



U.S. Army
Corps of Engineers
Omaha District



FINAL SITE INSPECTION REPORT

Central Oregon Gunnery Range

Lake County, OR

FUDS Property No. F10OR0170

Site Inspections at Multiple Sites, NWO Region
Formerly Used Defense Sites
Military Munitions Response Program

Contract No. W912DY-04-D-0010
Delivery Order No. 003

September 2007



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The views, opinions, and/or findings contained in this report are those of the author(s) and should not be construed as official department of the Army position, policy, or decision, unless so designated by other documentation.

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Military Munitions Response Program

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Submitted to:

U.S. Department of the Army
U.S. Army Corps of Engineers, Omaha District

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List of Acronyms

°F	degrees Fahrenheit
ADR	Automated Data Review
AOC	area of concern
ARC	Defense Environmental Programs Annual Report to Congress Fiscal Year 2006
ASR	Archives Search Report
BLM	Bureau of Land Management
CA	California
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
COGR	Central Oregon Gunnery Range
CSM	conceptual site model
DERP	Defense Environmental Restoration Program
DMM	discarded military munitions
DoD	Department of Defense
DOI	Department of the Interior
DQO	data quality objective
EDR	Environmental Data Resources, Inc.
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
ER	Engineering Regulation
ESV	Ecological Screening Value
FR	Federal Register
ft	foot or feet
FUDS	Formerly Used Defense Sites
GPS	Global Positioning System
HRS	Hazard Ranking System
HTRW	hazardous, toxic, or radioactive wastes
IEP	Important Ecological Places
INPR	Inventory Project Report
MC	munitions constituents
MEC	munitions and explosives of concern
µg/L	microgram(s) per liter
mg/kg	milligram(s) per kilogram
mm	millimeter
MMRP	Military Munitions Response Program
MRA	Munitions Response Area
MRS	Munitions Response Site
MRSP	Munitions Response Site Prioritization Protocol
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NDAI	No Department of Defense Action Indicated

List of Acronyms (cont.)

NWO	Northwest Region (Omaha District Military Munitions Design Center)
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
OR	Oregon
RAC	Risk Assessment Code
RI/FS	remedial investigation/feasibility study
Shaw	Shaw Environmental, Inc.
SHPO	State Historic Preservation Office
SI	Site Inspection
SLERA	Screening Level Ecological Risk Assessment
SOPs	Standard Operating Procedures
SSWP	Site-Specific Work Plan
TPP	Technical Project Planning
USACE	U.S. Army Corps of Engineers
USC	United States Code
USGS	United States Geological Society
UTL	Upper Tolerance Limit
UTM	Universal Transverse Mercator
UXO	unexploded ordnance

Glossary of Terms

Comprehensive Environmental Response, Compensation, and Liability Act of 1980

(CERCLA) – Also known as “Superfund,” this congressionally enacted legislation provides the methodology for the removal of hazardous substances resultant from past / former operations. Response actions must be performed in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (USACE, 2003). CERCLA was codified as 42 USC 9601 et seq., on December 11, 1980, and amended by the Superfund Amendments and Reauthorization Act (SARA) on October 17, 1986.

Defense Sites – Locations that are or were owned by, leased to, or otherwise possessed or used by the Department of Defense (DoD). The term does not include any operational range, operating storage, or manufacturing facility, or facility that is used for or was permitted for the treatment or disposal of military munitions (10 USC 2710(e)(1)).

Discarded Military Munitions (DMM) – Military munitions that have been abandoned without proper disposal or removed from storage in a military magazine or other storage area for the purpose of disposal. The term does not include unexploded ordnance, military munitions that are being held for future use or planned disposal, or military munitions that have been properly disposed consistent with applicable environmental laws and regulations (10 USC 2710(e)(2)).

Explosive Ordnance Disposal (EOD) – The detection, identification, on-site evaluation, rendering safe, recovery, and final disposal of unexploded ordnance and of other munitions that have become an imposing danger, for example, by damage or deterioration (10 USC 2710(e)(2)).

Formerly Used Defense Site (FUDS) – Real property that was formerly owned by, leased by, possessed by, or otherwise under the jurisdiction of the Secretary of Defense or the components, including organizations that predate DoD. Some FUDS properties include areas formerly used as military ranges (10 USC 2710(e)(2)).

Military Munitions – Ammunition products and components produced for or used by the armed forces for national defense and security, including ammunition products or components under the control of the DoD, the U.S. Coast Guard, the U.S. Department of Energy, and the National Guard. The term includes confined gaseous, liquid, and solid propellants, explosives, pyrotechnics, chemical and riot control agents, smokes, and incendiaries, including bulk explosives, and chemical warfare agents, chemical munitions, rockets, guided and ballistic missiles, bombs, warheads, mortar rounds, artillery ammunitions, small arms ammunition, grenades, mines, torpedoes, depth charges, cluster munitions and dispensers, demolition charges, and devices and components of the above.

The term does not include wholly inert items, improvised explosive devices, and nuclear weapons, nuclear devices, and nuclear components, other than non-nuclear components of

nuclear devices that are managed under the nuclear weapons program of the Department of Energy after all required sanitization operations under the Atomic Energy Act of 1954 (42 USC 2011 et seq.) have been completed (10 USC 101(e)(4)(A) through (C)).

Munitions Constituents (MC) – Any materials originating from unexploded ordnance (UXO), discarded military munitions (DMM), or other military munitions, including explosive and non-explosive materials, and emission, degradation, or breakdown elements of such ordnance or munitions (10 USC 2710(e)(3)).

Munitions Debris (MD) – Remnants of munitions (e.g., fragments, penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or disposal (10 USC 2710(e)(2)).

Munitions and Explosives of Concern (MEC) – This term, which distinguishes specific categories of military munitions that may pose unique explosives safety risks means: (A) Unexploded ordnance (UXO), as defined in 10 USC 101(e)(5); (B) Discarded military munitions (DMM), as defined in 10 USC 2710(e)(2); or (C) Munitions constituents (e.g., TNT, RDX), as defined in 10 USC 2710(e)(3), present in high enough concentrations to pose an explosive hazard (10 USC 2710(e)(2)).

Munitions Response Area (MRA) – Any area on a defense site that is known or suspected to contain UXO, DMM, or MC. Examples are former ranges and munitions burial areas. An MRA comprises one or more munitions response sites (32 CFR§179.3).

Munitions Response Site (MRS) – A discrete location within an MRA that is known to require a munitions response (32 CFR§179.3).

Munitions Response Site Prioritization Protocol (MRSP) – The MRSP was published as a rule on October 5, 2005. This rule implements the requirement established in section 311(b) of the National Defense Authorization Act for Fiscal Year 2002 for the Department of Defense (DoD) to assign a relative priority for munitions responses to each location in the DoD's inventory of defense sites known or suspected of containing unexploded ordnance (UXO), discarded military munitions (DMM), or munitions constituents (MC). The DoD adopted the MRSP under the authority of 10 USC 2710(b). Provisions of 10 USC 2710(b) require that the Department assign to each defense site in the inventory required by 10 USC 2710(a) a relative priority for response activities based on the overall conditions at each location and taking into consideration various factors related to safety and environmental hazards (70 FR 58016).

Range – A designated land or water area that is set aside, managed, and used for range activities of the Department of Defense. The term includes firing lines and positions, maneuver areas, firing lanes, test pads, detonation pads, impact areas, electronic scoring sites, buffer zones with restricted access, and exclusionary areas. The term also includes airspace areas designated for

military use in accordance with regulations and procedures prescribed by the Administrator of the Federal Aviation Administration (10 USC 101(e)(1)(A) and (B)).

