

**U.S. Army Corps of Engineers
Omaha District**

**Final Technical Project Planning
Memorandum
Central Oregon Gunnery Range
FUDS ID F10OR0170**

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

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Final Technical Project Planning Memorandum

**Site Inspection
Central Oregon Gunnery Range
Formerly Used Defense Site
FUDS ID F10OR0170**

Military Munitions Response Program

Documentation for Technical Project Planning Meeting
Bureau of Land Management
Lakeview, Oregon
July 17, 2006

Hosted by U.S. Army Corps of Engineers

Prepared by Shaw Environmental, Inc.

November 1, 2006

Concurrences

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TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS..... ii

ADMINISTRATIVE INFORMATION..... 1

 Technical Project Planning Meeting Summary 4

SITE INSPECTION OBJECTIVES 6

 Goal..... 7

 Objectives 7

 Roles & Responsibilities..... 7

 Site Inspection Process 8

 Technical Project Planning Process 8

BACKGROUND INFORMATION 9

 Site Description and Regulatory History 10

 Operational History and MEC/MC Characteristics 11

 Groundwater 12

 Surface Water..... 13

 Terrestrial Exposure..... 13

 Air 14

CONCEPTUAL SITE MODEL 15

 Overview..... 16

 Conceptual Site Model – Air-to-Air Gunnery Range AOC..... 17

 Data Gaps..... 22

PROPOSED SAMPLING SCHEME 23

 Proposed Field Investigation..... 24

TPP NOTES AND DATA QUALITY OBJECTIVES 26

 Technical Project Planning and Development of Data Quality Objectives 27

 TPP Phases..... 27

 Data Quality Objectives 31

 Next Steps 33

FIGURES..... 34

TABLES..... 35

DRAFT WORKSHEETS..... 36

ABBREVIATIONS AND ACRONYMS

AOC	area of concern
ASR	Archives Search Report
BLM	Bureau of Land Management
COGR	Central Oregon Gunnery Range
CSM	Conceptual Site Model
DFW	Department of Fish and Wildlife
DoD	Department of Defense
DOI	Department of the Interior
DQO	data quality objective
°F	degrees Fahrenheit
ft	foot or feet
FUDS	Formerly Used Defense Site
HRS	Hazard Ranking System
LC/MS	liquid chromatography/mass spectrometry
MC	munitions constituents
MEC	munitions and explosives of concern
mm	millimeter
MMRP	Military Munitions Response Program
MRSP	Munitions Response Site Prioritization Protocol
NDAI	No Department of Defense Action Indicated
ODEQ	Oregon Department of Environmental Quality
PCOC	potential contaminant of concern
PRG	Preliminary Remediation Goal
RAC	Risk Assessment Code
RI/FS	Remedial Investigation/Feasibility Study
Shaw	Shaw Environmental, Inc.
SHPO	State Historic Preservation Office
SI	Site Inspection
SSWP	Site-Specific Work Plan
TPP	Technical Project Planning
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USEPA	U.S. Environmental Protection Agency
UXO	unexploded ordnance

Administrative Information

***Site Inspection
Central Oregon Gunnery Range***

***Technical Project Planning Meeting
July 17, 2006***

The Technical Project Planning (TPP) Memorandum is one in a series of documents used during the Site Inspection (SI) process to document the information collected and processes used to evaluate Formerly Used Defense Sites (FUDS) for the possible presence of munitions and explosives of concern (MEC) and/or munitions constituents (MC). TPP meeting information provided in the Memorandum reflects both the original version of information shared with meeting participants, as well as changes/updates to site-specific information obtained during the TPP meeting.

The TPP meeting for the former Central Oregon Gunnery Range (COGR) was conducted on July 17, 2006 at the Bureau of Land Management (BLM) offices located in Lakeview, Oregon. Representatives from the U.S. Army Corps of Engineers (USACE) – Seattle District, the Oregon Department of Environmental Quality (ODEQ), BLM, and Shaw Environmental, Inc. (Shaw) were in attendance. By agreement with the USACE, landowners (other than BLM) were not present at this meeting. A separate meeting for the public was held in the evening on the same day. A site tour was not conducted as part of this meeting.

