal.

Regrowth of Vegetation and Maintenance Requirements

Vegetation cleared by manual methods would not likely require additional cutting if each area has an OE Remedial Action immediately following vegetation clearance; however, standards for long-term maintenance of manually cleared vegetation within HMP areas have not been established.

Level of Effort in Terms of Personnel

Manual clearance would require coordination of numerous labor crews accompanied by UXO specialists working with vegetation clearance teams.

6.1.2 OE Remedial Action Alternatives

A range of OE Remedial Action Alternatives identified as applicable for removing UXO/OE at the former Fort Ord are considered herein:

- No Action with Existing Site Security Measures
- Enhanced Site Security Measures
- Identify and Remove OE.

This section presents a summary of each of the remedial alternatives that are considered further for development of OE Remedial Action Alternatives herein. Tables 6 through 8 present a summary and comparison of the alternatives for each IA site.

6.1.2.1 No Action with Existing Site Security Measures

The No Action with Existing Site Security Measures Alternative is provided, as required under CERCLA and the National Contingency Plan (NCP), as a baseline for comparison to the other proposed alternatives. This alternative assumes existing site access restrictions such as fencing, warning signs, and regular security patrols would be maintained in accordance with the Ordnance and Explosives Site Security Program Summary (*Army, 2001b*). There are no capital costs associated with the No Action with Existing Site Security Measures Alternative. O&M costs for the No Action with Existing Site Security Measures Alternative would include those associated with maintaining existing site access restrictions (maintenance of fences and signs and regular security patrols).

6.1.2.2 Enhanced Site Security Measures

The Enhanced Site Security Measures Alternative includes (1) maintenance of existing site security measures at the site (fencing, warning signs and security patrols) in accordance with the Ordnance and Explosives Site Security Program Summary for the former Fort Ord (*Army, 2001b*), (2) implementation of additional access controls as described below.

Warning Signs would identify the area behind the signs as a dangerous explosives area. They would be posted in a way that will ensure a person cannot enter the area without seeing at least one sign within a legible distance, and the signs should be multi-lingual. Typical signs are described in the Ordnance and Explosives Site Security Program Summary (*Army, 2001b*).

Informational Kiosks or display boards would provide safety information regarding OE hazards. Kiosks are described in the Ordnance and Explosives Site Security Program Summary (*Army, 2001b*).

Fencing would be selected based on land use and potential for residual hazard, but would likely be similar to the types described in the Ordnance and Explosives Site Security Program Summary (*Army, 2001b*)(four-strand barbed wire or chain link fence) and may be reinforced by concertina wire or thick vegetation.

Security Patrols may be required and employed by either private or governmental entities.

Many of the measures described above, such as fencing and warning signs, are already in place at the IA sites. Administrative controls, such as deed language or notifications, recurring reviews, siting, zoning, or deed restrictions, would be implemented on a programmatic basis at Fort Ord after the OE RI/FS is complete and long-term risk management measures are decided upon based on the results of the OE RI/FS.

6.1.2.2.1 Summary of Existing Site Security Measures

Each of the three IA sites already have fencing and warning signs and the area is patrolled regularly by a security service to reduce unauthorized entry into the IA sites as follows:

- **Ranges 43-48** – Access to the ranges are limited by four-strand barbed-wire fencing with one roll (and in some areas two rolls) of concertina wire behind the barbed wire. Each of five chain link access gates are reinforced with concertina wire, and warning signs are posted approximately every 500 feet along the fencing. A larger warning sign (4 foot by 6 foot) is also posted near the main access gate to the ranges. Patrols of perimeter fencing and access gates are conducted approximately every eight hours.

- **Range 30A** – Access to the range is limited by four-strand barbed-wire fencing with one roll (and in some areas two rolls) of concertina wire behind the barbed wire. Each of three chain link access gates are reinforced with concertina wire, and warning signs are posted approximately every 500 feet along the fencing. A larger warning sign (4 foot by 6 foot) is also posted near the main access gate to the range.

- **Site OE-16** – Access to the site is limited by 6-foot high temporary chain link fencing. There is one chain link access gate, and warning signs are posted approximately every 500 feet along the fencing. Patrols of perimeter fencing and the access gate are conducted approximately every eight hours.

As described in Section 5.2, existing access deterrents such as barbed-wire fencing, concertina wire, chain link fencing, and chain link gates posted with warning signs, and patrols discourage, but have not prevented entry into IA sites.

6.1.2.2.2 Description of Enhanced Site Security Measures for Alternative Evaluation

This IA evaluation focuses on improvements to existing site security measures at the IA sites, and makes the following assumptions:

- Existing fencing will be upgraded to the maximum level possible to deter access

- Large warning signs will be posted at a greater frequency along fencing and at access roads or gates that lead to IA sites

- The frequency of patrols will be increased around the perimeters of the sites.

Site-specific Enhanced Site Security Measures at each of the three IA sites will be as follows for the purposes of evaluating OE Remedial Action Alternatives:

- **Ranges 43-48** – The existing four-strand barbed wire fencing that currently encircles the MRA (and Ranges 43-48 within it) will be replaced with permanent 10-foot chain link fencing reinforced with concertina wire around the entire perimeter/boundary of Ranges 43-48. Each of the five chain link access gates will be replaced with 10-foot high chain link gates reinforced with concertina wire. Although these additional controls are considered as Interim Action measures, the Army intends for any measures implemented during Interim Action to be as consistent as possible with potential long-term remedies. Therefore, the integrity of the fencing will be monitored weekly and the fence will be repaired and maintained for an interim period of 5 years until long term O&M needs are determined in the basewide OE RI/FS. Warning signs will be posted approximately every 100 feet along the fence. Larger warning signs (4 foot by 6 foot) will be posted at each of the five access gates to the ranges. The frequency of patrols of perimeter fencing and access gates will be every four hours.

- **Range 30A** – The existing four-strand barbed-wire fencing will be replaced with permanent 10-foot chain link fencing reinforced with concertina wire around the entire perimeter/boundary of Range 30A. Each of the three chain link access gates will be replaced with 10-foot high chain link

gates reinforced with concertina wire. Although these additional controls are considered as Interim Action measures, the Army intends for any measures implemented during Interim Action to be as consistent as possible with potential long-term remedies. Therefore, the integrity of the fencing will be monitored weekly and the fence will be repaired and maintained for an interim period of 5 years until long term O&M needs are determined in the basewide OE RI/FS. Warning signs will be posted approximately every 100 feet along the fence. Larger warning signs (4 foot by 6 foot) will be posted at each of the five access gates to the range. The frequency of patrols of perimeter fencing and access gates will be every four hours.

- **Site OE-16** – The existing temporary 6-foot chain link fencing will be replaced with permanent 10-foot chain link fencing reinforced with concertina wire around the entire perimeter/boundary of Site OE-16. The chain link access gate will be replaced with a 10-foot high chain link gate reinforced with concertina wire. Although these additional controls are considered as Interim Action measures, the Army intends for any measures implemented during Interim Action to be as consistent as possible with potential long-term remedies. Therefore, the integrity of the fencing will be monitored weekly and the fence will be repaired and maintained for an interim period of 5 years until long term O&M needs are determined in the basewide OE RI/FS. Warning signs will be posted approximately every 100 feet along the fence. A larger warning sign (4 foot by 6 foot) will be posted at the access gate to the site. The frequency of patrols of perimeter fencing and the access gate will be four hours.

6.1.2.3 Identify and Remove OE

OE Remedial Action at the IA sites would consist of identifying, investigating and excavating OE found under one of the following scenarios:

- Surface OE Removal – Identify and Remove All OE on the Surface
- Subsurface OE Removal – Identify, Investigate, and Remove All Anomalies to Depths Consistent with Planned Reuse in Each Area
- OE Removal to Depth – Identify, Investigate, and Remove All Anomalies to Depth Found.

After vegetation clearance is performed using one of the Vegetation Clearance Alternatives described above, OE crews would walk the site using geophysical OE detection equipment. OE and any other anomalies identified visually or using the detection equipment would be investigated under one of the OE Remedial Action depth scenarios described above and if UXO was found, it would be detonated using one of the OE Detonation Alternatives described below. Detection equipment would be selected and Standard Operating Procedures (SOPs) would be performed in accordance with the *Ordnance Detection and Discrimination Study for Fort Ord* (*USACE, 2001*).

Screening evaluations of the three OE Remedial Action depth scenarios for each of the IA sites are presented in Tables B1, B2, and B3 of Appendix B (OE Depth of Remedial Action Screening Tables) for Ranges 43-48, Range 30A, and Site OE-16, respectively. Based on the results of the screening, Subsurface OE Removal (Identify, Investigate, and Remove All Anomalies to Depths Consistent with Planned Reuse in Each Area), was selected as the appropriate depth scenario for the Identify and Remove OE alternative for each of the IA Sites.

Subsurface OE Removal will consist of identification of OE (conduct a visual search and operate OE detection equipment), and investigation and removal of any OE found/detected on the ground surface of the site and in the subsurface to depths determined in the site-specific work plan. Subsurface OE removal depths will be determined based on (1) the type of OE, (2) the typical depth the type of OE is found, (3) planned reuse of specific areas within the IA site, and (4) the capabilities of the geophysical detection equipment selected as best suited for site conditions by the OE Site Geophysicist. The site-specific work plan outlining planned subsurface OE removal depths will be available for regulatory agency and public review.

Costs for Subsurface OE Removal are based on a range of costs associated with conducting a 1 foot to 4 foot OE removal consistent with the planned reuse in specific areas of the IA sites. Under the Subsurface OE Removal Alternative, existing site security measures such as fencing, warning signs, and security patrols would be maintained for an interim period of 5 years until long term O&M needs are determined in the basewide OE RI/FS.

6.1.3 OE Detonation Alternatives

OE Detonation consists of detonating any UXO found during physical removal of OE after vegetation clearance has been performed. OE remedial crews would conduct a visual search and walk the site using geophysical OE detection equipment. Any OE identified visually or using the detection equipment would be handled as follows depending on whether the item is transportable or nontransportable:

- All small arms/subcaliber OE items including bullets/ammunition and practice 35mm subcaliber M73 rockets (without spotting charge) would be transported offsite to a facility that would perform detonation by heating in a "popper oven" and the metal would be recycled. These transportable OE items would be excluded from onsite detonation procedures and are not considered further in the evaluation of detonation alternatives.

- ***Nontransportable OE Items*** – For the purposes of addressing OE at Fort Ord, non-transportable OE items include those that are non-movable (unsafe to move under any circumstances), and moveable (may be moved by hand only within close proximity to their original position for consolidation and/or to ensure detonations are performed under the safest possible conditions). Because nontransportable OE items are extremely dangerous and cannot be moved except under the circumstances described above, detonation-in-place with engineering controls is the selected alternative for all nontransportable OE items. Although detonation of OE has the potential to release air pollutants to the atmosphere, studies evaluated in the *Final Detonation Sampling and Analysis Plan* (*Harding ESE, 2000b*) indicate that air emissions from ordnance detonations at Fort Ord are not expected to be significant. OE detonation is not expected to cause significant impacts to soil based results of the *Basewide Remedial Investigation/Feasibility Study* (*Harding ESE, 1995a*) and on studies discussed in the *Final Ordnance Detonation Sampling and Analysis Plan* (*Harding ESE, 2000b*). Although the studies mentioned above indicate there would be no significant impacts to soil and/or air from OE detonation, the *Final Detonation Sampling and Analysis Plan* (*Harding ESE, 2000b*) presents approaches to further evaluate potential emissions to air and soil under Fort Ord-specific conditions using OE obtained from sampling and removal activities. In addition, detonation would be performed in conjunction with engineering controls that typically consist of covering the OE item to dampen the explosion and in turn minimize OE-related emissions as described below.

- ***Transportable OE Items*** –For the purposes of addressing OE at Fort Ord, transportable OE items are those that, as determined by the OE contractor (with concurrence of the USACE UXO Safety Specialist), may be transported by vehicle from their original position to an area outside the vicinity for the purposes of storage, consolidation with other items for detonation, or for offsite destruction. A range of methods for detonation of transportable OE items are available and potentially applicable at the IA sites. A summary and screening of these detonation methods is presented below.

OE Detonation Alternatives

No Action

The No Action Alternative is provided, as required under CERCLA and the NCP, as a baseline for comparison to the other proposed alternatives. This alternative assumes no action would be taken to detonate any OE items that are found leaving OE where it was found or stored.