Range Activities – Research, development, testing, and evaluation of military munitions, other ordnance, and weapons systems; and the training of members of the armed forces in the use and handling of military munitions, other ordnance, and weapons systems (10 USC 101(e)(2)(A) and (B)).

Risk Assessment Code (RAC) – An interim risk assessment procedure developed by the U.S. Army Engineering and Support Center, Huntsville (USAESCH), Ordnance and Explosives Directorate (CEHNC-OE) to address explosives safety hazards related to munitions. The RAC score was formerly used by the USACE to prioritize response actions at FUDS. The RAC procedure, which does not address environmental hazards associated with munitions constituents, has been superseded by the MRSPP.

Unexploded Ordnance – Military munitions that (A) have been primed, fuzed, armed, or otherwise prepared for action; (B) have been fired, dropped, launched, projected, or placed in such a manner as to constitute a hazard to operations, installations, personnel, or material; and (C) remain unexploded either by malfunction, design, or any other cause (10 USC 101(e)(5)(A) through (C)).

Executive Summary

The Department of Defense (DoD) has established the Military Munitions Response Program (MMRP) under the Defense Environmental Restoration Program to address DoD sites suspected of containing munitions and explosives of concern (MEC) or munitions constituents (MC). Under the MMRP, the U.S. Army Corps of Engineers (USACE) is conducting environmental response activities at Formerly Used Defense Sites (FUDS) for the Army, DoD's Executive Agent for the FUDS program. Shaw Environmental, Inc. (Shaw) is responsible for conducting Site Inspections (SIs) at FUDS in the northwest region managed by the Omaha District Military Munitions Design Center.

SI Objectives and Scope

The primary objective of the MMRP SI is to determine whether a FUDS project warrants further response action under the Comprehensive Environmental Response, Compensation, and Liability Act. The SI collects the minimum amount of information necessary to make this determination, as well as it (i) determines the potential need for a removal action; (ii) collects or develops additional data, as appropriate, for Hazard Ranking System scoring by the Environmental Protection Agency; and (iii) collects data, as appropriate, to characterize the release for effective and rapid initiation of the Remedial Investigation and Feasibility Study. An additional objective of the MMRP SI is to collect the additional data necessary to complete the Munitions Response Site Prioritization Protocol (MRSP).

The scope of the SI reported herein is restricted to evaluation of the presence of MEC or MC related to historical use of the FUDS prior to transfer. Potential releases of hazardous, toxic, or radioactive wastes are not addressed within the current scope. The intent of the SI is to confirm the presence or absence of MEC and/or associated MC contamination.

Central Oregon Gunnery Range

This report presents the results of an SI conducted at Central Oregon Gunnery Range (COGR), FUDS property number F10OR0170, located approximately 50 miles north of Lakeview, Oregon (OR) in Lake County, OR. COGR was commissioned in 1942 and was used primarily for air-to-air and air-to-ground gunnery training. COGR was declared excess in June 1947 and transferred to the Department of the Interior. The property has been since sold to the State Of Oregon and private parties.

Technical Project Planning

The approach for the SI was developed by Shaw in consultation with site stakeholders. A Technical Project Planning meeting conducted in July 2006 was attended by representatives from the USACE - Seattle District, Oregon Department of Environmental Quality (ODEQ), Bureau of Land Management (BLM) – Lakeview office, and Shaw. A representative from the USACE –

Omaha District was unable to attend this meeting. The stakeholders agreed to the approach and identified one area of concern (AOC), the former Air to Air Gunnery Range. The AOC includes the entire 795,057-acre FUDS, which includes the air-to-ground target sites.

SI Field Activities

SI field activities, conducted in February 2007, included a site reconnaissance to verify the site conceptual site model. Samples were collected from surface soil, sediment, and groundwater. Surface water was not present so proposed surface water samples were not collected.

SI Recommendations

Results of the SI provide the basis for conclusions and/or recommendations for further actions at the Air to Air Gunnery Range AOC.

Air to-Air Gunnery Range

Based on historical evidence and results from the SI field activities, there are reports of scattered occurrences of practice bombs within the COGR FUDS. However, no bomb target areas have been reported or identified. The bombing may have been unregulated. MEC was identified in 1988 in the Christmas Valley area west of the COGR FUDS boundary. The SI currently being conducted for the Northwest Maneuver Area FUDS will address this MEC occurrence.

Sample results indicated that all metals concentrations were below background concentrations. The explosive nitrobenzene was detected in several samples at low concentrations below the human health and ecological screening values. Based on the low risk for MEC and no MC hazards, a recommendation for No Department of Defense Action Indicated (NDAI) is made for the Air to Air Gunnery Range.

Removal Actions

There is no indication that a high MEC risk is present at COGR. No MEC was identified during the SI or ASR field activities. There have only been reports of scattered occurrences of practice bombs in the 795,057-acre site. A removal action is not recommended.

A recommendation is made that the area of the MRS in the MMRP Inventory should be corrected to 795,057 acres. The MMRP Inventory incorrectly lists the area as 795.06 acres.

1.0 Introduction

This Site Inspection (SI) Report presents the results of an SI conducted at the Central Oregon Gunnery Range (COGR) Formerly Used Defense Site (FUDS) located near Lakeview, Oregon (OR). Shaw Environmental, Inc. (Shaw) has prepared this report for the U.S. Army Corps of Engineers (USACE) in accordance with Task Order 003, issued under USACE Contract No. W912DY-04-D-0010. Shaw is responsible for conducting SIs at FUDS in the northwest region managed by the Omaha District Military Munitions Design Center (NWO) as directed by the Performance Work Statement (Appendix A).

The technical approach is based on the *Type I Work Plan, Site Inspections at Multiple Sites, NWO Region* (Shaw, 2006a) and the *Formerly Used Defense Sites, Military Munitions Response Program, Site Inspections, Program Management Plan* (USACE, 2005).

1.1 Project Authorization

The Department of Defense (DoD) has established the Military Munitions Response Program (MMRP) to address DoD sites suspected of containing munitions and explosives of concern (MEC) or munitions constituents (MC). Under the MMRP, the USACE is conducting environmental response activities at FUDS for the Army, DoD's Executive Agent for the FUDS program.

Pursuant to USACE's Engineer Regulation (ER) 200-3-1 (USACE, 2004a) and the *Management Guidance for the Defense Environmental Restoration Program* (DERP) (Office of the Deputy Under Secretary of Defense [Installations and Environment], September 2001), USACE is conducting FUDS response activities in accordance with the DERP statute (10 USC 2701 et seq.), the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (42 USC 9601), Executive Orders 12580 and 13016, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR Part 300). As such, USACE is conducting remedial SIs, as set forth in the NCP, to evaluate hazardous substance releases or threatened releases from eligible FUDS.

While not all MEC/MC constitute CERCLA hazardous substances, pollutants, or contaminants, the DERP statute provides DoD the authority to respond to releases of MEC/MC, and DoD policy states that such responses shall be conducted in accordance with CERCLA and the NCP.

1.2 Site Name and Location

COGR, property number F10OR0170, is located approximately 50 miles north of Lakeview, OR, in Lake County (Figure 1-1). The COGR is included in the MMRP Inventory in the *Defense Environmental Programs Annual Report to Congress (ARC) Fiscal Year 2006* (DoD, 2006) and

in the *Archives Search Report (ASR) Supplement* (USACE, 2004b), with one identified range as follows:

Range Name	Range ID	Approximate Area (acres)	UTM Coordinates (meters)
Air to Air Gunnery Range	F10OR017001R01	795.06	N 4770451.8; E 720685.2

Coordinates for the ranges are in Universal Transverse Mercator (UTM), Zone 10N, NAD83.