The TPP Memorandum documents discussions for the TPP meeting and includes the sections described below:

- **Administrative Information:** includes meeting logistics, the list of attendees, and a summary of the meeting;
- **Site Inspection Objectives:** provides the goal and objectives of the SI, roles and responsibilities, the SI process, and the TPP process;
- **Background Information:** includes site and project history, area physical setting, a summary of previous environmental work, and an introduction to the areas of concern (AOCs) addressed by the SI;
- **Conceptual Site Model (CSM):** identifies environmental attributes, potential human and ecological receptors in the area's environment, and the relationships between these factors;
- **Proposed Sampling Scheme:** describes the type and quantity of samples to be taken, and the analytical methods to be used for characterizing the AOC;
- **TPP Notes and Data Quality Objectives (DQOs):** captures project and site-specific information as discussed during the TPP meeting to ensure the necessary and appropriate information is shared among meeting participants, and that meeting participants concur with the identified goal, objectives, and approach used to complete the SI process; and
- **Worksheets:** includes the **Site Information Worksheet, Draft Munitions Response Site Prioritization Protocol (MRSPP) Data Gaps, and Hazard Ranking System (HRS) Data Gaps.**

Site: Central Oregon Gunnery Range

Location: Lakeview, Oregon

USACE District: Seattle

TPP #1 Meeting Location: Bureau of Land Management, Lakeview, Oregon

TPP #1 Meeting Date: 7/17/06

Agenda

Monday, July 17, 2006

- **Convene at BLM Office**
 - Introductions
 - Review Site Inspection Objectives
 - Goals, Objectives, Roles & Responsibilities
 - Site Inspection Process
 - Technical Project Planning Process
 - Review of Background Information

- **Technical Project Planning Discussion**

- **Conclude Meeting**

- **Evening Public Meeting**

TPP Meeting Attendees

Mike Nelson	USACE – Seattle District
David Anderson	ODEQ
Dale Landon	Shaw
Dan Stewardson	BLM
Todd Forbes	BLM
Tom Rasmussen	BLM
William Cannon	BLM
Paul Whitman	BLM
Lynn Miracle	BLM
Rebecca Lange	BLM
Ken Tillman	BLM

Technical Project Planning Meeting Summary

The TPP meeting for the former COGR was held at the BLM offices in Lakeview, Oregon 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 Technical Project Planning Memorandum was issued. Comments on the Draft Technical Project Planning Memorandum have been received from stakeholders and incorporated in this document and the Draft Site-Specific Work Plan (SSWP). Specific discussions included:

Types of MEC Used at the Site: The archeologist for BLM pointed out that the scattered occurrences of practice bombs have 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, 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.

AOCs: It was agreed that while the entire 795,056 acres were used for air-to-air gunnery practice and unregulated bombing practice, the SI would focus on the two target areas located near Alkali Lake where air-to-ground gunnery practice occurred. It was discussed and agreed that because the primary MEC used at the site was 50-caliber and 20-millimeter (mm) small and medium arms ammunition for air-to-air gunnery practice, identifying a particular location to sample for either MEC or MC was neither warranted nor practical.

The BLM archeologist discussed that he had walked most of the area and had found projectiles and casings (mostly 50-caliber, very few 20-mm) throughout the COGR. 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. These reports were to be sent to Mr. Mike Nelson of the USACE but to date have not been received by Shaw.

ODEQ discussed 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 in COGR (e.g., Alkali Lake machine gun and rocket firing, the sand dune area in the northern portion of the COGR with unexploded ordnance [UXO] finds) are likely from activity during the Northwest Maneuver Area operations. It was agreed to by the USACE and Shaw that those locations would not be included in the COGR but would be addressed in the Northwest Maneuver Area FUDS 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. Note the data have been provided by ODEQ

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.

In 1987, the Sierra Army Depot Explosive Ordnance Disposal 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.