Detonation with Engineering Controls

This method consists of applying additional detonating charges to single or consolidated OE items, and applying engineering controls (covering the OE with tamped dirt, sandbags, contained water, or other materials, and using foam tents or bomb pots) prior to detonation to control the blast and any fragmentation, emissions, or noise that would be associated with the detonation. The foam tent is not approved for use by Department of Defense Explosives Safety Board (DDESB) and the bomb pot is not designed for destruction of OE (it merely controls the direction of the blast by funneling it upward); therefore, these methods are eliminated from further consideration as engineering controls. Transportable OE items can be moved for consolidation purposes (in order to detonate several OE items at once) as described above. Although these methods are not capable of withstanding multiple detonations, they offer flexibility in managing the detonations depending on the type, location, and position of OE. Therefore, OE Detonation with Engineering Controls is retained for further consideration as an OE Detonation Alternative.

Detonation Chambers

Some specially designed detonation chambers that can withstand and contain the explosive force of the detonation are in development or are commercially available such as the Donovan Blast Chamber. The Donovan Blast Chamber is the only detonation chamber considered in this evaluation because it is the only one of its kind that has been approved for detonation of OE by the DDESB. The Donovan Blast Chamber (chamber) is capable of withstanding detonations up to every 5 minutes of munitions equivalent to two 81mm mortar rounds and the donor charge used to initiate detonation. It also captures and cleans the demolition gases, contains fragmentation, reduces noise associated with the detonation, and may reduce associated fire risks for transportable OE items. According to vendor specifications, the chamber is trailer-mounted and transportable over terrain where 4-wheel drive pickup trucks could typically travel. However, the vertical clearance of the trailer's undercarriage is 18 inches above ground surface and would not allow it to be transported over the majority of the terrain at the IA sites. The trailer-mounted chamber would have to be temporarily located immediately within the entrance of each of several access gates where it would be operated as a stationary device.

OE Items Eligible for Detonation in Chamber

For all of the IA sites, the OE items that could be detonated in the chamber would have to be transportable and 81mm in size or smaller, and would require additional handling of items to transport them to temporary chamber locations immediately within access gates to the IA sites.

Ranges 43-48

Based on the results of recent TCRA surface OE removals at Ranges 43-48 (Section 4.1.3.2), it is estimated that approximately 95 percent of OE items anticipated to be found at Ranges 43-48 would be nontransportable items that are too dangerous to be transported to the temporary detonation chamber locations. Therefore, use of and costs associated with the detonation chamber would be limited to 5 percent of the OE items that may be found.

Range 30A and Site OE-16

Based on the results of recent TCRA surface OE removals at Range 30A and Site OE-16 (Sections 4.2.3.2 and 4.3.3.2, respectively), adequate data was not available to determine percentages of OE items that would be eligible for detonation in the chamber. Therefore, based on general OE removal data collected during OE removals at Fort Ord, it is estimated that approximately 90 percent of OE items anticipated to be found at these IA sites would be nontransportable items that are too dangerous to be transported to the temporary detonation chamber locations. Therefore, use of and costs associated with the detonation chamber would be limited to 10 percent of the OE items that may be found.

The Detonation Chamber and Detonation with Engineering Controls Alternative is retained for further consideration as an OE Detonation Alternative because, even with the drawbacks mentioned above, they are capable of withstanding and containing multiple detonations and could be used for approximately 5 to 10 percent of the OE items requiring detonation. Use of the detonation chamber will therefore only be considered as a combination of 5 to 10 percent detonation chamber use and 90 to 95 percent detonation with engineering controls.

Offsite Destruction

Collection, transport, and offsite destruction of OE would eliminate onsite fragmentation, emissions, and fire risks associated with detonating OE at the IA sites. However, this method would require handling and transporting OE on public roadways in order to transfer it to the offsite facility, which would present unacceptable risks to the public and to workers. For these reasons, offsite destruction is eliminated from further consideration as an OE Detonation Alternative.

OE Detonation Methods Retained for Further Consideration

Based on the screening and analysis of the OE Detonations methods described above, the following methods were retained for further consideration as OE Detonation Alternatives and are described below:

- No Action
- Detonation with Engineering Controls
- Detonation Chamber and Detonation with Engineering Controls.

6.1.3.1 No Action

The No Action Alternative is required for consideration under CERCLA as a basis for comparison to the other alternatives, and would consist of taking no action to detonate any OE items found at the IA sites.

6.1.3.2 Detonation with Engineering Controls

The Detonation with Engineering Controls Alternative consists of applying additional detonating charges to single or consolidated OE items, and applying engineering controls (covering the OE with tamped dirt, sandbags, contained water, or other materials) prior to detonation to control the blast and any fragmentation, emissions, or noise that would be associated with the detonation. As described

above, this method would be applicable and well suited for detonations at the IA sites because it can be performed in any location OE is found during Physical Removal of OE.

6.1.3.3 Detonation Chamber and Detonation with Engineering Controls

The Detonation Chamber and Detonation with Engineering Controls Alternative consists of operation of the Donovan Blast Chamber for transportable OE items (approximately 5 to 10 percent of the total items) and using detonation with engineering controls as described above for nontransportable OE items (approximately 90 to 95 percent of the total items). The Donovan Chamber is the only type of chamber approved for use by the DDESB, and is a detonation containment device capable of withstanding multiple detonations. For 5 to 10 percent of the OE items found, this method would reduce noise and emissions, contain fragmentation, and reduce fire risks associated with detonations, but would require handling and transfer of OE over the 951 total acres of land found at the IA sites to the temporary chamber locations immediately within access gates to the IA sites. For the other 90 to 95 percent of the OE items found, applying engineering controls (covering the OE with tamped dirt, sandbags, contained water, foam tents, bomb pots, or other materials) prior to detonation to control the blast would also reduce noise and emissions, contain fragmentation, and reduce fire risks associated with detonations, but not to the same degree as detonation in the chamber.

6.2 Applicable or Relevant and Appropriate Requirements (ARARs)

This section presents a description and analysis of ARARs that are potentially applicable for the Interim Action Alternatives described in Section 6.1.

Section 121 of CERCLA requires that site cleanups comply with federal and state laws that are "applicable or relevant and appropriate requirements" (ARARs). Under CERCLA Section 121(d)(2), the federal ARARs for a remedial action could include requirements under any of the federal environmental laws. State ARARs include promulgated requirements under state environmental or facility siting laws that are more stringent than federal ARARs, and that have been identified in a timely manner, pursuant to 40 Code of Federal Regulations (CFR) Part 300.400(g)(4). A requirement may be either "applicable" or "relevant and appropriate." Potential federal and state ARARs that may be pertinent to OE-related Interim Actions at Fort Ord are listed in Table 5 and described below.

6.2.1 Definition of ARARs

Applicable requirements are defined as those cleanup or control standards, or other substantive environmental protection requirements, criteria, or limitations, promulgated under federal or state laws. Applicable requirements are identified on a site-specific basis by determination of whether the jurisdictional prerequisite of a requirement fully addresses the circumstances at the site or the proposed remedial activity. All pertinent jurisdictional prerequisites must be met for the requirement to be applicable. These jurisdictional prerequisites are as follows:

- The party must be subject to the law
- The substances or activities must fall under the authority of the law
- The law must be in effect at the time the activities occur
- The statute or regulation requires, limits, or protects the types of activities.

A requirement is applicable if the specific terms (or jurisdictional prerequisites) of the statute or regulation directly addresses the circumstances at the site.

"Relevant and appropriate" refers to those cleanup standards, or other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law, that while not necessarily applicable, address problems or situations sufficiently similar to those encountered at the CERLCA site, and whose use is well suited to the particular site (*EPA, 1993*). The relevance and appropriateness of a requirement can be judged by comparing a number of factors including the characteristics of the remedial action, the items in question, or the physical circumstances of the site, with those addressed in the requirement. If there is sufficient similarity between the requirements and the circumstances at the site, determination of the requirement as relevant and appropriate may be made.

Determining whether a requirement is both relevant and appropriate is a two-step process. First, to determine relevance, a comparison is made between the response action, location, or chemicals covered by the requirement and related conditions at the site, release, or potential remedy. A requirement is relevant if it generally pertains to these conditions. Second, to determine whether the requirement is appropriate, the comparison is further refined by focusing on the nature of the items, the characteristics of the site, the circumstances of the release, and the proposed response action. The requirement is appropriate if, based on such comparison, its use is well suited to the particular site. The facility must comply with the substantive elements of requirements that are determined to be both relevant and appropriate.

There are certain circumstances under which ARARs may be waived. CERCLA Section 121(d) allows the selection of alternatives that will not attain ARAR status if any of six conditions for a waiver of ARARs exists. However, the selected alternative must be protective even if an ARAR is waived. Only five of the conditions for a waiver may apply to a DoD site. The conditions for a waiver are as follows:

- The action selected is only part of a total response action that will attain the required level or standard of control when completed
- Compliance with the designated requirement at that site will result in greater risk to human health and the environment (e.g., worker safety) than alternative options
- Compliance with the designated requirement is technically impracticable from an engineering perspective
- The action selected will result in a standard of performance that is equivalent to an applicable requirement through the use of another method or approach
- A state requirement has not been equitably applied in similar circumstances on other clearance actions within the state
- A fund-financed clearance action does not provide a balance between available monies and the need for protection of human health and the environment at sites where the need is more immediate (not applicable to DoD sites).

To Be Considered Requirements (TBCs)

To Be Considered Requirements (TBCs), the final class of requirements considered by EPA during the development of ARARs, are non-promulgated advisories or guidance documents issued by federal or state governments. They do not have the status of ARARs, and are not legally binding, but may be considered in determining the necessary cleanup levels or actions to protect human health and the environment.

6.2.2 Types of ARARs

ARARs that govern actions at CERCLA sites fall into three broad categories based upon the chemical contamination present, site characteristics, and alternatives proposed for cleanup. These three categories (chemical-

specific, location-specific, and action-specific) are described in the following subsections.

Chemical-Specific ARARs

Chemical-specific ARARs include those environmental laws and regulations that regulate the release to the environment of materials with certain chemical or physical characteristics or that contain specified chemical compounds. These requirements generally set health or risk-based concentration limits or discharge limits for specific hazardous substances by media. Chemical-specific ARARs are triggered by the specific chemical contaminants found at a particular site. Examples of potential chemical-specific ARARs are effluent limitations, emission limitations, drinking water standards and hazardous waste characteristics identified for specific chemicals and compounds. A more stringent standard, requirement, criterion, or limitation promulgated pursuant to a state environmental statute and identified in a timely manner is also a potential ARAR.

Location-Specific ARARs

Location-specific ARARs govern activities in certain environmentally sensitive areas. These requirements are triggered by the particular location and the proposed activity at the site. An example of a location-specific ARAR is compliance with the Endangered Species Act of 1973, as amended, to avoid sensitive ecosystems or habitats. Location-specific ARARs also focus on wetland or floodplain protection areas, or archaeologically significant areas.

Action-Specific ARARs

Action-specific ARARs are restrictions that define acceptable treatment and disposal procedures for hazardous substances. These ARARs generally set performance, design, or other similar action-specific controls or restrictions on particular kinds of activities. An example might be a state Air Quality Management Authority that sets limitations on fugitive dust generated during grading and excavation activities during clearance action.

6.2.3 Application of ARARs at Former Fort Ord

In addition to ARARs being classified into three broad categories (i.e. chemical-specific, location-specific, and action-specific), each ARAR is also noted by the action that may be taken at Fort Ord in the process of OE remedial action. Thus, an ARAR may pertain to: (1) site preparation (vegetation clearance) that may involve prescribed burning, mechanical clearing, or manual clearance of vegetation; (2) existing or enhanced site security measures or physical removal of OE that may involve excavation; and (3) detonation of OE with engineering controls or detonation within a blast chamber. In many cases, an ARAR will pertain to more than one type of action stated above.

In determining whether a requirement is pertinent to OE site preparation (vegetation clearance), OE Remedial Action, and OE detonations at Fort Ord, potential ARARs are initially screened for applicability. If determined not to be applicable, the requirement is then reviewed for both relevance and appropriateness. Requirements that are considered to be relevant and appropriate command the same importance as applicable requirements. Potential federal and state ARARs that may be pertinent to vegetation clearance, OE Remedial Action, and OE detonations, at Fort Ord are listed in Table 5.