Note that the acreage shown on the ARC (DoD, 2006) and a table in the ASR Supplement (USACE, 2004b) are not correct due to an apparent typographical error. Figures in the ARC and ASR Supplement are consistent with the following text from the ASR Supplement:

The range area is delineated as being the entire site property. The 795,057-acre range was calculated based on the fact that the entire site could have been used for air-to-air gunnery training.

The correct area should be 795,057 acres. Figure 1-2 shows the original site layout.

1.3 Purpose, Scope, and Objectives of the Site Inspection

The primary objective of the MMRP SI is to determine whether a FUDS project warrants further response action under CERCLA or not. The SI collects the minimum amount of information necessary to make this determination, as well as it (i) determines the potential need for a removal action; (ii) collects or develops additional data, as appropriate, for Hazard Ranking System (HRS) scoring by Environmental Protection Agency (EPA); and (iii) collects data, as appropriate, to characterize the release for effective and rapid initiation of the Remedial Investigation and Feasibility Study (RI/FS). An additional objective of the MMRP SI is to collect the additional data necessary to complete the Munitions Response Site Prioritization Protocol (MRSPP).

The scope of the SI reported herein is restricted to evaluation of the presence of MEC or MC related to historical use of the FUDS prior to transfer. Potential releases of hazardous, toxic, or radioactive wastes (HTRW) are not addressed within the current scope. The intent of the SI is to confirm the presence or absence of contamination from MEC and/or MC. The general approach for each SI is to conduct records review and site reconnaissance to evaluate the presence or absence of MEC, and to collect samples at locations where MC might be expected based on the conceptual site model (CSM). The following decision rules are used to evaluate the results of the SI:

Is No DoD Action Indicated (NDAI)? An NDAI recommendation may be made if:

- There is no indication of MEC;
and

- MC contamination does not exceed screening levels determined from Technical Project Planning (TPP).

Is an RI/FS warranted? An RI/FS may be recommended if:

- There is evidence of MEC hazard. MEC hazard may be indicated by direct observation of MEC during the SI, by indirect evidence (e.g., a false crater potentially caused by impact of unexploded ordnance [UXO]), or by a report of MEC being found in the past without record that the area was subsequently cleared;

or

- MC contamination exceeds screening levels determined from TPP.

Is a removal action warranted? A removal action may be needed if:

- High MEC hazard is identified. Shaw will immediately report any MEC findings so that USACE can determine the hazard in accordance with the MRSPP. An example of a high hazard would be finding sensitive MEC at the surface in a populated area with no barriers to restrict access;
- or
- Elevated MC risk is identified. Identification of a complete exposure pathway (e.g., confirming MC concentrations above health-based risk standards in a water supply well) would trigger notification of affected stakeholders. Data would be presented at a second TPP meeting regarding the possible need for a removal action.

For purposes of applying these decision rules, USACE has provided guidance that evidence of MEC will generally be a basis of recommending RI/FS. Evidence of MEC may include confirmed presence of MEC from historical sources or SI field work, or presence of munitions debris.

1.4 Munitions Response Site Prioritization Protocol

The MRSPP was published as a rule on October 5, 2005 (70 FR 58028). This rule implements the requirement established in section 311(b) of the National Defense Authorization Act for Fiscal Year 2002 for the DoD to assign a relative priority for munitions responses to each location in the DoD's inventory of defense sites known or suspected of containing UXO, discarded military munitions, or MC (70 FR 58016).

Draft MRSPP scoring sheets for the munitions response sites (MRSs) identified in this SI Report are included in Appendix K. The MRSPP scoring will be updated on an annual basis to incorporate new information.

2.0 *Property Description and History*

The setting, history, and use of COGR are described in the following sections. Unless otherwise referenced, this information is taken from the ASR (USACE, 1995).

2.1 *Historical Military Use*

COGR (Figure 2-1) was used primarily for air-to-air and air-to-ground gunnery training. Air-to-air gunnery training used towed targets; however, no remnants of these targets have been reported.

Two air-to-ground target sites are located on the eastern border of the FUDS near Alkali Lake (Figure 2-1). Rounds of .50-caliber and 20 millimeter (mm) ammunition have been found in both target sites. The southern target site is a circular mound, approximately 15 feet (ft) high, and covering an area of approximately 10 acres. The ASR identified the remnants of seven wood structures, presumably targets, which were located on the mound in an east-west line. The layout seems to represent a convoy. These wooden structure remnants were not observed during the SI field work. The northern target site is triangular in appearance, and situated on a naturally occurring rise.

There is also evidence that COGR may have been used for practice bombing purposes. Scattered occurrences of AN-MK 5, AN-MK 23, and AN-MK 43 practice bombs have been reported throughout the FUDS by a Bureau of Land Management (BLM) archeologist. No bombing target locations have been identified and the bombing practice possibly was unregulated.

It was reported that a portion of the FUDS near Alkali Lake was used for .50-caliber machine gun training and firing at airborne targets. In addition, in 1943 a local newspaper, the Lake County Examiner reported that rockets were fired from the same location. These activities may have been associated with the Northwest Maneuvers conducted in 1943. The Northwest Maneuvers Area is a separate, and significantly larger (8 million acres) FUDS project, that fully encompasses the COGR.

The COGR was declared excess in June 1947 and transferred to the Department of the Interior (DOI). Some of the property has since been sold to the State of Oregon or private parties

2.2 *Munitions Information*

The types of munitions used at COGR were .50-caliber machine gun and 20 mm ball M55A1, MK1. As stated above, there is evidence that AN-MK 5, AN-MK 23, and AN-MK 43 practice bombs were also used at COGR. No bombing targets have been identified. Table 2-1 contains a list of the munitions and associated MC reportedly used at the FUDS.

2.3 Ownership History

Between 1942 and 1943, the Army acquired 737,000 acres of public domain land and 58,056.77 acres of lease lands for the former COGR, totaling 795,056.77 acres. In June 1947, the site was declared excess. Public lands were retransferred in November 1947 and the leases cancelled in January 1948.

Presently, the majority of the acreage comprising the former COGR is open public land administered by the DOI and managed by the BLM. The remaining acreage is comprised of some individual private holdings within the site boundaries. Figure 2-1 shows the current land use from an aerial photograph perspective. Parcel ownership within the identified range areas is shown on Figures 2-2A and 2-2B. Property ownership is identified by an index number, located within a parcel rather than a name on the figures. The property owner name is available on request from the USACE Seattle District office.

2.4 Physical Setting

2.4.1 Topography and Vegetation

The elevation of the area ranges from approximately 4,100 ft near Alkali Lake on the east boundary to nearly 6,000 ft at St. Patrick Mountain to the west. The area is a relatively flat region characterized by sand dunes and alkali lakes. Elevated features are predominantly volcanic in origin. Figure 2-3 shows the topography of the COGR area.

2.4.2 Land Use

The former range is situated on 795,057 acres, and is currently used for agricultural purposes and grazing on open range land. Current landowners include private citizens, the BLM, and the State of Oregon. Access to the FUDS is uncontrolled. However, a small parcel of land, near and including the two target sites, is fenced with barbed wire to control access to the Alkali Lake Disposal Site.

The Alkali Lake Disposal Site is located adjacent to and south of the southern target site (Figure 2-2B). The site is a hazardous waste disposal site consisting of a series of 12 shallow unlined disposal trenches each approximately 400 ft long. The site is owned by the State of Oregon. Wastes disposed include herbicide residue, metallic chloride waste, paint and paint solvent, and dioxins/furans. There is an approximately 2,000-ft-long groundwater plume (phenols, dioxins, and 2,4-toluenediamine) extending to the west-northwest. The site is currently monitored by the Oregon Department of Environmental Quality (ODEQ).