Additional information from the TPP meeting is included in the Technical Project Planning Notes and Data Quality Objectives section of this TPP Memorandum.

Site Inspection Objectives

*Site Inspection
Central Oregon Gunnery Range*

*Technical Project Planning Meeting
July 17, 2006*

Goal

- The USACE is conducting SIs of FUDS properties to determine if any MEC or related MC are present on property formerly owned or leased by the U.S. Department of Defense (DoD).

Objectives

- Determine if the site requires further response action because of the presence of MEC/MC.
- Collect minimum information needed to:
 - Eliminate a site from further consideration if:
 - No evidence of MEC and/or
 - Concentrations of MC in samples are below risk-based action levels, or below background concentrations; or
 - Determine the potential need for removal action or initiation of the Remedial Investigation/Feasibility Study (RI/FS) if:
 - MEC identified and/or
 - Concentrations of MC in samples exceed risk-based action levels and background concentrations.
 - Provide sufficient data to prioritize future actions using the HRS and MRSPP.

Roles & Responsibilities

- **USACE:** Acts as the executing agency for the DoD with regard to the FUDS program. In this role, the USACE has decision making authority and is responsible for ensuring work is conducted in accordance with applicable USACE and federal guidance. Additionally, USACE coordinates and works with project team members to meet needs expressed by regulatory agencies and stakeholders to the extent possible within programmatic guidelines.
- **Regulatory Agency:** Participates in planning of SI activities to ensure the project meets applicable state regulatory standards and requirements.
- **Property Owner(s):** Provides available and pertinent information about the area, provides in sight on current and anticipated future land uses for the property, and participates in project team discussions.
- **Shaw:** As a contractor to the USACE, conducts work on behalf of the USACE, provides TPP materials, makes site information available to the project team through a web-based information portal or other means, and conducts and reports SI activities.

Site Inspection Process

- Data review,
- TPP,
- SSWP,
- SI field activities – reconnaissance, sampling, and analysis, and
- SI Report.

Technical Project Planning Process

- Conduct TPP meeting(s) with key organizations and stakeholders;
- Identify stakeholder(s) concerns;
- Identify all AOCs for this SI;
- Review site information;
- Verify current and anticipated future land use;
- Develop CSM;
- Identify data gaps;
- Plan how to address data gaps;
- Develop DQOs for meeting SI requirements; and
- Concur on SI field work approach.

Background Information

***Site Inspection
Central Oregon Gunnery Range***

***Technical Project Planning Meeting
July 17, 2006***

Site Description and Regulatory History

Historical information (including references to interviews and historical documents) contained in this package was obtained from the USACE 1995 Archives Search Report (ASR) and 2004 ASR Supplement for the COGR.

Site Location

- The former COGR is located in Lake County, Oregon. The southern boundary of the FUDS is approximately 50 miles north of Lakeview, Oregon. It is located in the south central portion of Oregon (Figure 1).
- The COGR occupied 795,056 acres that was acquired in 1942.
- The former COGR has one AOC which includes air-to-air, air-to-ground, and ground-to-air ranges.
- The COGR lies entirely within the Northwest Maneuver Area FUDS. The Northwest Maneuver Area FUDS was used briefly in 1943 for a major practice maneuver that occurred in eastern Oregon. The maneuver area included over 8 million acres in eastern Oregon. Portions of the northwest COGR and areas near Alkali Lake were used during the maneuvers.

Physical Setting

- The COGR lies within the Walla Walla Plateaus section of the Columbia Intermontane Physiographic Province.
- The elevation of the area ranges from approximately 4,100 feet (ft) near Alkali Lake on the east boundary to nearly 6,000 ft at St. Patrick Mountain to the west.
- The COGR is a relatively flat region characterized by sand dunes and alkali lakes. Elevated features are predominantly volcanic in origin.
- The site is currently used for agricultural purposes and grazing on open range land.
- Lakeview, Oregon is the nearest incorporated community (approximately 50 miles south) with a population of 2,420 (2004 estimated census).
- The climate in the COGR 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.
- Current landowners include private citizens, the BLM, and the State of Oregon.
- The Alkali Lake Disposal Site is located adjacent to and south of the southern target site. The site is a hazardous waste disposal site consisting of a series of 12 shallow unlined disposal trenches each approximately 400 ft long. 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 site is currently monitored by the ODEQ.