6.3 Evaluation and Comparison of Interim Action Alternatives

This section presents the evaluation and comparison of Interim Action Alternatives. The three-tiered Interim Action Alternatives for the IA sites developed in Section 6.1 are evaluated and compared to the nine criteria specified in the U.S. Environmental Protection Agency's (EPA) *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (*EPA, 1988*) (RI/FS Guidance). These nine criteria are:

1. Overall Protection of Human Health and the Environment
2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)
3. Long-Term Effectiveness and Permanence
4. Reduction of Toxicity, Mobility, or Volume Through Treatment
5. Short-Term Effectiveness
6. Implementability
7. Cost
8. State Acceptance
9. Community Acceptance.

The evaluation of Interim Action Alternatives is discussed within the following three categories that encompass the nine criteria:

- **Effectiveness** (Includes Overall Protection of Human Health and the Environment, Compliance with ARARs, and Short-Term Effectiveness, Long-Term Effectiveness and Permanence, Reduction of Toxicity, Mobility, or Volume Through Treatment)
- **Implementability** (Includes State and Community Acceptance, which will be addressed in the IA RI/FS ROD once comments on the IA RI/FS report and Proposed Plan have been received [*EPA, 1988*]).
- **Cost**

The three evaluation criteria categories used in the comparative analysis are described below:

Effectiveness
Effectiveness is the ability of the alternative to provide protection of human health and the environment in the short term and comply with ARARs. The evaluation of each alternative is based on the effectiveness of the alternative in: (1) meeting the remedial action objectives, (2) minimizing potential impacts to human health and the environment during and following implementation, (3) the reliability, proven history, and permanence of the alternative with respect to the conditions found at the site, (4) the ability of the alternative to achieve Reduction of Toxicity, Mobility, or Volume through Treatment of the components of concern, and (5) the ability to meet federal and state requirements.

Implementability
Implementability is based on the technical and administrative feasibility of applying a given alternative. Technical feasibility considerations include the availability of clearance, removal, storage, and disposal services, necessary equipment, and skilled workers to implement a particular option. Administrative feasibility includes obtaining necessary permits and regulatory approvals. State and Community Acceptance will be addressed in the IA RI/FS ROD once comments on the IA RI/FS report and Proposed Plan have been received (*EPA, 1988*).

Cost
Capital and operations and maintenance (O&M) costs are estimated for each alternative based on quotes for labor, materials, and equipment necessary to implement the alternative. For annual O&M costs, the net present value (NPV) is calculated over a period of years based on a 6.4 percent interest rate (Source: *Engineering News Record Cost Index for Construction, January, 2002*). The cost estimates have an accuracy of +50 percent/-30 percent.

Sections 6.3.1 through 6.3.3 and Tables 6 through 8 summarize the comparative analyses of alternatives for each of the three IA sites.

6.3.1 Ranges 43–48

The following Vegetation Clearance, OE Remedial Action, and OE Detonation Alternatives were developed for Ranges 43–48 and are compared below for each of the three categories. Table 6 presents a summary and comparison of the alternatives for Ranges 43-48. Based on the comparison, a three-tiered

Preliminarily Identified Preferred Alternative is selected for Ranges 43–48 and is summarized in Section 7.0 and in Table 9.

Vegetation Clearance Alternatives
No Action, Prescribed Burning, Mechanical Methods, Manual Methods.

OE Remedial Action Alternatives
No Action with Existing Site Security Measures, Enhanced Site Security Measures, Subsurface OE Removal (Identify, Investigate, and Remove All Anomalies to Depths Consistent with Planned Reuse in Each Area).

OE Detonation Alternatives
No Action, Detonation with Engineering Controls, Detonation Chamber and Detonation with Engineering Controls.

6.3.1.1 Effectiveness

The effectiveness of each of the alternatives is compared below.

6.3.1.1.1 Vegetation Clearance Alternatives

Each of the vegetation clearance alternatives was evaluated in terms of its effectiveness in clearing vegetation found at Ranges 43-48. The Army considered the use of different vegetation clearance alternatives and combinations of alternatives for specific areas within Ranges 43-48; however, there were sufficient reasons to discount the viability of a piecemeal approach to vegetation clearance as described below.

The No Action Alternative would not be effective in clearing vegetation. Manual and Mechanical Vegetation Clearance Alternatives (cutting) would be much less effective in the short term than the Prescribed Burning Alternative because cutting would not clear vegetation to the same level as burning. The criteria related to reduction of toxicity, mobility, or volume through treatment is not applicable to vegetation clearance. Cutting would require more time to clear the ranges than burning and would not be as protective of workers because they could come in contact with UXO while cutting (burning would be conducted remotely from areas being cleared).

Cutting at this site could not be conducted in compliance with the substantive elements of ARARs. The HMP that was developed as required by the Biological and Conference Opinion (*USFWS, 1993, 1997*) issued to the Army in accordance with the Endangered Species Act requires burning be used as the primary means of vegetation clearance in CMC habitat reserve areas. Fire is required to clear CMC vegetation because this habitat type contains many rare and endangered plant species, and in order to duplicate the natural processes that maintain the composition and distribution of these rare and protected plant species, fire is necessary. Cutting does not duplicate this natural process and based upon vegetation monitoring conducted on several sites where cutting was used at Fort Ord, the rare obligate seed – producing shrub species subject to management under the HMP would be substantially reduced or eliminated from sites cleared by cutting. Therefore, burning would have advantages in the long term compared to cutting. In addition, cutting could not be conducted in a manner that is protective of human health (OE workers would come in direct contact with OE while clearing vegetation) and the environment (the health of rare and endangered species would be compromised by cutting).

Burning would temporarily affect local air quality and may have impacts on human health due to smoke; however, the burn would be conducted under carefully controlled conditions and the public would be notified of the burn. Smoke management while conducting the burn and temporary relocation of individuals from areas affected by smoke to unaffected areas would minimize potential impacts of smoke from the burn on human health. Burning could be conducted in a manner that is protective of human health and the environment through these mitigation measures.

There is only one method (prescribed burning) approved for widespread use in CMC habitat present over the majority of Ranges 43-48 based on HMP requirements that limit the use of other methods to areas less than 50 acres in size. The use of other vegetation clearance methods would only be applicable to approximately 5 percent (50 acres of 951 total acres) of the IA sites, would take much longer to implement than burning, and therefore, significant benefits in adopting a piecemeal approach to vegetation clearance were not identified (except in the 72 acres of development area as described in Section 4.1).

6.3.1.1.2 OE Remedial Action Alternatives

Each of the OE Remedial Action Alternatives was evaluated in terms of its effectiveness in addressing OE risks at Ranges 43-48. The Army considered the use of different OE Remedial Action Alternatives and combinations of alternatives for specific areas within each of the IA sites; however, there were sufficient reasons to discount the viability of a piecemeal approach to OE Remedial Action as described below.

The No Action with Existing Site Security Measures and Enhanced Site Security Measures Alternatives would be much less effective than the Subsurface OE Removal Alternative because they would not achieve the same degree of hazard reduction and removal of the physical threat associated with the presence of OE in areas that may be accessed by the public. The Subsurface OE Removal Alternative would be effective because it meets the definition of an Interim Action as a remedial action that can be implemented quickly and that, although not necessarily intended as a final remedial measure at a site, substantially reduces potential immediate, imminent, and/or substantial risks to human health and is consistent with long term goals. However, remedial activities conducted at the IA sites will be evaluated under the basewide OE RI/FS to determine adequacy of actions taken and the need for further action, if any.

Methods that enhance or maintain existing site security measures (fencing, warning signs, security patrols) have been — and could continue to be — breached by trespassers, even with enhanced site security measures in place. Therefore, use of these methods in certain areas was not considered further because significant benefits in adopting a piecemeal approach to OE Remedial Action were not identified.

6.3.1.1.3 OE Detonation Alternatives

Each of the OE Detonation Alternatives was evaluated in terms of its effectiveness in detonating OE identified at Ranges 43-48. The Army considered the use of different OE Detonation Alternatives and combinations of alternatives for specific areas within Ranges 43-48 (the Detonation with Engineering Controls Alternative and the Detonation Chamber and Detonation with Engineering Controls Alternative) and determined Detonation with Engineering Controls best met the evaluation criteria for the entire IA site.

The No Action Alternative would not be effective, because UXO found at the IA sites is dangerous and requires detonation to render it safe. The Detonation with Engineering Controls Alternative would be much more effective than the Detonation Chamber and Detonation with Engineering Controls Alternative because:

- It would achieve the same degree of hazard reduction as the detonation chamber, and the detonation chamber can only be used on approximately 5 percent of the OE items anticipated to be found at Ranges 43-48
- Studies show no significant impacts on human health or the environment from detonation with engineering controls
- It is a proven and flexible method used at Fort Ord over many years that is considered safe for detonating any type of OE found at the ranges

- The chamber can only be used for OE items that are transportable to access gate locations where the chamber would be temporarily located and are 81mm or less in diameter, and only 5 percent of OE items would be transportable to the chamber

- It can be implemented immediately as OE is discovered over the course of physical removal of OE, and can be applied in-place or transferred with other OE items and detonated in consolidation shots

- Use of a detonation chamber would require OE at the ranges to be handled, moved, and stored/stockpiled prior to its operation, which would greatly increase safety hazards to workers associated with accidental detonation of OE

6.3.1.2 Implementability

The implementability of each of the alternatives is compared below. The implementability of these alternatives in terms of State and Community Acceptance will be addressed in the IA RI/FS ROD once comments on the IA RI/FS report and Proposed Plan have been received (*EPA, 1988*).

6.3.1.2.1 Vegetation Clearance Alternatives

Although the No Action Alternative would be easy to implement because it takes no action to clear vegetation, it could not be implemented because worker safety requires vegetation be cleared to provide visibility of ground surface. Prescribed burning would be implementable as it has been used regularly in habitat areas containing rare, threatened and endangered species at Fort Ord and is the primary method approved by USFWS and designated in the HMP for clearing vegetation in habitat areas. Cutting would not be implementable in terms of administrative feasibility because it is only approved for use in limited applications (less than 50 acres) where burning cannot be conducted, and implementation of cutting in areas greater than 50 acres in size would not be consistent with the Biological and Conference Opinion (*USFWS, 1993; 1997*) issued by USFWS in accordance with the Endangered Species Act. . In addition, mobilizing and operating cutting equipment within rugged terrain containing UXO would be difficult to implement because some areas will not be accessible.

Burning would be somewhat difficult to implement from an administrative perspective because of air quality and some public concerns; however, potential effects would be mitigated during the burn because it would be conducted under carefully controlled conditions and the public would be notified of the burn. Smoke management while conducting the burn and temporary relocation of individuals from areas affected by smoke to unaffected areas would minimize potential adverse impacts of the smoke from the burn on human health.

6.3.1.2.2 OE Remedial Action Alternatives

No Action with Existing Site Security Measures would be the easiest OE Remedial Action Alternative to implement because it takes no further action to respond to OE risks at the site beyond those measures already in place at the ranges such as maintaining fencing, signs and security patrols for access control. The Enhanced Site Security Measures Alternative would be the second easiest to implement because it includes replacement of existing fencing with permanent 10-foot high chain link fencing reinforced with concertina wire, warning signs every 100 feet along the fence, additional large warning signs at access gates, increased security patrols, and maintenance of these controls for an interim period of 5 years until long term O&M needs are determined in the basewide OE RI/FS. Installation of fencing and signs would be performed with a full time OE escort.

The Subsurface OE Removal Alternative would be the most difficult to implement because it

includes OE Remedial Action at the ranges; however, OE Remedial Actions have been implemented regularly in such areas for many years at the former Fort Ord, and could be successfully implemented using readily available trained personnel and equipment once the vegetation has been removed. Current estimates indicate OE Remedial Action at each of the IA sites could be completed before vegetation grows back to a level that would make OE Remedial Action hazardous. Initial removal of surface OE items is the only activity that must be performed within the timeframe before vegetation grows back to ensure worker safety. Based on past experience by the Army's OE contractor, surface removal can be performed within the regrowth period of approximately one year for Ranges 43-48. Once surface OE has been removed, subsurface OE remedial operations can be performed as vegetation gradually grows back and would not disrupt digital geophysical surveys, excavation, and removal of subsurface OE items. The total duration of OE remedial activities for Ranges 43-48 is estimated at 25 months.