2.4.3 Nearby Population

The nearest incorporated community to the former COGR is Lakeview, OR, with an estimated population of 2,474 (U.S. Census, 2000) (Figure 2-4). Lake County, OR, has a population of 7,422 with an average of 0.9 people per square mile (U.S. Census, 2000). There are no schools located within 4 miles of the FUDS (Figure 2-5). Estimated population (2000 census) within a

4-mile radius of the COGR FUDS property boundary is 409. The estimated numbers of housing units and households within a 4-mile radius are 277 and 177, respectively.

2.4.4 Climate

The climate in the area of the FUDS area is semi-arid. It is warm and dry in the summer and cool and dry in the winter. The wettest months are generally January and December with the driest months being July and August. The highest monthly average temperature is 84.2 degrees Fahrenheit (°F) in July and the lowest monthly average temperature is 19.0°F in January. Lakeview's average annual precipitation is 14.93 inches per year, with an average annual snowfall of 57 inches.

2.4.5 Area Water Supply

The COGR is located within the Summer Lake and Lake Abert Watersheds. Because of the flat topography, there is little developed stream drainage (Figure 2-6) and most precipitation collects in shallow ponds and lakes that evaporate in the summer. Much of the water in the area lakes is alkaline in chemistry, as a result of the high evaporative rates in the summer and low stream inflows/outflows.

There are numerous private groundwater wells within the 795,057-acre COGR (Figure 2-7). Most of the wells are used for irrigation purposes and are completed in deep aquifers. Several shallow water-bearing zone groundwater monitoring wells are located near the target sites at Alkali Lake Disposal Site.

2.4.6 Geologic and Hydrogeologic Setting

The COGR lies within the Walla Walla Plateaus section of the Columbia Intermontane Physiographic Province.

2.4.6.1 Bedrock Geology

The bedrock of the area consists of late Cenozoic basalt flows that are interspersed with rhyolitic and rhyolite volcanic structures. The bedrock forms a wide, high lava plateau. The area of the FUDS is heavily faulted, with northwest trending faults with scarps that have been eroded but are visible from the air. The faults are collectively named the Brothers Fault Zone. South of the fault line the lava plateau is broken into large block faulted mountains and valleys, and north of the fault line the lava plateau is mostly unbroken by faulting (Alt and Hyndman, 1990).

2.4.6.2 Overburden Soils

The surface, in the area of the FUDS, consists primarily of various rock outcroppings, most of which are composed of basalt. Where present, the soils in the area are thin. The soils near the target sites are primarily Playas soil type.

2.4.6.3 Hydrogeology

Depth to shallow groundwater near the target sites is approximately 6 ft, based on groundwater monitoring studies at the Alkali Lake Disposal Site. The shallow groundwater is saline and

alkaline in chemistry. Depth to fresh water is much deeper (250 ft below ground surface), within and below the basalt bedrock. Groundwater from the deeper fresh water artesian water-bearing zone is thought to feed portions of the Hutton Springs located approximately 3,500 ft north of the two target sites.

Some surface water to shallow groundwater communication is likely. However, an upward groundwater flow gradient from the deep aquifer to the shallow water-bearing zone would prevent the downward migration of any impacted surface water or shallow groundwater into deeper water-bearing units with higher groundwater quality.

2.4.7 Sensitive Environments

The COGR is currently used for agricultural purposes and grazing on open range land. Located approximately 3,500 ft north of the air-to-ground gunnery target is Hutton Springs (Figure 2-5), which provides habitat for a federal and state threatened subspecies, the Hutton Tui Chub. In addition the Western Snowy Plover, a state listed species, also uses the COGR. While the use of the land for agricultural purposes and grazing would not qualify the area as a ‘sensitive environment,’ the presence of this habitat within the FUDS qualifies this site as an Important Ecological Place (IEP) or Sensitive Environment as defined by USACE (2006) or EPA (1997) and shown in Table 2-2.

2.5 Previous Investigations for MEC and MC

There have been no previous investigations for MC performed at COGR. Previous MEC evaluations are summarized in the following sections.

2.5.1 Inventory Project Report

In 1993, a DERP FUDS Inventory Project Report (INPR) was conducted for the COGR. The findings determined that the site had been formerly used by the DoD and was therefore eligible under the DERP program (USACE, 1993). A Risk Assessment Code (RAC) of 5 was assigned to the COGR during the INPR.

2.5.2 Archives Search Report

The USACE completed an ASR in 1995, which compiled available information on the COGR. The emphasis of the ASR was the types and areas of ordnance use and disposal at site. The ASR included a visit to the site in August of 1995. The primary purpose of the site visit was to assess the presence of MEC through non-intrusive means. Interviews, historical research, and site reconnaissance confirmed that small and medium arms (.50-caliber and 20 mm) were used at the FUDS (USACE, 1995). The ASR mentioned that practice bombing may have occurred at the COGR but no additional information was provided. The focus of the ASR field visit was the two target mounds identified in the INPR (USACE, 1993). At each of the two target sites, .50-caliber rounds were found. No other munitions were found during the ASR site visit.

2.5.3 ASR Supplement

The USACE completed an ASR Supplement in 2004 that identified the entire FUDS as one range. A RAC score of 4 was assigned to the range (USACE, 2004b).

2.5.4 Other Investigations

A letter sent from USACE to DOI in 1947 stated that “The lands had been examined and have been cleared of all explosives or explosive objects reasonably possible to detect by visual inspection” (USACE, 1995).

In 1988, the 34th Ordnance Detachment at the Sierra Army Depot, in Herlong, California, disposed by detonation an AN-MK 43 practice bomb, near the town of Christmas Valley, OR. This location is outside but near the COGR FUDS northwest boundary (approximately 2 miles). However, the practice bomb may be related to the unregulated practice bombing that occurred at COGR. MEC occurrences near COGR have been reported. These occurrences will be addressed in the Northwest Maneuver Area FUDS SI currently being conducted.

2.6 Other Land Uses that May Have Contributed to Contamination

The Alkali Lake Disposal Site is located adjacent to and south of the southern target site (Figure 2-1). The site is a hazardous waste disposal site consisting of a series of 12 shallow unlined disposal trenches each approximately 400 ft long. About 25,000 drums of pesticide manufacturing wastes were disposed here in the late 1960s and early 1970s. Wastes disposed include herbicide residue, metallic chloride waste, paint and paint solvent, and dioxins/furans. There is an approximately 2,000-ft-long groundwater plume extending to the west-northwest. The primary contaminants are phenols, dioxins, and 2,4-toluenediamine. The site is currently monitored by the ODEQ (ODEQ, 2007).

2.7 Past Regulatory Activities

There have been no regulatory actions, with respect to MEC or MC, reported for the site.

2.8 Previous MEC Finds

A .50-caliber ammunition belt was found in the northern portion of the FUDS in 1990. In 1988, the 34th Ordnance Detachment at the Sierra Army Depot, in Herlong, California, disposed by detonation an AN-MK 43 practice bomb, near the town of Christmas Valley, Oregon. This location is outside but near the COGR FUDS northwest boundary. As noted above, the AN-MK-43 practice bomb may have been related to practice bombing at COGR FUDS. Therefore, it will be addressed in the Northwest Maneuver Area FUDS SI.