6.3.1.2.3 OE Detonation Alternatives

No Action would be the easiest OE Detonation Alternative to implement because it takes no further action to respond to risks associated with OE found during physical removal of OE. The Detonation with Engineering Controls Alternative would be easier to implement than the Detonation Chamber and Detonation with Engineering Controls Alternative because it consists of detonating any dangerous OE discovered during physical removal of OE in place or consolidating it nearby without having to handle or relocate the OE as would be required when using a detonation chamber. The Detonation Chamber and Detonation with Engineering Controls Alternative would be difficult to implement for the 5 percent of transportable OE items because it would require additional handling of OE to transport it to the chamber at temporary locations immediately within access gates, which would significantly increase the potential for accidental detonation of UXO and associated risks to workers. In addition, the chamber can only be used for approximately 5 percent of the OE items anticipated to be found at Ranges 43-48, so its implementability is limited. Detonation with Engineering Controls has been implemented regularly in such areas for many years at Fort Ord, and could be successfully implemented using readily available trained personnel and equipment during the course of physical removal of OE.

6.3.1.3 Cost

Cost estimates have been prepared for each of the alternatives. Detailed cost estimate tables are included in Appendix C. The cost criterion examines both capital costs and annual operations and maintenance (O&M) costs for the alternatives. Capital costs include contingencies, engineering, and supervision costs. O&M costs include annual fixed costs such as site labor costs, monitoring costs, and maintenance costs for existing or enhanced site security measures. These cost estimates are primarily for comparative purposes. Actual costs to perform work may vary and will be, to a large extent, dependent upon the duration of the alternatives, and the actual extent of OE-related impacts discovered at each IA site. The cost estimates have an accuracy of +50 percent/-30 percent.

6.3.1.3.1 Vegetation Clearance Alternatives

Capital, O&M, and total costs for each of the Vegetation Clearance Alternatives are summarized below.

Capital Costs

Capital costs for implementing Vegetation Clearance Alternatives at Ranges 43-48 vary from $0 for the No Action Alternative to $1.7 million for the Prescribed Burning Alternative (Table C1 of Appendix C), to

$1.4 million for the Mechanical Clearance Alternative (Table C2 of Appendix C), and $2.5 million for the Manual Clearance Alternative (Table C3 of Appendix C).

O&M Costs

O&M costs for each of the Vegetation Clearance Alternatives were estimated over a monitoring period of five years assumed to be necessary to monitor the recovery of the habitat as specified in the HMP. Long-term O&M costs for monitoring after implementation of each of the Vegetation Clearance Alternatives range from $0 for the No Action Alternative to $213,000 for the Prescribed Burning, Mechanical, and Manual Clearance Alternatives (Tables C1, C2, and C3 of Appendix C). These cost estimates do not include the cost to implement corrective measures such as active plantings and additional monitoring and reporting if the HMP success criteria are not met. The costs to repair damages caused to the CMC habitat areas would likely be significant if methods other than prescribed burning are used, which is the only method approved for vegetation clearance of CMC habitat found at the site for areas greater than 50 acres.

Total Costs

Total costs for the Vegetation Clearance Alternatives vary from $0 per acre ($0 total) for the No Action Alternative to $3,972 per acre ($1.9 million total) for the Prescribed Burning Alternative (Table C1 of Appendix C), to $3,350 per acre ($1.6 million total) for the Mechanical Clearance Alternative (Table C2 of Appendix C), to $5,713 per acre ($2.8 million total) for the Manual Clearance Alternative (Table C3 of Appendix C) as shown in Appendix C and summarized in Table 6. Excluding the No Action Alternative, which has no costs, long-term O&M costs for monitoring the recovery of the habitat for a period of five years as specified in the HMP are included in the total costs.

6.3.1.3.2 OE Remedial Action Alternatives

Capital, O&M, and total costs for each of the OE Remedial Action Alternatives are summarized below. The cost estimates have an accuracy of +50 percent/-30 percent.

Capital Costs

Capital costs for implementing OE Remedial Action Alternatives range from $0 for the No Action with Existing Site Security Measures Alternative (Table C4 of Appendix C), to $1.1 million for the Enhanced Site Security Measures Alternative (Table C5 of Appendix C), and range from $10.6 to $11.2 million for the Subsurface OE Removal Alternative (Table C6 of Appendix C).

O&M Costs

O&M costs for the OE Remedial Action Alternatives are applicable only to the No Action with Existing Site Security Measures and Enhanced Site Security Measures Alternatives and were estimated for an interim period of 5 years until long term O&M needs are determined in the basewide OE RI/FS. A present worth analysis was used to evaluate expenditures that would occur over the 5-year time period (i.e., O&M costs) by discounting all future costs to 2002, the base year for this report. This procedure allows the cost of the alternative to be compared on the basis of a single figure representing the amount of money that, if invested in 2002 and disbursed as needed, would be sufficient to cover all costs associated with the action over its planned life. In

conducting the present worth analysis, the Net Present Value (NPV) was calculated for an interim period of 5 years until long term O&M needs are determined in the basewide OE RI/FS based on a 6.4 percent interest rate (Source: *Engineering News Record Cost Index for Construction, January 2002*). O&M costs for the No Action with Existing Site Security Measures Alternative were estimated at $235,000 (Table C4 of Appendix C) and were estimated at $3.4 million for the Enhanced Site Security Measures Alternative (Table C5 of Appendix C) for an interim period of 5 years until long term O&M needs are determined in the basewide OE RI/FS. The Subsurface OE Removal Alternatives has no associated O&M costs.

Total Costs

Total costs for the OE Remedial Action Alternatives vary from $486 per acre ($235,000 total) for the No Action with Existing Site Security Measures Alternative (Table C4 of Appendix C), to $9,222 per acre ($4.5 million total) for the Enhanced Site Security Measures Alternative (Table C5 of Appendix C), and range from $22,013 to $23,109 per acre ($10.6 to $11.2 million total) for the Subsurface OE Removal Alternative (Table C6 of Appendix C) as shown in Appendix C and summarized in Table 6. Long-term O&M costs associated with the No Action with Existing Site Security Measures and Enhanced Site Security Measures Alternatives for a period of five years are included in the total costs.

6.3.1.3.3 OE Detonation Alternatives

Capital, O&M, and total costs for each of the OE Detonation Alternatives are summarized below. The cost estimates have an accuracy of +50 percent/-30 percent.

Capital Costs

Capital costs for the OE Detonation Alternatives range from $0 for the No Action Alternative to $1.1 million for the Detonation with Engineering Controls Alternative (Table C7 of Appendix C) to $1.1 million for the Detonation Chamber and Detonation with Engineering Controls Alternative (Table C8 of Appendix C).

O&M Costs

There are no operations and maintenance costs for the OE Detonation Alternatives.

Total Costs

Total costs for the OE Detonation Alternatives vary from $0 per acre ($0 total) for the No Action Alternative, to $2,221 per acre ($1.1 million total) for the Detonation with Engineering Controls Alternative (Table C7 of Appendix C), to $2,361 per acre ($1.1 million total) for the Detonation Chamber and Detonation with Engineering Controls Alternative (Table C8 of Appendix C) as shown in Appendix C and summarized in Table 6.

6.3.2 Range 30A

The following Vegetation Clearance, OE Remedial Action, and OE Detonation Alternatives were developed for Range 30A and are compared below for each of the three categories. Table 7 presents a summary and comparison of the alternatives for Range 30A. Based on the comparison, a three-tiered Preliminarily Identified Preferred Alternative is selected for Range 30A and is summarized in Table 10 and Section 7.0.

Vegetation Clearance Alternatives
No Action, Prescribed Burning, Mechanical Methods, Manual Methods.

OE Remedial Action Alternatives
No Action with Existing Site Security Measures, Enhanced Site Security Measures, Subsurface OE Removal (Identify, Investigate, and Remove All Anomalies to Depths Consistent with Planned Reuse in Each Area).

OE Detonation Alternatives
No Action, Detonation with Engineering Controls, Detonation Chamber and Detonation with Engineering Controls.

6.3.2.1 Effectiveness

The effectiveness of each of the alternatives is compared below.

6.3.2.1.1 Vegetation Clearance Alternatives

Each of the vegetation clearance alternatives was evaluated in terms of its effectiveness in clearing vegetation found at Range 30A. The Army considered the use of different vegetation clearance alternatives and combinations of alternatives for specific areas within Range 30A; however, there were sufficient reasons to discount the viability of a piecemeal approach to vegetation clearance as described below.

The No Action Alternative would not be effective in clearing vegetation. Manual and Mechanical Vegetation Clearance Alternatives (cutting) would be much less effective in the short term than the Prescribed Burning Alternative because cutting would not clear vegetation to the same level as burning. The criteria related to reduction of toxicity, mobility, or volume through treatment is not applicable to vegetation clearance. Cutting would require more time to clear the ranges than burning and would not be as protective of workers because they could come in contact with UXO while cutting (burning would be conducted remotely from areas being cleared).

Cutting at this site could not be conducted in compliance with the substantive elements of ARARs. The HMP that was developed as required by the Biological and Conference Opinion (*USFWS, 1993, 1997*) issued to the Army in accordance with the Endangered Species Act requires burning be used as the primary means of vegetation clearance in CMC habitat reserve areas. Fire is required to clear CMC vegetation because this habitat type contains many rare and endangered plant species, and in order to duplicate the natural processes that maintain the composition and distribution of these rare and protected plant species, fire is necessary. Cutting does not duplicate this natural process and based upon vegetation monitoring conducted on several sites where cutting was used at Fort Ord, the rare obligate seed – producing shrub species subject to management under the HMP would be substantially reduced or eliminated from sites cleared by cutting. Therefore, burning would have advantages in the long term compared to cutting. In addition, cutting could not be conducted in a manner that is protective of human health (OE workers would come in direct contact with OE while clearing vegetation) and the environment (the health of rare and endangered species would be compromised by cutting).

Burning would temporarily affect air quality and may have impacts on human health due to smoke; however, the burn would be conducted under carefully controlled conditions and the public would be notified of the burn. Smoke management while conducting the burn and temporary relocation of individuals from areas affected by smoke to unaffected areas would minimize potential adverse impacts of smoke from the burn on human health. Burning could be conducted in a manner that is protective of human health and the environment through these mitigation measures.

There is only one method (prescribed burning) approved for widespread use in CMC habitat present over the majority of Range 30A based on HMP requirements that limit the use of other methods to areas less than 50 acres in size. The

use of other vegetation clearance methods would only be applicable to approximately 5 percent (50 acres of 951 total acres) of the IA sites, would take much longer to implement than burning, and therefore, significant benefits in adopting a piecemeal approach to vegetation clearance were not identified.

6.3.2.1.2 OE Remedial Action Alternatives

Each of the OE Remedial Action Alternatives was evaluated in terms of its effectiveness in addressing OE risks at Range 30A. The Army considered the use of different OE Remedial Action Alternatives and combinations of alternatives for specific areas within Range 30A; however, there were sufficient reasons to discount the viability of a piecemeal approach to OE Remedial Action as described below.

The No Action with Existing Site Security Measures and Enhanced Site Security Measures Alternatives would be much less effective than the Subsurface OE Removal Alternative because they would not achieve the same degree of hazard reduction as OE Remedial Action, which removes the physical threat associated with the presence of OE in areas that may be accessed by the public. The Subsurface OE Removal Alternative would be effective because it meets the definition of an Interim Action as a remedial action that can be implemented quickly and that, although not necessarily intended as a final remedial measure at a site, substantially reduces potential immediate, imminent, and/or substantial risks to human health and is consistent with long term goals. However, remedial activities conducted at the IA sites will be evaluated under the basewide OE RI/FS to determine adequacy of actions taken and the need for further action, if any.

Methods that enhance or maintain existing site security measures (fencing, warning signs, security patrols) have been — and could continue to be — breached by trespassers, even with enhanced site security measures in place. Therefore, use of these methods in certain areas was not considered further because significant benefits in adopting a piecemeal approach to OE Remedial Action were not identified.