3.0 SI Tasks and Findings

SI tasks conducted for this FUDS property involved compiling and reviewing historical reports and information, and using this information in the subsequent TPP and overall SI process. Following the TPP meeting, the a *Site-Specific Work Plan* (SSWP) (Shaw, 2006c) was prepared to define the SI field activities necessary to collect the information needed to address the data gaps and data quality objectives (DQOs). Field work was conducted at the site the week of February 13, 2007.

3.1 Technical Project Planning

TPP involved compiling and reviewing historical reports and information to identify data gaps and develop a path forward. A TPP meeting for the former COGR was held at the BLM offices in Lakeview, OR, on July 17, 2006. Representatives from the USACE – Seattle District, ODEQ, BLM – Lakeview office, and Shaw were in attendance. A representative from the USACE – Omaha District was unable to attend this meeting.

Shaw reviewed the site information and presented a summary of the site and the proposed approach for the SI, addressing reconnaissance for MEC and sampling for MC. All parties were in general agreement with the approach, but reserved judgment until the Draft TPP Memorandum was issued. Specific discussions included:

Types of MEC used at the Site: The archeologist for BLM pointed out that scattered occurrences of practice bombs had been identified throughout the range. An inert example was shown to the meeting participants and the practice bomb appeared to be an AN-MK 23 or AN-MK 43 type. The archeologist indicated that anecdotal accounts suggest that pilots would target small playa lakes (ponds) within the range for unregulated bombing practice.

Area of Concern (AOC): Historical and physical evidence indicate that air-to-air and air-to-ground gunnery practice and unregulated bombing practice occurred over much of 795,057-acre FUDS property. Consequently, the entire FUDS is considered to be an AOC, consistent with the ASR Supplement. However it was agreed during the TPP meeting that the SI field effort would focus on the two target sites located near Alkali Lake where air-to-ground gunnery practice occurred, because these specific locations (northern and southern target sites) were the most likely to be affected by former munitions activity within the expansive AOC. Figure 3-1 shows the single AOC and the two target sites.

The BLM archeologist discussed that he had walked most of FUDS and had found projectiles and casings (mostly .50-caliber and very few 20 mm) throughout the FUDS. He also noted that he had found a few discarded .50-caliber ammunition belts within the range. He has prepared several archeological reports that include discussions of the density of munitions. Follow-up discussions were held with the BLM archeologist. He stated that it appears that the Army pilots

would use the barren playa lakes as targets for practice bombing and strafing with .50-caliber guns. These occurrences were scattered throughout the COGR area. Because collectors have picked up munitions debris as souvenirs, fewer practice bombs are being discovered now than at previous times. He has never seen munitions other than expended practice bombs or 20 mm and .50-caliber bullets and casings.

ODEQ discussed the fact that the COGR lies within the Northwest Maneuver Area FUDS that was used in 1943 by the U.S. Army. Several of the reported training areas within COGR (e.g., Alkali Lake machine gun and rocket firing, the sand dune area in the northern portion of the COGR with UXO finds [AN-MK-43 practice bomb]) are likely from activity during the Northwest Maneuver Area operations. It was agreed that those locations would not be included in the COGR SI but would be addressed in the Northwest Maneuver Area FUDS SI project.

Pathways: ODEQ indicated that because of the arid environment and likely blowing dust and sand problem, the air pathway should be addressed using the soil data.

Background: ODEQ indicated that a soil background study is currently being completed for the south central and southeastern part of Oregon, and that that data would be made available for use as background soil data. The data has been received from the ODEQ (from the *National Geochemical Survey Database* [USGS, 2006]) and utilized in the SI Report.

General Discussion: A report was prepared by the Oregon National Guard in 1991 evaluating the use of a portion of the COGR as a new practice bombing range for the Guard (no copy available). In 1987, the Sierra Army Depot Explosive Ordnance Disposal (EOD) unit responded to a UXO find in the northern portion of the COGR. USACE agreed to follow up with the Sierra Army Depot to obtain the report. A copy of the report was provided to Shaw by USACE following the TPP Meeting. The UXO disposed was an AN-MK 43 practice bomb and was located off COGR FUDS property north of Christmas Valley. A copy of the disposal reported is provided in Appendix L.

TPP Meeting results were documented in the *Final Technical Project Planning Memorandum* (TPP Memorandum) (Shaw, 2006b), which was issued final on November 1, 2006, after incorporating comments from the stakeholders. The proposed technical approach was defined in the SSWP (Shaw, 2006c), which was issued final on December 19, 2006, after incorporating comments from the stakeholders.

A more complete discussion of the TPP meeting is contained in Appendix B. As discussed during the TPP meeting and documented in the TPP Memorandum (Shaw, 2006b), the following project objectives and DQOs were developed.

Objective 1: Determine if the site requires additional investigation or can be recommended for NDAI based on the presence or absence of MEC.

DQO #1 – Utilizing trained UXO personnel and handheld magnetometers, a visual search of the air-to-ground gunnery range will be conducted searching for physical evidence to indicate the presence of MEC (ammunition belts, MEC on the surface, munitions debris, and soil discoloration indicative of explosives). The visual search will consist of a meandering path survey along trails and in accessible areas. The following decision rules will apply:

- The following reconnaissance results would support a recommendation for further action with respect to MEC:
 - Direct evidence is found of the presence of MEC, other than incidental small and medium arms rounds, or evidence of potential MEC that is inconsistent with the air-to-ground gunnery range CSM (e.g., debris from munitions other than small and medium arms).
 - Direct evidence of MEC is not found, but abundant munitions debris and/or magnetic anomalies, other than from small or medium arms, are identified suggesting a potential for the presence of unexploded spotting charges or other MEC.
- The following reconnaissance results would support a recommendation for NDAI with respect to MEC:
 - Direct evidence of MEC is not found; isolated munitions debris and/or magnetic anomalies consistent with either the air-to-air or the air-to-ground gunnery range CSM are identified.
 - No evidence of MEC, munitions debris, or magnetic anomalies is identified.
- If there is indication of an imminent MEC hazard, the site may be recommended for a removal action.

Objective 2: Determine if the site requires additional investigation or can be recommended for NDAI based on the presence or absence of MC above screening values.

DQO#2 – Soil, sediment, surface water, and groundwater samples will be collected and analyzed as proposed in Table 3 of the TPP Memorandum (Shaw, 2006b; Appendix B). Analytical results will be compared to screening values for human health and ecological risk assessment, and to background values for naturally occurring substances. The following decision rules will apply:

- If sample results are less than human health and ecological screening values (ESVs), the site will be recommended for NDAI relative to MC.
- If sample results exceed both human health screening values and background values, the site will be recommended for additional investigation.
- If sample results do not exceed human health screening values but do exceed both ESVs and background values, additional evaluation of the data will be conducted in conjunction with the stakeholders to determine if additional investigation is warranted.

3.2 Additional Records Research

3.2.1 Coordination with State Historic Preservation Office

The State Historic Preservation Office (SHPO) was contacted in order to determine if any areas of cultural or archaeological significance have been identified in or in proximity to the AOCs at this FUDS. According to the SHPO, no previous cultural resource surveys have been completed near the project area. However, the SHPO recommended “extreme caution” during ground disturbing activities because the project area is located in an area perceived to have a high probability for possessing archaeological sites and/or buried human remains (OR SHPO, 2006).

3.2.2 Coordination with Natural Resources Offices

The Oregon Department of Fish and Wildlife (ODFW) was contacted to determine if there are threatened or endangered species in the area that might be potentially impacted by field inspection activities. According to the ODFW, the Hutton Tui Chub and Western Snowy Plover are federally- and state-listed threatened species that occur in the area. However, based on Shaw’s description of the work and time of year it will be conducted, the ODFW did not anticipate any impact to these species (ODFW, 2006).