6.3.2.1.3 OE Detonation Alternatives

Each of the OE Detonation Alternatives was evaluated in terms of its effectiveness in detonating OE identified at Range 30A. The Army considered the use of different OE Detonation Alternatives and combinations of alternatives for specific areas within Ranges 43-48 (the Detonation with Engineering Controls Alternative and the Detonation Chamber and Detonation with Engineering Controls Alternative) and determined Detonation with Engineering Controls best met the evaluation criteria for the entire IA site.

The No Action Alternative would not be effective, because UXO found at the IA sites is dangerous and requires detonation to render it safe. The Detonation with Engineering Controls Alternative would be much more effective than the Detonation Chamber and Detonation with Engineering Controls Alternative because:

- It would achieve the same degree of hazard reduction as the detonation chamber, and the detonation chamber can only be used on approximately 10 percent of the OE items anticipated to be found at Range 30A
- It is a proven and flexible method used at Fort Ord over many years that is considered safe for detonating any type of OE found at the ranges
- The chamber can only be used for OE items that are transportable and 81mm or less in diameter and would require additional handling of UXO to transport it to the temporary chamber locations immediately within access gates to the site
- It can be implemented immediately as OE is discovered over the course of physical removal of OE, and can be applied in-place or transferred with other OE items and detonated in consolidation shots

- Use of a detonation chamber would require OE at the ranges to be handled, moved, and stored/stockpiled prior to its operation, which would greatly increase safety hazards to workers associated with accidental detonation of OE

A combination of these methods in certain areas was not considered further because significant benefits in adopting a piecemeal approach to OE detonation were not identified.

6.3.2.2 Implementability

The implementability of each of the alternatives is compared below. The implementability of these alternatives in terms of State and Community Acceptance will be addressed in the IA RI/FS ROD once comments on the IA RI/FS report and Proposed Plan have been received (*EPA, 1988*).

6.3.2.2.1 Vegetation Clearance Alternatives

The No Action Alternative would be the easiest to implement, but worker safety considerations and protocols require vegetation be cleared to improve ground surface visibility. Prescribed burning would be implementable as it has been used regularly in habitat areas containing rare, threatened and endangered species at Fort Ord and is the primary method approved by the USFWS and designated in the HMP for clearing vegetation in habitat areas. Cutting would not be implementable in terms of administrative feasibility because it is only approved for use in limited applications (less than 50 acres) where burning cannot be conducted, and implementation of cutting in areas greater than 50 acres in size would not be consistent with the Biological and Conference Opinion (*USFWS, 1993; 1997*) issued by USFWS in accordance with the Endangered Species Act. In addition, mobilizing and operating cutting equipment within rugged terrain containing UXO would be difficult to implement because some areas will not be accessible. Burning would be somewhat difficult to implement from an administrative perspective because of air quality and some public concerns; however, potential effects would be mitigated during the burn because it would be conducted under carefully controlled conditions and the public would be notified of the burn. Smoke management while conducting the burn and temporary relocation of individuals from areas affected by smoke to unaffected areas would minimize potential impacts of smoke from the burn on human health.

6.3.2.2.2 OE Remedial Action Alternatives

No Action with Existing Site Security Measures would be the easiest OE Remedial Action Alternative to implement because it takes no further action to respond to OE risks at the site beyond those measures already in place at Range 30A such as maintaining fencing and warning signs and conducting patrols to limit access to the site. The Enhanced Site Security Measures Alternative includes replacement of existing fencing with permanent 10-foot high chain link fencing reinforced with concertina wire, warning signs every 100 feet along the fence, additional large warning signs at access gates, increased security patrols, and maintenance of these controls for an interim period of 5 years until long term O&M needs are determined in the basewide OE RI/FS. Installation of fencing and signs would be performed with a full time OE escort.

The Subsurface OE Removal Alternative would be the most difficult to implement because it includes OE Remedial Action at Range 30A; however, OE Remedial Actions have been implemented regularly in such areas for many years at the former Fort Ord, and could be successfully implemented using readily available trained personnel and equipment once the vegetation has been removed. Current estimates indicate OE Remedial Action at each of the IA sites could be completed before vegetation grows back to a level that would make OE Remedial Action hazardous. Initial removal of surface OE items is the only activity that must be performed within the timeframe

before vegetation grows back to endure OE worker safety. Based on past experience by the Army's OE contractor, surface removal can be performed within the regrowth period of approximately one year for Range 30A. Once surface OE has been removed, subsurface OE remedial operations can be performed as vegetation gradually grows back and would not disrupt digital geophysical surveys, excavation, and removal of subsurface OE items. The total duration of OE remedial activities for Range 30A is estimated at 15 months.

6.3.2.2.3 OE Detonation Alternatives

No Action would be the easiest OE Detonation Alternative to implement because it takes no further action to respond to risks associated with OE found during physical removal of OE. The Detonation with Engineering Controls Alternative would be easier to implement than the Detonation Chamber and Detonation with Engineering Controls Alternative because it consists of detonating any dangerous OE discovered during physical removal of OE in place or consolidating it nearby without having to handle or relocate the OE as would be required when using a detonation chamber. The Detonation Chamber and Detonation with Engineering Controls Alternative would be difficult to implement because it would require OE items be transported to temporary chamber locations immediately within access gates to the site, which would significantly increase the potential for accidental detonation of UXO and associated risks to workers. In addition, the chamber can only be used for approximately 10 percent of the OE items anticipated to be found at Range 30A, so its implementability is limited. Detonation with Engineering Controls has been implemented regularly in such areas for many years at Fort Ord, and could be successfully implemented using readily available trained personnel and equipment during the course of physical removal of OE.

6.3.2.3 Cost

Cost estimates have been prepared for each of the alternatives. Detailed cost estimate tables are included in Appendix C. The cost criterion examines both capital costs and annual operations and maintenance (O&M) costs for the alternatives. Capital costs include contingencies, engineering, and supervision costs. O&M costs include annual fixed costs such as site labor costs, monitoring costs, and maintenance costs for existing or enhanced site security measures. These cost estimates are primarily for comparative purposes. Actual costs to perform work may vary and will be, to a large extent, dependent upon the duration of the alternatives, and the actual extent of OE-related impacts discovered at each IA site. The cost estimates have an accuracy of +50 percent/-30 percent.

6.3.2.3.1 Vegetation Clearance Alternatives

Capital, O&M, and total costs for each of the Vegetation Clearance Alternatives are summarized below.

Capital Costs

Capital costs for implementing Vegetation Clearance Alternatives range from $0 for the No Action Alternative to $1.4 million for the Prescribed Burning Alternative (Table C9 of Appendix C), to $1.1 million for the Mechanical Clearance Alternative (Table C10 of Appendix C), and $2.0 million for the Manual Clearance Alternative (Table C11 of Appendix C).

O&M Costs

O&M costs for each of the Vegetation Clearance Alternatives were estimated over a monitoring period of five years assumed to be necessary to monitor the recovery of the habitat as specified in the HMP. Long-term O&M costs for

monitoring after implementation of each of the Vegetation Clearance Alternatives range from $0 for the No Action Alternative to $149,000 for the Prescribed Burning, Mechanical Clearance, and Manual Clearance Alternatives (Tables C9, C10, and C11 of Appendix C). These cost estimates do not include the cost to implement corrective measures such as active plantings and additional monitoring and reporting if the HMP success criteria are not met. The costs to repair damages caused to the CMC habitat areas would likely be significant if methods other than prescribed burning are used, which is the only method approved for vegetation clearance of CMC habitat found at the site for areas greater than 50 acres.

Total Costs

Total costs for the Vegetation Clearance Alternatives vary from $0 per acre ($0 total) for the No Action Alternative to $3,906 per acre ($1.5 million total) for the Prescribed Burning Alternative (Table C9 of Appendix C), to $3,178 per acre ($1.2 million total) for the Mechanical Clearance Alternative (Table C10 of Appendix C), to $5,481 per acre ($2.1 million total) for the Manual Clearance Alternative (Table C11 of Appendix C) as shown in Appendix C and summarized in Table 7. Excluding the No Action Alternative, which has no costs, long-term O&M costs for monitoring the recovery of the habitat for a period of five years as specified in the HMP are included in the total costs.

6.3.2.3.2 OE Remedial Action Alternatives

Capital, O&M, and total costs for each of the OE Remedial Action Alternatives are summarized below. The cost estimates have an accuracy of +50 percent/-30 percent.

Capital Costs

Capital Costs for the OE Remedial Action Alternatives vary from $0 for the No Action with Existing Site Security Measures Alternative (Table C12 of Appendix C), to $1.0 million for the Enhanced Site Security Measures Alternative (Table C13 of Appendix C), to $6.8 to $7.7 million for the Subsurface OE Removal Alternative (Table C14 of Appendix C) as shown in Appendix C and summarized in Table 7.

O&M Costs

O&M costs for the OE Remedial Action Alternatives are only applicable for the No Action with Existing Site Security Measures and Enhanced Site Security Measures Alternatives and were estimated for an interim period of 5 years until long term O&M needs are determined in the basewide OE RI/FS. A present worth analysis was used to evaluate expenditures that would occur for an interim period of 5 years until long term O&M needs are determined in the basewide OE RI/FS (i.e., O&M costs) by discounting all future costs to 2002, the base year for this report. This procedure allows the cost of the alternative to be compared on the basis of a single figure representing the amount of money that, if invested in 2002 and disbursed as needed, would be sufficient to cover all costs associated with the action over its planned life. In conducting the present worth analysis, the NPV was calculated for an interim period of 5 years until long term O&M needs are determined in the basewide OE RI/FS based on a 6.4 percent interest rate (Source: *Engineering News Record Cost Index for Construction, January 2002*). O&M costs were

estimated at $164,000 for The No Action with Existing Site Security Measures Alternative (Table C12 of Appendix C) and $3.2 million for the Enhanced Site Security Measures Alternative (Table C13 of Appendix C) for an interim period of 5 years until long term O&M needs are determined in the basewide OE RI/FS. The Subsurface OE Removal Alternatives has no associated O&M costs.

Total Costs

Total costs for the OE Remedial Action Alternatives vary from $423 per acre ($164,000 total) for the No Action with Existing Site Security Measures Alternative (Table C12 of Appendix C), to $10,871 per acre ($4.2 million total) for the Enhanced Site Security Measures Alternative (Table C13 of Appendix C), and range from $17,511 to $19,895 per acre ($6.8 to $7.7 million total) for the Subsurface OE Removal Alternative (Table C14 of Appendix C) as shown in Appendix C and summarized in Table 7. Long-term O&M costs associated with the No Action with Existing Site Security Measures and Enhanced Site Security Measures Alternatives for a period of five years are included in the total costs.

6.3.2.3.3 OE Detonation Alternatives

Capital, O&M, and total costs for each of the OE Detonation Alternatives are summarized below. The cost estimates have an accuracy of +50 percent/-30 percent.

Capital Costs

Capital costs for the OE Detonation Alternatives range from $0 for the No Action Alternative to $124,000 for the Detonation with Engineering Controls Alternative (Table C15 of Appendix C), to $136,000 for the Detonation Chamber and Detonation with Engineering Controls Alternative (Table C16 of Appendix C).

O&M Costs

There are no operations and maintenance costs for the OE Detonation Alternatives.

Total Costs

Total costs for the OE Detonation Alternatives vary from $0 per acre ($0 total) for the No Action Alternative, to $319 per acre ($124,000 total) for the Detonation with Engineering Controls Alternative (Table C15 of Appendix C), to $352 per acre ($136,000 total) for the Detonation Chamber and Detonation with Engineering Controls Alternative (Table C16 of Appendix C) as shown in Appendix C and summarized in Table 7.

6.3.3 Site OE-16

The following Vegetation Clearance, OE Remedial Action, and OE Detonation Alternatives were developed for Site OE-16 and are compared below for each of the three categories. Table 8 presents a summary and comparison of the alternatives for Site OE-16. Based on the comparison, a three-tiered Preliminarily Identified Preferred Alternative is selected for Site OE-16 and is summarized in Table 11 and Section 7.0.

Vegetation Clearance Alternatives
No Action, Prescribed Burning, Mechanical Methods, Manual Methods.

OE Remedial Action Alternatives
No Action with Existing Site Security Measures, Enhanced Site Security Measures, Subsurface OE Removal (Identify, Investigate, and Remove All Anomalies to Depths Consistent with Planned Reuse in Each Area).

OE Detonation Alternatives
No Action, Detonation with Engineering Controls, Detonation Chamber and Detonation with Engineering Controls.