3.2.3 Historical Aerial Photographs

Limited historical photography is available for the COGR. The ASR reviewed aerial photographs from 1954 and reported that no evidence of ordnance or munitions was identified during the review of these aerial photos. Shaw was not able to obtain copies of the 1954 aerial photographs. The two target sites are visible in recent (1994 and 2005) aerial photographs. The available historical aerial photographs are provided in Appendix L.

3.2.4 Environmental Database Search

A search of available environmental records was conducted by Environmental Data Resources Inc. (EDR) on June 8, 2006 (EDR, 2006). The government records search met the requirements of ASTM Standard Practice for Environmental Site Assessments (ASTM, 2006). Search results indicated the AOCs did not appear on mapped sites in known federal, state, or local ASTM or ASTM Supplemental databases (Appendix L). Additional information on the databases searched and the results for surrounding properties is included in the EDR report found in Appendix L.

3.2.5 Rights of Entry

Prior to mobilizing to the site, the Project Manager for the USACE Seattle District office obtained the Right of Entry from the BLM, State of Oregon, and private landowners for the property where the SI field activities were performed.

3.3 Field Work

SI field activities, conducted the week of February 13, 2007, included site reconnaissance, collection of surface soil, sediment, and groundwater samples at the air-to-ground gunnery

targets. The following conditions were recorded in the field log book (Appendix D) and/or by digital photographs (Appendix E):

- Presence or absence of evidence of MEC;
- Changes, if any, in sample location because of field constraints;
- Vegetative cover; and
- Presence or absence of water for sediment and surface water samples, and other conditions encountered that impacted sample collection.

3.4 Sampling and Analysis

Sampling included collection of surface soil, sediment, and groundwater samples. Samples were collected and analyzed in accordance with the SSWP (Shaw, 2006a) using the standard operating procedures (SOPs) from the *Type I Work Plan, Site Inspections at Multiple Sites, NWO Region* (Shaw, 2006a).

3.5 Laboratory Analysis and Data Quality Review

Laboratory analysis was performed by GPL Laboratories of Frederick, Maryland, using methods defined in the SSWP. Analytical results are provided in Appendix F.

The data review process compares sample results to pre-established criteria referenced in the Sampling and Analysis Plan, (Shaw, 2006a, Appendix E) to confirm that the data are of acceptable technical quality. GPL provided Shaw with a Level 4 data package including “Contract Laboratory Program (CLP)-Like” summary forms, Staged Electronic Data Deliverables Stage 2b (version Draft 5.0), and Automated Data Review (ADR) compatible A1, A2, and A3 files for all sample delivery groups. Shaw conducted a data assessment on all samples collected in support of this SI. One hundred percent of the analytical data have been reviewed based on EPA CLP *National Functional Guidelines for Organic Data Review* (EPA, 1999), and EPA CLP *National Functional Guidelines for Inorganic Data Review* (EPA, 2004). ADR software (version 8.1) was used to assist in the data validation process for all areas with the exception of initial calibration blanks, continuing calibration blanks, interference check standards, serial dilutions, internal standards, and second-column confirmation, which were reviewed manually. Data were evaluated against specific criteria to verify the achievement of all precision, accuracy, representativeness, completeness, comparability, and sensitivity goals established to meet the project DQOs.

The overall quality of the data collected is discussed in the Analytical Data QA/QC Report (Appendix G). Results of the analyses as discussed in this evaluation are indicative of the media analyzed with the exceptions of some perchlorate and explosive results. Perchlorate in one sample (NWO-033-6002) was qualified as “J” estimated as a result of low continuing calibration verification and acceptance criteria for isotope ratios. Nitrobenzene results in several samples were qualified as “J” estimated as a result of confirmation column relative percent difference

exceeding acceptance criteria. Explosive analytes in several samples were qualified as “J” estimated or “UJ” not detected with estimated detection limit because surrogate spike recoveries were reported as outside QC criteria. No data were qualified “R” as unusable. Overall, the data reflect expected site conditions and they are fully usable for their intended purpose.

3.6 Screening Values

The following subsections describe the development of screening values for this SI.

3.6.1 Background Data

Background sample locations are shown in Figures 3-2 and 3-3.

A soil background concentration data set for the COGR area was obtained from the United States Geological Survey (USGS), National Geochemical Survey database (<http://tin.er.usgs.gov/geochem/>) (USGS, 2006) and was used to calculate site background concentrations. The data set is a compilation of soil samples collected by the USGS and others from locations in the COGR vicinity. Background soil sample locations are shown on Figure 3-3. Twenty-four samples were used in the calculations. The soil background locations were selected from locations nearby to COGR that were similar in type to those present at the FUDS, based on the information available in the database. Background sediment and groundwater sampling locations are shown on Figure 3-2.

The background soil sample analytical results were used to calculate background metal soil concentrations using published EPA Guidance (1989, 1992, 1994, 1995b, and 2006). The background concentrations are either a 95th upper tolerance limit (UTL) for normally and lognormally distributed analytes or the 95th percentile for nonparametric distributed analytes. The background soil sample analytical results are provided in Appendix L. Table 3-1 lists the soil and sediment metal background concentrations used in this report. A summary of the soil background calculations is presented in Appendix L.

One background sediment sample (NWO-033-5001) was collected from the COGR vicinity (Figure 3-2) and analyzed for metals. One background groundwater sample (NWO-033-6002) was collected from an upgradient well and analyzed for perchlorate. The sediment and groundwater analytical results are presented in Appendix G.

The method for comparing sediment and groundwater results to background was not defined in the TPP process. For purposes of comparison in this SI, the background concentrations for sediments and groundwater are taken to be the background sample value. The approach for determining if a release has occurred is consistent with the EPA’s HRS (40 CFR Part 300: Appendix A): “The minimum standard to establish an observed release by chemical analysis is analytical evidence of a hazardous substance in the media significantly above the background level.” Table 2-3, “Observed Release Criteria for Chemical Analysis” in the above referenced regulation has the following criteria:

1. If the sample measurement is less than or equal to the sample quantitation limit, no observed release is established.
2. If the sample measurement is greater than or equal to the sample quantitation limit, then an observed release is established as follows:
 - If the background concentration is not detected (or is less than the detection limit), an observed release is established when the sample measurement equals or exceeds the sample quantitation limit.
 - If the background concentration equals or exceeds the detection limit, an observed release is established when the sample measurement is three times or more above the background concentration.

In the discussions that follow in Section 4, these criteria are used to determine whether a release of MC has occurred in sediment and groundwater regardless of whether the analyte is considered a hazardous substance. However, these criteria are not applied for soils because a statistically based determination of background has been established, and an exceedance of the 95th UTL or 95th percentile, depending on the individual analyte, is used to establish a release of MC.

3.6.2 Human Health Screening

Human health screening values for soil and sediment analytical results were established using the EPA Region 9 Preliminary Remediation Goals for Residential Soil. Note that in recent meetings with ODEQ for other FUDS, they indicated that EPA Region 6 Preliminary Remediation Goals should be used for all new sites in Oregon. Table 3-2 lists the human health screening values that were agreed to during the TPP process.

3.6.3 Ecological Screening

According to the *Screening-Level Ecological Risk Assessment (SLERA) Guidance for FUDS MMRP Site Inspections* (USACE, 2006), only sites that are considered to be IEP or are to be managed for ecological purposes, require a SLERA. As shown in Table 2-2, the site does meet some of the 33 criteria for designation as an IEP. Table 3-3 lists the ESVs that were agreed to during the TPP process. Shaw developed a SLERA (Appendix L) using ESVs obtained from ODEQ (2001) and other appropriate sources as described in the TPP Memorandum included as Appendix B in this SI Report.