6.3.3.1 Effectiveness

The effectiveness of each of the alternatives is compared below.

6.3.3.1.1 Vegetation Clearance Alternatives

Each of the vegetation clearance alternatives was evaluated in terms of its effectiveness in clearing vegetation found at Site OE-16. The Army considered the use of different vegetation clearance alternatives and combinations of alternatives for specific areas within Site OE-16; however, there were sufficient reasons to discount the viability of a piecemeal approach to vegetation clearance as described below.
The No Action Alternative would not be effective in clearing vegetation. Manual and Mechanical Vegetation Clearance Alternatives (cutting) would be much less effective in the short term than the Prescribed Burning Alternative because cutting would not clear vegetation to the same level as burning. The criteria related to reduction of toxicity, mobility, or volume through treatment is not applicable to vegetation clearance. Cutting would require more time to clear the ranges than burning and would not be as protective of workers because they could come in contact with UXO while cutting (burning would be conducted remotely from areas being cleared).
Cutting at this site could not be conducted in compliance with the substantive elements of ARARs. The HMP that was developed as required by the Biological and Conference Opinion (*USFWS, 1993; 1997*) issued to the Army in accordance with the Endangered Species Act requires burning be used as the primary means of vegetation clearance in CMC habitat reserve areas. Fire is required to clear CMC vegetation because this habitat type contains many rare and endangered plant species, and in order to duplicate the natural processes that maintain the composition and distribution of these rare and protected plant species, fire is necessary. Cutting does not duplicate this natural process and based upon vegetation monitoring conducted on several sites where cutting was used at Fort Ord, the rare obligate seed – producing shrub species subject to management under the HMP would be substantially reduced or eliminated from sites cleared by cutting. Therefore, burning would have advantages in the long term compared to cutting. In addition, cutting could not be conducted in a manner that is protective of human health (OE workers would come in direct contact with OE while clearing vegetation) and the environment (the health of rare and endangered species would be compromised by cutting).

Burning would temporarily affect air quality and may have impacts on human health due to smoke; however, the burn would be conducted under carefully controlled conditions and the public would be notified of the burn. Smoke management while conducting the burn and temporary relocation of individuals from areas affected by smoke to unaffected areas would minimize potential impacts of smoke from the burn on human health. Burning could be conducted in a manner that is protective of human health and the environment through these mitigation measures.

There is only one method (prescribed burning) approved for widespread use in CMC habitat present over the majority of Site OE-16 based on HMP requirements that limit the use of other methods to areas less than 50 acres in size. The use of other vegetation clearance methods would only be applicable to approximately 5 percent (50 acres of 951 total acres) of the IA sites, would take much longer to implement than burning, and therefore, significant benefits in adopting a piecemeal approach to vegetation clearance were not identified.

6.3.3.1.2 OE Remedial Action Alternatives

Each of the OE Remedial Action Alternatives was evaluated in terms of its effectiveness in addressing OE risks at Site OE-16. The Army considered the use of different OE Remedial Action Alternatives and combinations of alternatives for specific areas within Site OE-16; however, there were sufficient reasons to discount the viability of a piecemeal approach to OE Remedial Action as described below.

The No Action with Existing Site Security Measures and Enhanced Site Security Measures Alternatives would be much less effective than the Subsurface OE Removal Alternative because they would not achieve the same degree of hazard reduction as the Subsurface OE Removal Alternative, which removes the physical threat associated with the presence of OE in areas that may be accessed by the public. The Subsurface OE Removal Alternative would be effective because it meets the definition of an Interim Action that can be implemented quickly and that, although not necessarily intended as a final remedial measure at a site, substantially reduces potential immediate, imminent, and/or substantial risks to human health and is consistent with long term goals.

Methods that enhance or maintain existing site security measures (fencing, warning signs, security patrols) have been — and could continue to be — breached by trespassers, even with enhanced site security measures in place. Therefore, use of these methods in certain areas was not considered further because significant benefits in adopting a piecemeal approach to OE Remedial Action were not identified.

Remedial activities conducted at the IA sites will be evaluated under the basewide OE RI/FS to determine adequacy of actions taken and the need for further action, if any.

6.3.3.1.3 OE Detonation Alternatives

Each of the OE Detonation Alternatives was evaluated in terms of its effectiveness in detonating OE identified at Site OE-16. The Army considered the use of different OE Detonation Alternatives and combinations of alternatives for specific areas within Ranges 43-48 (the Detonation with Engineering Controls Alternative and the Detonation Chamber and Detonation with Engineering Controls Alternative) and determined Detonation with Engineering Controls best met the evaluation criteria for the entire IA site.

The No Action Alternative would not be effective, because UXO found at the IA sites is dangerous and requires detonation to render it safe. The Detonation with Engineering Controls Alternative would be much more effective than the Detonation Chamber and Detonation with Engineering Controls Alternative because:

- It would achieve the same degree of hazard reduction as the detonation chamber, and the detonation chamber can only be used on approximately 10 percent of the OE items anticipated to be found at Site OE-16
- It is a proven and flexible method used at Fort Ord over many years that is considered safe for detonating any type of OE found at the ranges
- The chamber can only be used for transportable OE items that are 81mm or less in diameter, and would require additional handling of OE items to transport them to temporary chamber locations immediately within access gates to the site
- It can be implemented immediately as OE is discovered over the course of physical removal of OE, and can be applied in-place or transferred with other OE items and detonated in consolidation shots
- Use of a detonation chamber would require OE at the ranges to be handled, moved, and

stored/stockpiled prior to its operation, which would greatly increase safety hazards to workers associated with accidental detonation of OE.

A combination of these methods in certain areas was not considered further because significant benefits in adopting a piecemeal approach to OE detonation were not identified.

6.3.3.2 Implementability

The implementability of each of the alternatives is compared below. The implementability of these alternatives in terms of State and Community Acceptance will be addressed in the IA RI/FS ROD once comments on the IA RI/FS report and Proposed Plan have been received (*EPA, 1988*).

6.3.3.2.1 Vegetation Clearance Alternatives

The No Action Alternative would not be implementable because it takes no action to clear vegetation, which is required for OE worker safety. Prescribed burning would be implementable as it has been used regularly in habitat areas containing rare, threatened and endangered species at Fort Ord and is the primary method approved by USFWS and designated in the HMP for clearing vegetation in habitat areas. Cutting would not be implementable in terms of administrative feasibility because it is only approved for use in limited applications (less than 50 acres) where burning cannot be conducted, and implementation of cutting in areas greater than 50 acres in size would not be consistent with the Biological and Conference Opinion (*USFWS, 1993, 1997*) issued by USFWS in accordance with the Endangered Species Act. . In addition, mobilizing and operating cutting equipment within rugged terrain containing UXO would be difficult to implement because some areas will not be accessible. Burning would be somewhat difficult to implement from an administrative perspective because of air quality and some public concerns; however, potential effects would be mitigated during the burn because it would be conducted under carefully controlled conditions and the public would be notified of the burn. Smoke management while conducting the burn and temporary relocation of individuals from areas affected by smoke to unaffected areas would minimize potential adverse impacts of smoke from the burn on human health.

6.3.3.2.2 OE Remedial Action Alternatives

No Action with Existing Site Security Measures would be the easiest OE Remedial Action Alternative to implement because it takes no further action to respond to OE risks at the site beyond those measures already in place at Site OE-16 such as maintaining fencing, warning signs and security patrols for access control. The Enhanced Site Security Measures Alternative would be the second easiest to implement because it includes replacement of existing fencing with permanent 10-foot high chain link fencing reinforced with concertina wire, warning signs every 100 feet along the fence, additional large warning signs at access gates, increased security patrols, and maintenance of these controls for an interim period of 5 years until long term O&M needs are determined in the basewide OE RI/FS. Installation of fencing and signs would be performed with a full time OE escort.

The Subsurface OE Removal Alternative would be the most difficult to implement because it includes OE Remedial Action at Site OE-16; however, OE Remedial Actions have been implemented regularly in such areas for many years at the former Fort Ord, and could be successfully implemented using readily available trained personnel and equipment once the vegetation has been removed. Current estimates indicate OE Remedial Action at each of the IA sites could be completed before vegetation grows back to a level that would make OE Remedial Action hazardous. Initial removal of surface OE items is the only activity that must be performed within the timeframe before vegetation grows back to ensure OE worker safety. Based on past experience by the Army's OE contractor, surface removal can be

performed within the regrowth period of approximately one year for Site OE-16. Once surface OE has been removed, subsurface OE remedial operations can be performed as vegetation gradually grows back and would not disrupt digital geophysical surveys, excavation, and removal of subsurface OE items. The total duration of OE remedial activities for Site OE-16 is estimated at 2 months.

6.3.3.2.3 OE Detonation Alternatives

No Action would be the easiest OE Detonation Alternative to implement because it takes no further action to respond to risks associated with OE found during physical removal of OE. The Detonation with Engineering Controls Alternative would be easier to implement than the Detonation Chamber and Detonation with Engineering Controls Alternative because it consists of detonating any dangerous OE discovered during physical removal of OE in place or consolidating it nearby without having to handle or relocate the OE as would be required when using a detonation chamber. The Detonation Chamber and Detonation with Engineering Controls Alternative would be difficult to implement because it would require UXO be transported to the temporary chamber locations immediately within access gates to the site, which would significantly increase the potential for accidental detonation of UXO and associated risks to workers. In addition, the chamber can only be used for approximately 10 percent of the OE items anticipated to be found at Site OE-16, so its implementability is limited. Detonation with Engineering Controls has been implemented regularly in such areas for many years at Fort Ord, and could be successfully implemented using readily available trained personnel and equipment during the course of physical removal of OE.

6.3.3.3 Cost

Cost estimates have been prepared for each of the alternatives. Detailed cost estimate tables are included in Appendix C. The cost criterion examines both capital costs and annual operations and maintenance (O&M) costs for the alternatives. Capital costs include contingencies, engineering, and supervision costs. O&M costs include annual fixed costs such as site labor costs, monitoring costs, and maintenance costs for existing or enhanced site security measures. These cost estimates are primarily for comparative purposes. Actual costs to perform work may vary and will be, to a large extent, dependent upon the duration of the alternatives, and the actual extent of OE-related impacts discovered at each IA site. The cost estimates have an accuracy of +50 percent/-30 percent.

6.3.3.3.1 Vegetation Clearance Alternatives

Capital, O&M, and the total range of costs for each of the Vegetation Clearance Alternatives are summarized below.

Capital Costs

Capital costs for implementing Vegetation Clearance Alternatives range from $0 for the No Action Alternative to $288,000 for the Prescribed Burning Alternative (Table C17 of Appendix C), to $228,000 for the Mechanical Clearance Alternative (Table C18 of Appendix C), and $411,000 for the Manual Clearance Alternative (Table C19 of Appendix C).

O&M Costs

O&M costs for each of the Vegetation Clearance Alternatives were estimated over a monitoring period of five years assumed to be necessary to monitor the recovery of the habitat as specified in the HMP. Long-term O&M costs for monitoring after implementation of each of the Vegetation Clearance Alternatives range from $0 for the No Action Alternative to $30,000 for the Prescribed Burning, Mechanical, and

Manual Clearance Alternatives (Tables A17, A18, and A19 of Appendix C). These cost estimates do not include the cost to implement corrective measures such as active plantings and additional monitoring and reporting if the HMP success criteria are not met. The costs to repair damages caused to the CMC habitat areas would likely be significant if methods other than prescribed burning are used, which is the only method approved for vegetation clearance of CMC habitat found at the site for areas greater than 50 acres.

Total Costs

Total costs for the Vegetation Clearance Alternatives vary from $0 per acre ($0 total) for the No Action Alternative to $3,973 per acre ($318,000 total) for the Prescribed Burning Alternative (Table C17 of Appendix C), to $3,220 per acre ($ 258,000 total) for the Mechanical Clearance Alternative (Table C18 of Appendix C), to $5,516 per acre ($441,000 total) for the Manual Clearance Alternative (Table C19 of Appendix C) as shown in Appendix C and summarized in Table 8. Excluding the No Action Alternative, which has no costs, long-term O&M costs for monitoring the recovery of the habitat for a period of five years as specified in the HMP are included in the total costs.

6.3.3.3.2 OE Remedial Action Alternatives

Capital, O&M, and total costs for each of the OE Remedial Action Alternatives are summarized below. The cost estimates have an accuracy of +50 percent/-30 percent.