3.7 Variances from the SSWP

There were two variances to the SSWP (Shaw, 2006c). The first was to change the name of the field team leader. The second was to change the downgradient well sampling location when the original proposed well could not be accessed. Copies of the variances are provided in Appendix D.

3.8 Second TPP Meeting

A second TPP Meeting was held on September 6, 2007 via teleconference. Results of the SI were reviewed. All parties indicated that they concurred with the conclusions and

580 recommendations of the SI. A copy of the meeting agenda and minutes are included in
581 Appendix B.

4.0 Air to Air Gunnery Range

The findings for MEC and MC are discussed in the following sections.

4.1 History and Land Use

While the AOC is termed the Air to Air Gunnery Range, there were two primary uses for the AOC. These were air-to-air gunnery training that occurred over much of the 795,057-acre site and the air-to-ground gunnery training that was focused on two targets located on the eastern border of the AOC adjacent to Alkali Lake (Figure 3-1). As discussed in Section 3.1, the entire COGR is one AOC and the SI field activities focused on the two air-to-ground gunnery targets. Figure 4-1 shows the location of the air-to-ground gunnery target sites. Unregulated practice bombing at scattered locations also occurred at the FUDS and practice bombs have been found.

There was also a reported use of the AOC for ground-to-air gunnery practice and machine gun and rocket firing in 1943, about the time of the Northwest Maneuvers. The location of the ground-to-air gunnery training and machine gun and rocket firing was reported as being at Camp Alkali, which was a Civilian Conservation Corps camp during the 1930s and early 1940s. These activities will be evaluated in the SI for the Northwest Maneuver Area FUDS.

Currently, the site is used primarily for livestock grazing. Use of the range for agricultural purposes (i.e., grazing and farming) will likely continue into the foreseeable future. In addition to agricultural use, some off-road recreational use occurs.

4.2 Previous Investigations

In 1995, the ASR field team identified remnants of targets at the southern target site arranged in a pattern that resembled a military convoy.

4.3 MEC Evaluation

The ASR identified that the AOC was used for air-to-air and air-to-ground gunnery practice. The air-to-air portion would have used towed targets. No aerial target remnants have been reported. The air-to-ground practice is supported by the wooden targets on the southern and northern target sites. Although not identified in the ASR or ASR Supplement, AN-MK 5, AN-MK 23, and AN-MK 43 practice bombs have also been found throughout the FUDS as reported by the BLM archeologist at the TPP meeting. However, no bombing targets have been identified. Conversations with a longtime BLM archeologist indicated that he had not observed any evidence of bombing targets. DoD records indicate that small arms and medium caliber munitions (.50-caliber, and 20 mm ammunition) were used at the FUDS.

4.3.1 Field Observations and Historical Evidence of MEC

A visual reconnaissance of the air-to-ground gunnery target sites was conducted during the collection of samples to identify evidence of former range activities (e.g., surface debris or

stressed vegetation). The visual reconnaissance was supplemented with a Fisher all-metal detector to identify any metallic items that may be present. The Fisher unit was chosen due to the high-iron content basaltic rock that may cause false indications of buried items on a typical magnetometer. The paths walked during the visual reconnaissance were recorded using a hand-held Global Positioning System (GPS) unit and are shown on Figure 4-1. No MEC was identified during the SI field work. Two spent .50-caliber rounds were identified during field work.

Historically, MEC has not been reported at the target sites. For the COGR FUDS in general, bombs described as AN-MK 5, AN-MK 23, and AN-MK 43 practice bombs have been found at scattered locations. None were located during SI field work.

4.3.2 MEC Risk Assessment

The following section presents a qualitative assessment of the risk associated with potential MEC at COGR. This assessment is based on historical documentation, prior investigation, and visual inspection conducted during this SI. A MEC assessment is provided to convey relative risk on a scale from low to high and is not intended to be a thorough risk assessment as would be conducted for an RI/FS.

Access to COGR is unrestricted to the public. COGR is used primarily for recreation and leased grazing. Because of reports of practice bombs at COGR, it is possible that undetonated practice bombs that do not contain a sensitive fuze are present at COGR. Other than the reports of practice bombs, the only other munitions use was small arms. The MEC risk for this area is considered to be low, based on the following:

- COGR is a large area of over 795,000 acres;
- The unfenced area is used for limited farming, grazing, and limited recreational use;
- There are limited reports of practice bombs by the BLM archeologist; and
- No bombing targets have been identified.

4.4 Munitions Constituents Evaluation

MC consist of metals (chromium, copper, iron, lead, molybdenum, and nickel), explosives, and perchlorate (Table 2-1)

4.4.1 Terrestrial Pathway

Terrestrial receptors may be exposed to MC because soil was directly affected by firing at targets. Three surface soil samples from the south target (NWO-033-0001, NWO-033-0002, and NWO-033-0003) and three from the north target (NWO-033-0004, NWO-033-0005, NWO-033-0006, and field duplicate NWO-033-0007) were proposed and collected. Samples were analyzed for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) using EPA SW-846 Method 6020A. The metals list was based on the metals expected to be

present in munitions used at COGR (primarily steel and sheet metal). Aluminum and manganese were included as they may be used in geochemical comparison of site soil concentrations to background. Note that only chromium, copper, lead, and nickel are CERCLA hazardous substances.

One sample from each target site, NWO-033-0001 from the south target and NWO-033-0004 and field duplicate NWO-033-0007 from the north target, was also analyzed for explosives, including nitroglycerin, using EPA SW-846 Method 8330A. Sample locations are shown in Figure 4-2.

The surface soil sample locations were collected from the upper 6 inches of soil and were composited using the wheel method as described in the *Final Type I Work Plan* (Shaw, 2006a).

4.4.1.1 Comparison to Background Data

The detected metals were compared to the soil background concentrations. The comparison is shown on Tables 4-1A and 4-1B. Molybdenum exceeded background concentration of 6.9 milligrams per kilogram (mg/kg) in soil samples NWO-033-0002 (149 mg/kg) at the south target and NWO-033-0004 (32.4 mg/kg), NWO-033-0006 (20.9 mg/kg), and field duplicate NWO-033-0007 (29.1 mg/kg) at the north target. The high concentrations of molybdenum are not thought to be related to munitions. Molybdenum can be present in small quantities of steel (a few percent). However, if the elevated molybdenum concentrations were due to steel in munitions, elevated concentrations of iron should also be present. However, iron concentrations in all samples were well below the background concentration (Tables 4-1A and 4-1B).

Nitrobenzene was detected at estimated quantities (0.049 J mg/kg and 0.043 J mg/kg) between the method detection limit and the laboratory reporting limit in sample NWO-033-0004 and its field duplicate NWO-033-0007, respectively. Nitrobenzene was the only explosive compound detected. Shaw has observed similar results at other FUDS and has required the laboratory to perform additional data review. Although the laboratory has confirmed the presence of nitrobenzene, the results are still open to question. The half-life of nitrobenzene was reported as 56 days in an aerobic soil column (Kincannon, 1985). Therefore, nitrobenzene associated with military activities at a site more than 60 years before sample collection would have degraded to non-detectable concentrations. Nitrobenzene has many industrial uses, in particular, for the manufacture of aniline, which is used in rubbers, dyes, photographic chemicals, urethane foams, pharmaceuticals, explosives, petroleum refining, phenolics, herbicides, and fungicides (Sax and Lewis, 1987), and may also be found in pesticides (EPA, 1995a). However, it is not clear how these industrial uses can explain the distribution at COGR.