Capital Costs

Capital Costs for the OE Remedial Action Alternatives vary from $0 for the No Action with Existing Site Security Measures Alternative (Table C20 of Appendix C), to $412,000 for the Enhanced Site Security Measures Alternative (Table C21 of Appendix C), and $1.3 million for the Subsurface OE Removal Alternative (Table C22 of Appendix C) as shown in Appendix C and summarized in Table 8.

O&M Costs

O&M costs for the OE Remedial Action Alternatives are only applicable to the No Action with Existing Site Security Measures and Enhanced Site Security Measures Alternatives and were estimated for an interim period of 5 years until long term O&M needs are determined in the basewide OE RI/FS. A present worth analysis was used to evaluate expenditures that would occur for an interim period of 5 years until long term O&M needs are determined in the basewide OE RI/FS (i.e., O&M costs) by discounting all future costs to 2002, the base year for this report. This procedure allows the cost of the alternative to be compared on the basis of a single figure representing the amount of money that, if invested in 2002 and disbursed as needed, would be sufficient to cover all costs associated with the action over its planned life. In conducting the present worth analysis, the NPV was calculated for an interim period of 5 years until long term O&M needs are determined in the basewide OE RI/FS based on a 6.4 percent interest rate (Source: *Engineering News Record Cost Index for Construction, January 2002*). Long-term O&M costs were estimated at $35,000 for the No Action with Existing Site Security Measures Alternative (Table C20 of Appendix C) and $1.4 million for the Enhanced Site Security Measures Alternative (Table C21 of Appendix C). The Subsurface OE Removal

Alternative has no associated O&M costs.

Total Costs

Total costs for the OE Remedial Action Alternatives vary from $440 per acre ($35,000 total) for the No Action with Existing Site Security Measures Alternative (Table C20 of Appendix C), to $23,088 per acre ($1.8 million total) for the Enhanced Site Security Measures Alternative (Table C21 of Appendix C), and range from $16,230 to $16,254 per acre ($1.3 million total) for the Subsurface OE Removal Alternative (Table C22 of Appendix C) as shown in Appendix C and summarized in Table 8. Long-term O&M costs associated with the No Action with Existing Site Security Measures and Enhanced Site Security Measures Alternatives for a period of five years are included in the total costs.

6.3.3.3.3 OE Detonation Alternatives

Capital, O&M, and the total range of costs for each of the OE Detonation Alternatives are summarized below. The cost estimates have an accuracy of +50 percent/-30 percent.

Capital Costs

Capital costs for the OE Detonation Alternatives range from $0 for the No Action Alternative, to $13,000 for the Detonation with Engineering Controls Alternative (Table C23 of Appendix C), to $28,000 for the Detonation Chamber and Detonation with Engineering Controls Alternative (Table C24 of Appendix C).

O&M Costs

There are no O&M costs for the OE Detonation Alternatives.

Total Costs

Total costs for the OE Detonation Alternatives vary from $0 per acre ($0 total) for the No Action Alternative, to $157 per acre ($13,000 total) for the Detonation with Engineering Controls Alternative (Table C23 of Appendix C), to $344 per acre ($28,000 total) for the Detonation Chamber and Detonation with Engineering Controls Alternative (Table C24 of Appendix C) as shown in Appendix C and summarized in Table 8.

7.0 SELECTION OF THE PRELIMINARILY IDENTIFIED PREFERRED INTERIM ACTION ALTERNATIVES

This section presents the selection of the Preliminarily Identified Preferred Interim Action Alternatives for each of the IA sites based on the evaluation and comparison of alternatives presented in Section 6.0. These Preliminarily Identified Preferred Alternatives will undergo formal public review and regulatory agency approval through the IA RI/FS Proposed Plan and ROD process described in Section 8.0 and shown on Plate 11. The Preferred Interim Action Alternatives for each of the IA sites will be presented in the Proposed Plan and selected and documented in the ROD. Tables 6 through 8 present summaries and comparisons of the alternatives for each of the IA sites. Tables 9 through 11 present summaries of the Preliminarily Identified Preferred Interim Action Alternatives for each of the IA sites.

7.1 Ranges 43–48

The Preliminarily Identified Preferred Alternative selected for Ranges 43–48 consists of the three-tiered alternative described below and summarized in Table 9. A summary of the Interim Action Alternative follows the rationale presented for selection of each of the three-tiered alternatives.

Vegetation Clearance Alternative

Prescribed burning was selected as the Preliminarily Identified Preferred Vegetation Clearance Alternative for Ranges 43–48. The No Action Alternative is not effective in clearing vegetation, and the manual or mechanical methods would:

- Not achieve the same degree of vegetation clearance as burning.
- Not be conducted in compliance with the substantive elements of ARARs (the HMP and ESA).
- Take much longer to clear the ranges than burning.
- Not access rugged terrain areas or would be difficult to implement in these areas.
- Not be as protective of workers because they could come in contact with UXO while cutting (burning would be conducted remotely from areas being cleared).
- Not promote the health and functioning of the habitat to the same degree as burning.
- Can only be implemented in limited areas because of restrictions on the use of these methods as outlined in the HMP.
- Costs for Prescribed Burning ($1.9 million) are only slightly higher than for Mechanical Methods ($1.6 million), and are less than for Manual Methods ($2.8 million). There are no costs associated with No Action, which is the least effective.

OE Remedial Action Alternative

Subsurface OE Removal was selected as the Preliminarily Identified Preferred OE Remedial Action Alternative for Ranges 43–48 because, although its cost is much higher than the other two alternatives:

- The No Action with Existing Site Security Measures Alternative would not be effective at removing the physical threat associated with the presence of OE in areas that may be accessed by the public.
- The Enhanced Site Security Measures Alternatives would not be as effective as the Subsurface OE Removal Alternative at removing the physical threat associated with the presence of OE in areas that may be accessed by the public, and Enhanced Site

Security Measures would only increase access limitations that have already been breached by the public at these ranges.

- Under the Subsurface OE Removal Alternative, the Army intends to conduct OE Remedial Action to identify, investigate and remove all UXO/OE found to remove the physical threat associated with the presence of OE that may be accessed by the public.

- Although costs for Subsurface OE Removal ($10.6 to $11.2 million) are higher than for Enhanced Site Security Measures ($4.5 million) and No Action with Existing Site Security Measures ($235,000), these methods would not be as effective in minimizing OE risks.

OE Detonation Alternative

The Detonation with Engineering Controls Alternative was selected as the Preliminarily Identified Preferred OE Detonation Alternative because:

- The No Action Alternative is not effective in reducing hazards associated with UXO

- The Detonation with Engineering Controls Alternative would achieve the same degree of hazard reduction as the Detonation Chamber and Detonation with Engineering Controls Alternative, and the detonation chamber can only be used on approximately 5 percent of the OE items anticipated to be found at Ranges 43-48

- The Detonation with Engineering Controls Alternative is a proven and flexible method used at Fort Ord over many years that is considered safe for detonating any type of OE found at the ranges

- The chamber can only be used for transportable OE items that are 81mm or less in diameter, and would require additional handling to transport items to temporary chamber locations immediately within access gates to the site, and only 5 percent of these types of items are anticipated to be safe for transport to the chamber

- The Detonation with Engineering Controls Alternative can be implemented immediately as OE is discovered over the course of physical removal of OE, and can be applied in-place or transferred with other OE items and detonated in consolidation shots

- Use of a detonation chamber would require OE at the ranges to be handled, moved, and stored/stockpiled prior to its operation, which would greatly increase safety hazards to workers associated with accidental detonation of OE

- Costs for Detonation with Engineering Controls and Detonation Chamber and Detonation with Engineering Controls are $1.1 million. There are no costs associated with No Action, which is the least effective alternative.

7.1.1 Summary of the Preliminarily Identified Preferred Interim Action Alternative for Ranges 43–48

The Preliminarily Identified Preferred Interim Action Alternative for Ranges 43–48 includes:

- Vegetation Clearance via Prescribed Burning

- OE Remedial Action via Subsurface OE Removal

- OE Detonation via Detonation with Engineering Controls.

These alternatives are the most successful in meeting the Interim Action evaluation criteria categorized in terms of effectiveness, implementability, and cost. Prescribed Burning, Subsurface OE Removal, and Detonation with

Engineering Controls are each the most effective and implementable of the alternatives considered as described above. The total cost of the Preliminarily Identified Preferred Alternative for Ranges 43-48 is estimated to range from $13.6 to $14.2 million as summarized in Table 9. The range of costs was controlled by three factors: (1) the duration of Vegetation Clearance Method, (2) the extent to which the OE Remedial Action mitigates OE risks, and (3) whether OE Detonation is performed using engineering controls alone or in combination with a detonation chamber.

7.2 Range 30A

The Preliminarily Identified Preferred Alternative selected for Range 30A consists of the three-tiered alternative described below and summarized in Table 10. A summary of the Interim Action Alternative follows the rationale presented for selection of each of the three-tiered alternatives.

Vegetation Clearance Alternative

Prescribed burning was selected as the Preliminarily Identified Preferred Vegetation Clearance Alternative for Range 30A. The No Action Alternative is not effective in clearing vegetation, and the manual or mechanical methods would:

- Not achieve the same degree of vegetation clearance as burning.
- Not be conducted in compliance with the substantive elements of ARARs (the HMP and ESA).
- Take much longer to clear the range than burning.
- Not access rugged terrain areas or would be difficult to implement in these areas.
- Not be as protective of workers because they could come in contact with UXO while cutting (burning would be conducted remotely from areas being cleared).
- Not promote the health and functioning of the habitat to the same degree as burning.
- Cutting can only be implemented in limited areas because of restrictions on the use of these methods as outlined in the HMP.
- Costs for Prescribed Burning ($1.5 million) are slightly higher than for Mechanical Methods ($1.2 million), and lower than Manual Methods ($2.1 million). There are no costs associated with No Action, which is the least effective of the alternatives.

OE Remedial Action Alternative

Subsurface OE Removal was selected as the Preliminarily Identified Preferred OE Remedial Action Alternative for Range 30A because, although its cost is much higher than the other two alternatives:

- The No Action with Existing Site Security Measures Alternative would not be effective at removing the physical threat associated with the presence of OE in areas that may be accessed by the public
- The Enhanced Site Security Measures Alternatives would not be as effective as the Subsurface OE Removal Alternative at removing the physical threat associated with the presence of OE in areas that may be accessed by the public, and Enhanced Site Security Measures would only increase access limitations that have already been breached by the public at this range
- Under the Subsurface OE Removal Alternative, the Army intends to conduct OE Remedial Actions to identify, investigate and remove all UXO/OE found to remove the physical threat associated with the presence of OE in areas that may be accessed by the public
- Although costs for Subsurface OE Removal ($6.8 to $7.7 million) are higher than for Enhanced Site Security Measures ($4.2 million) and No Action with Existing

Site Security Measures ($164,000), these methods would not be as effective in minimizing OE risks.

OE Detonation Alternative

The Detonation with Engineering Controls Alternative was selected as the Preliminarily Identified Preferred OE Detonation Alternative because:

- The No Action Alternative is not effective in reducing hazards associated with UXO
- The Detonation with Engineering Controls Alternative would achieve the same degree of hazard reduction as the Detonation Chamber and Detonation with Engineering Controls Alternative, and the detonation chamber can only be used on approximately 10 percent of the OE items anticipated to be found at Range 30A
- The Detonation with Engineering Controls Alternative is a proven and flexible method used at Fort Ord over many years that is considered safe for detonating any type of OE found at the ranges
- The chamber can only be used for transportable OE items that are 81mm or less in diameter, and would require additional handling of UXO to transport items to temporary chamber locations immediately within access gates to the site
- The Detonation with Engineering Controls Alternative can be implemented immediately as OE is discovered over the course of physical removal of OE, and can be applied in-place or transferred with other OE items and detonated in consolidation shots
- Use of a detonation chamber would require OE at the ranges to be handled, moved, and stored/stockpiled prior to its operation, which would greatly increase safety hazards to workers associated with accidental detonation of OE
- Costs for Detonation with Engineering Controls ($124,000) are comparable to those for Detonation Chamber and Detonation with Engineering Controls ($136,000). There are no costs associated with No Action, which is the least effective alternative.