4.4.1.2 Comparison to Human Health Screening Values

Soil analytical results are only compared to human health screening values if background concentrations are exceeded. Molybdenum exceeded the background value and the human

health screening value of 390 mg/kg in one sample. The nitrobenzene detections of 0.049 J mg/kg and 0.043 J mg/kg were below the human health screening value of 20 mg/kg.

4.4.1.3 Comparison to Ecological Screening Values

Soil analytical results are only compared to ESVs if background concentrations are exceeded. Molybdenum exceeded the ESV of 2 mg/kg. Note that the site background value of 6.9 mg/kg also exceeded the ESV. The nitrobenzene detections of 0.049 J mg/kg and 0.043 J mg/kg were below the ESV of 2.4 mg/kg.

A SLERA was completed for COGR and concluded that molybdenum was a metal of ecological concern (Appendix L). The SLERA concluded that adverse ecological effects to birds and small mammals may be possible.

4.4.2 Surface Water Pathway

One sediment sample from each target (South – NWO-033-1001 and North – NWO-033-1002) was proposed and collected. The discrete samples were analyzed for select metals using EPA SW-846 Method 6020A and explosives, including nitroglycerin, using EPA SW-846 Method 8330A.

In accordance with the SSWP (Shaw, 2006c), two surface water samples were planned, contingent on the presence of surface water at the target locations. No surface water was found and no samples were collected.

4.4.2.1 Comparison to Background

The detected metals were compared to the sediment background concentrations. The comparisons are shown on Table 4-2. No metals concentrations significantly exceeded the sediment background concentration (three times the maximum background sediment sample concentration).

Nitrobenzene was detected at estimated quantities between the method detection limit and the laboratory reporting limit in sample NWO-033-0004 (0.029 J mg/kg) and its field duplicate NWO-033-0007 (0.041 J mg/kg). As discussed above in Section 4.4.1.1, the detections of nitrobenzene are suspect due to short half-life of the compound.

4.4.2.2 Comparison to Human Health Screening Values

No detected metals concentrations significantly exceeded (three times the maximum background concentration) background concentrations and, therefore, no comparison to human health screening values was completed.

Detections of nitrobenzene were below the human health screening value of 20 mg/kg.

4.4.2.3 Comparison to Ecological Screening Values

No detected metals concentrations significantly exceeded (three times the maximum background concentration) background concentrations and, therefore, no comparison to ESVs was

completed.

Detections of nitrobenzene were below the ESV of 32 mg/kg.

4.4.3 Groundwater Pathway

One groundwater sample (NWO-033-3001) was collected from the Alkali Lake Disposal Site groundwater monitoring well located downgradient of the south target (Figure 4-3). The well is sampled annually by the ODEQ to monitor groundwater plume movement from the Alkali Lake Disposal Site. The sample was analyzed for perchlorate only, using DataChem Laboratory internal standard operating procedure LCMS-CL04-Rev. 2 (see Analytical Data QA/QC Report provided in Appendix G). As agreed in the TPP Memorandum (Shaw, 2006b) metals were not analyzed because of the relatively low mobility of metals in the semi-arid environment at the COGR. The contaminated groundwater plume from the adjacent disposal site runs under both target sites.

The groundwater sample was collected using a peristaltic pump. The sample was filtered using a 0.2-micron filter prior to filling the sample container.

4.4.3.1 Comparison to Background

Perchlorate was the only analyte for the groundwater sample. Perchlorate was not detected in the sample above the reporting limit of 0.122 microgram per liter ($\mu\text{g/L}$). The COGR background value for perchlorate is 0.229 $\mu\text{g/L}$. Because there was no perchlorate detected, comparison to human health and ESV is not completed. Perchlorate is a naturally occurring chemical as well manufactured for industrial uses. Naturally occurring perchlorate has been found in arid environments, dry lake beds, and evaporative mineral deposits (ITRC, 2005) such as occurs at COGR and Alkali Lake.

4.4.4 Air Pathway

Air is a potential pathway, because of the potential of entrainment of metals and explosives in wind blown dust. The potential inhalation of soil particles is included in the development of health-based screening values for soil.

5.0 Summary and Conclusions

The conclusions of the SI are presented in this section. Recommendations for further action are presented in Section 6.0. An updated CSM is presented in Appendix J.

In the MMRP Inventory in the ARC (DoD, 2006) and in the ASR Supplement (USACE, 2004b), the site has one identified range as follows:

Range Name	Range ID	Approximate Area (acres)	UTM Coordinates (meters)
Air to Air Gunnery Range	F10OR017001R01	795.06	N 4770451.8; E 720685.2

Coordinates for the ranges are in UTM, Zone 10N, NAD83.

Note that the acreage shown on the ARC (DoD, 2006) and a table in the ASR Supplement (USACE, 2004b) are not correct due to an apparent typographical error. Figures in the ARC and ASR Supplement are consistent with the following text from the ASR Supplement:

The range area is delineated as being the entire site property. The 795,057-acre range was calculated based on the fact that the entire site could have been used for air-to-air gunnery training.

5.1 Air to Air Gunnery Range

The entire COGR FUDS is one AOC. Because of the large land area and that most of the FUDS was used for air-to-air gunnery practice and only small portion of the area was used for air-to-ground target practice, field investigations were focused on the air-to-ground gunnery targets.

The BLM archeologist reported that he has observed scattered occurrences over the 795,057 acre site of AN-MK5, AN-MK23, and AN-MK-43 practice bombs. No evidence of MEC was found during the SI field activities. Spent .50-caliber rounds were identified during SI field work. Based on this, the risk associated with potential MEC is low.

Six surface soil samples, one sediment sample, and one groundwater sample were collected from the south and north target sites. Analytes included select metals and explosives in soil and sediment, and perchlorate in groundwater. Molybdenum exceeded the site background concentration, human health screening value, and ESV in soil samples. A SLERA was completed that concluded Molybdenum may adversely effect birds and small mammals. Low levels of nitrobenzene were detected in soil samples from the north target and in sediment samples from both the south and north targets. All nitrobenzene detections were well below human health and ESVs.

6.0 Recommendations

Results of the SI provide the basis for conclusions and/or recommendations for further actions at each of the AOCs.

6.1 Air to Air Gunnery Range

Based on historical evidence and results from the SI field activities, there are reports of scattered occurrences of practice bombs within the COGR FUDS. However, no bomb target areas have been reported or identified. The bombing may have been unregulated.

Sample results indicated that only molybdenum exceeded the soil background, human health screening value, and ESV. A SLERA was completed that identified molybdenum as a metal of ecological concern. However, because molybdenum is not a CERCLA hazardous substance and in accordance with USACE guidance, a recommendation for additional investigations based on molybdenum alone cannot be made. The explosive nitrobenzene was detected in several samples at low concentrations below the human health screening values and ESVs. Based on the low risk for MEC and no MC hazards, a recommendation for NDAI is made for the Air to Air Gunnery Range.

6.2 Removal Actions

Section 1.3 identified as one of the decision rules, evaluation of whether a removal action is warranted. A removal action would be warranted if a high MEC hazard or elevated MC risk was identified. There is no indication that a high MEC risk is present at COGR. No MEC was identified during the SI or ASR field activities. There have been reports of scattered occurrences of practice bombs in 795,057 acre site.

6.3 Munitions Response Sites

Results of the SI field activities provide the basis for identifying MRSs and for scoring each MRS using the MRSP.

Based on the use and physical distribution of the AOC at COGR, one MRS is identified (Figure 6-1):

1. MRS #1 – Air to Air Gunnery Range.

This MRS consists of the entire Central Oregon Gunnery Range FUDS property. A recommendation is made that the area of the MRS in the MMRP Inventory should be corrected to 795,057 acres.

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