7.2.1 Summary of the Preliminarily Identified Preferred Interim Action Alternative for Range 30A

The Preliminarily Identified Preferred Interim Action Alternative for Range 30A includes:

- Vegetation Clearance via Prescribed Burning
- OE Remedial Action via Subsurface OE Removal
- OE Detonation via Detonation with Engineering Controls.

These alternatives are the most successful in meeting the Interim Action evaluation criteria categorized in terms of effectiveness, implementability, and cost. Prescribed Burning, Subsurface OE Removal, and Detonation with Engineering Controls are each the most effective and implementable of the alternatives considered as described above. The total cost of the Preliminarily Identified Preferred Alternative for Range 30A is estimated to range from $8.3 to $9.3 million as summarized in Table 10. The range of costs was controlled by three factors: (1) the duration of Vegetation Clearance Method, (2) the extent to which the OE Remedial Action mitigates OE risks, and (3) whether OE Detonation is performed using engineering controls alone or in combination with the detonation chamber.

7.3 Site OE-16

The Preliminarily Identified Preferred Alternative selected for Site OE-16 consists of

the three-tiered alternative described below and summarized in Table 11. A summary of the Interim Action Alternative follows the rationale presented for selection of each of the three-tiered alternatives.

Vegetation Clearance Alternative

Prescribed burning was selected as the Preliminarily Identified Preferred Vegetation Clearance Alternative for Site OE-16. The No Action Alternative is not effective in clearing vegetation, and the manual or mechanical methods would:

- Not achieve the same degree of vegetation clearance as burning.
- Not be conducted in compliance with the substantive elements of ARARs (the HMP and ESA).
- Take much longer to clear the site than burning.
- Not access rugged terrain areas or would be difficult to implement in these areas.
- Not be as protective of workers because they could come in contact with UXO while cutting (burning would be conducted remotely from areas being cleared).
- Not promote the health and functioning of the habitat to the same degree as burning.
- Cutting can only be implemented in limited areas because of restrictions on the use of these methods as outlined in the HMP.
- Costs for Prescribed Burning ($318,000) are only slightly higher than for Mechanical Methods ($258,000), and are less than for Manual Methods ($441,000). There are no costs associated with No Action, which is the least effective alternative.

OE Remedial Action Alternative

The Subsurface OE Removal Alternative was selected as the Preliminarily Identified Preferred OE Remedial Action Alternative for Site OE-16 because, although its cost is much higher than the other two alternatives:

- The No Action with Existing Site Security Measures Alternative would not be effective at removing the physical threat associated with the presence of OE in areas that may be accessed by the public
- The Enhanced Site Security Measures Alternatives would not be as effective as the Subsurface OE Removal Alternative at removing the physical threat associated with the presence of OE in areas that may be accessed by the public, and Enhanced Site Security Measures would only increase access limitations that have already been breached by the public at this site
- Under the Subsurface OE Removal Alternative, the Army intends to conduct OE Remedial Actions at each of the IA sites to identify, investigate and remove all UXO/OE found to remove the physical threat associated with the presence of OE in areas that may be accessed by the public
- Costs for Subsurface OE Removal ($1.3 million) are lower than for Enhanced Site Security Measures ($1.8 million), and higher than No Action with Existing Site Security Measures ($35,000); however, these methods would not be as effective in minimizing OE risks.

OE Detonation Alternative

The Detonation with Engineering Controls Alternative was selected as the Preliminarily Identified Preferred OE Detonation Alternative because:

- The No Action Alternative is not effective in reducing hazards associated with UXO.

- The Detonation with Engineering Controls Alternative would achieve the same degree of hazard reduction as the Detonation Chamber and Detonation with Engineering Controls Alternative, and the detonation chamber can only be used on approximately 10 percent of the OE items anticipated to be found at Site OE-16.

- The Detonation with Engineering Controls Alternative is a proven and flexible method used at Fort Ord over many years that is considered safe for detonating any type of OE found at the ranges.

- The chamber can only be used for transportable OE items that are 81mm or less in diameter, and would require additional handling of items during transport to temporary chamber location immediately within access gates to the site.

- The Detonation with Engineering Controls Alternative can be implemented immediately as OE is discovered over the course of physical removal of OE, and can be applied in-place or transferred with other OE items and detonated in consolidation shots.

- Use of a detonation chamber would require OE at the ranges to be handled, moved, and stored/stockpiled prior to its operation, which would greatly increase safety hazards to workers associated with accidental detonation of OE.

- Costs for Detonation with Engineering Controls ($13,000) are comparable to those for Detonation Chamber and Detonation with Engineering Controls ($28,000). There are no costs associated with No Action, which is the least effective alternative.

7.3.1 Summary of the Preliminarily Identified Preferred Interim Action Alternative for Site OE-16

The Preliminarily Identified Preferred Interim Action Alternative for Site OE-16 includes:

- Vegetation Clearance via Prescribed Burning

- OE Remedial Action via Subsurface OE Removal

- OE Detonation via Detonation with Engineering Controls.

Prescribed Burning, Subsurface OE Removal, and Detonation with Engineering Controls are each the most effective and implementable of the alternatives considered as described above. The total cost of the Preliminarily Identified Preferred Alternative for Site OE-16 is estimated at $1.6 million as summarized in Table 11. The range of costs was controlled by three factors: (1) the duration of Vegetation Clearance Method, (2) the extent to which the OE Remedial Action mitigates OE risks, and (3) whether OE Detonation is performed using engineering controls alone or in combination with the detonation chamber.

8.0 INTERIM ACTION APPROVAL PROCESS

This section presents a summary of the approval process that will be followed for Interim Action at the IA sites, including a description of the IA RI/FS Proposed Plan and Record of Decision (ROD), and Community Relations activities related to the approval process. An Implementation Process Flow Chart for Interim Action is shown on Plate 11. Responses to Comments on the Draft Interim Action Ordnance and Explosives Remedial Investigation/Feasibility Study for Ranges 43-48, Range 30A, Site OE-16 (Draft IA RI/FS), Former Fort Ord, California, October 23, 2001 are presented in Appendix D. This Draft Final IA RI/FS has been revised as indicated in Appendix D based on comments received on the Draft IA RI/FS.

8.1 Interim Action Proposed Plan

The Preliminarily Identified Preferred Alternatives for the Interim Action sites will be presented to the public in the IA RI/FS Proposed Plan. The Proposed Plan will briefly summarize the alternatives considered in the IA RI/FS, highlighting the key factors that led to the selection of the Preferred Alternatives. The Proposed Plan, the IA RI/FS, and other support documents that form the basis for the Army's Preferred Alternative selections will be made available for public review in the Fort Ord Administrative Record, the local repositories and on the Fort Ord web page (www.fortordcleanup.com). There will be a 30-day public comment period for the IA RI/FS Proposed Plan. There will be an opportunity for a public meeting during the 30-day public comment period as required by the National Contingency Plan (NCP).

8.2 Interim Action Record of Decision (ROD)

After consideration of public and final regulatory agency comments on the Proposed Plan, the Army will select and document the final interim action remedy decisions for each site which is approved by the EPA and DTSC, in an Interim Action ROD. The ROD documents the remedial action for each site and serves the following functions:

- It certifies that the remedy selection was carried out in accordance with CERCLA
- It describes the technical parameters of the remedy, specifying the methods selected to protect human health and the environment
- It provides the public with a consolidated summary of information for the IA sites, the chosen remedies, and the rationales for the remedy selection
- It documents the Army's responses to comments made to the Proposed Plan.

The Interim Action ROD must be followed by a final ROD. The final ROD will describe how the selected remedy will provide for the long-term protection of human health and the environment, and fully address the threats posed by OE at the IA sites.

8.3 Community Relations

Community relations activities for the IA RI/FS are intended to facilitate community participation in the decision process, keep communities informed of OE-related activities at the former Fort Ord relating to the Interim Action, and help supporting agencies respond to community concerns. Community relations plan (CRP) activities for the overall OE program are described in the *Community Relations Plan Update Number 2, Fort Ord, California* (*Army, 2001*). In November 1998, the Army agreed to evaluate UXO at Fort Ord in a basewide OE RI/FS. Although the CRP was created to address community relations for the overall Environmental Cleanup to include the

OE program prior to the initiation of the basewide OE RI/FS, the content of the CRP is still applicable and valid for basewide OE RI/FS activities and is updated on an annual basis. The CRP describes the community relations program that will be used during the basewide OE RI/FS process. The CRP is updated annually to implement/document CERCLA community relation requirements and program activities.

The CRP outlines communication techniques that will be used to keep the affected community informed throughout the OE Remedial Action and overall basewide OE RI/FS process. The basewide OE RI/FS will include a summary of community relations activities conducted during the planning and document preparation phases of the basewide OE RI/FS process; these activities will be conducted in keeping with the community relations program outlined in the CRP. Public participation activities, including educational programs and brochures, fact sheets, public notices, and press releases, related to OE sites at Fort Ord have been conducted to date in accordance with CERCLA.

The following sections summarize the approach outlined for community relations activities in the CRP that will be used during the IA RI/FS process.

8.3.1 Community Involvement

Community includes elected officials and public agencies; on-base and nearby businesses and residents; employees of the Installation; environmental and special interest groups; those with an interest in the activities associated with the Installation in the past; and those who are interested in future uses of the area. The CRP includes a profile of the community surrounding Fort Ord, a chronology of community involvement, and a description of the community's continuing involvement in the planning and implementation to be used in the IA RI/FS process.

Continuing community involvement will be achieved through a combination of newspaper notices, articles, fact sheets, presentations, community involvement workshops, public meetings, and tours.

8.3.2 Community Relations Strategy

Implementation of community relations for the IA RI/FS will focus on involving the community in the decision making process and providing information regarding the types of UXO found at IA sites on Fort Ord, the timeline for and reporting and scheduling of IA RI/FS activities, and potential hazards associated with the presence of OE. The Army will endeavor to achieve the following in conjunction with the regulatory agencies involved in the IA RI/FS process:

1. Enlist support of neighborhood representatives and local officials
2. Ensure a steady flow of information to and from stakeholders (i.e., local communities and their members affected by the base closure and IA RI/FS process)
3. Provide timely and accurate information concerning OE actions to the community
4. Keep the media informed about IA RI/FS activities
5. Provide regular updates to interested community members
6. Maintain the availability of information to community members through accessible information repositories and the web page (www.fortordcleanup.com)
7. Implement Environmental Justice Executive Order 12898. Provide announcements, fact sheets, and convenient information locations to inform minority community groups based on an evaluation of the ethnic makeup and predominant language used within significantly represented minority groups. Provide translation of cleanup information upon request.

8.3.3 Implementation of Community Relations Activities

The CRP contains a detailed description of the responsibilities of various parties in implementing community relations activities. The Army is committed to providing information about the IA RI/FS on a continuing basis to interested community members and groups under the framework described in the CRP.

Specific community relations activities related to conducting the IA RI/FS include:

- Providing orientation for organizations, agencies, and groups
- Mailing fact sheets regarding significant IA RI/FS milestones to community members who have requested to be on the community relations mailing list
- Publishing public notices in local newspapers and providing press releases to radio and television media announcing the availability of IA RI/FS–related documents and opportunities for public comment
- Responding to comments and inquiries from the community on IA RI/FS–related documents
- Soliciting media coverage, providing updates, and publishing advertisements related to IA RI/FS-related activities
- Including updates related to the IA RI/FS in the *Fort Ord NEWS*, a quarterly newsletter that addresses environmental cleanup issues at Fort Ord and is mailed to local residents and interested parties
- Updating local officials and neighborhood associations on the IA RI/FS process
- Providing a technical point of contact for all community inquiries regarding the IA RI/FS
- Maintaining IA RI/FS-related documents in the information repositories and Administrative Record
- Conducting workshops and public meetings at appropriate milestones in the IA RI/FS process
- Providing a 30-day public comment period for the Proposed Plan
- Providing an opportunity for a public meeting during the 30-day public comment period and providing a responsiveness summary in the ROD.

8.3.4 State and Local Authorities' Roles

State and local government cooperation has been achieved through DTSC as the State point of contact and has included regulatory agency involvement during the development of the IA RI/FS at the former Fort Ord. The Army continues to conduct the OE response, inform state and local agencies of progress related to OE investigations and remedial actions, and accept and respond to state and local agency input regarding implementation of those actions and conducting the basewide OE RI/FS.

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