- The FUDS access is uncontrolled.

Previous Investigations and Regulatory History

- A letter from the USACE to the Department of the Interior (DOI) in 1947 informed that “The lands had been examined and have been cleared of all explosives or explosive objects reasonably possible to detect by visual inspection.”
- In 1988, the 34th Ordnance Detachment at the Sierra Army Depot, in Herlong, CA disposed by detonation an AN-MK 43 practice bomb, near the town of Millican, Oregon. This location is outside but near the COGR FUDS northwest boundary. It is likely related to the Northwest Maneuvers of 1943 as it was found outside of the COGR FUDS boundary.
- A 50-caliber ammunition belt was found in the northern portion of the AOC in 1990.
- The USACE prepared an Inventory Project Report and Findings and Determinations of Eligibility for the COGR in 1993. The report determined that the site was eligible for Defense Environmental Restoration Program for FUDS.
- The USACE issued an ASR in 1995, which compiled available information for COGR with emphasis on types and areas of ordnance use and disposal. 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 nothing other than small and medium arms (50-caliber and 20-mm, respectively) were used at COGR.
- An ASR Supplement completed in 2004 identified the entire range as one AOC. A Risk Assessment Code (RAC) scoring was conducted by the USACE in 2004. Possible scores range from 5 (no risk) to 1 (high risk). The RAC score was 4.

Operational History and MEC/MC Characteristics

Historic Military Operations

- In 1942, the United States Government acquired 795,056 acres for the purpose of an aerial gunnery range.
- The COGR served as an aerial gunnery range and included air-to-air training and air-to-ground practice.
- The BLM archeologist reported that spent 50-caliber cartridges are found throughout the 795,056-acre site as well as a lesser amount of 20-mm spent cartridges. Discarded 50-caliber ammunition belts from aircraft have also been reported at the FUDS.
- Two target areas are located near Alkali Lake (Figure 2), and 50-caliber and 20-mm rounds are found in the area. The southern target area is a circular mound, approximately 15 feet high, and covering an area of approximately 10 acres. The remnants of seven wood structures, presumably targets, are located on the mound, in an east-west line. The layout seems to represent a convoy. The northern target area is triangular in appearance

situated on a naturally occurring rise. Some wood, possibly used for a target, was found at this location.

- The COGR FUDS may have been used to some extent for air-to-ground bombing purposes. As reported by a BLM archeologist, AN-MK 5, AN-MK 23, and AN-MK 43 practice bombs have been found throughout the FUDS. No bombing target locations have been identified and the bombing practice likely was unregulated. In addition, scattered occurrences of discarded 50-caliber ammunition belts have been documented by the archeologist.
- It was reported that a portion of the FUDS near Alkali Lake was used for 50-caliber machine gun training. In addition, it was reported that rockets were fired from the same location (Lake County Examiner, 1943). These activities likely were associated with the Northwest Maneuvers of conducted in 1943. Note that the Northwest Maneuver Area is a separate FUDS and that the COGR FUDS is entirely within the Northwest Maneuver Area FUDS.
- The COGR was declared excess in June 1947 and transferred to the DOI.

MEC/MC Characteristics

- The MEC reported in the ASR and ASR Supplement as being used at the COGR was limited to small arms ranging from 50-caliber to 20-mm ball munitions.
- AN-MK 5, AN-MK 23, and AN-MK 43 practice bombs have been found scattered throughout the FUDS. These practice bombs contained a spotting charge consisting of a 10 gauge shotgun shell with a red or white phosphorus pyrotechnic charge.
- Table 1 lists the constituents of the munitions.
- No chemical warfare materiel has been used at the site.

Groundwater

- Where present, the soils at COGR are thin. For the most part, the surface is composed of various rock outcroppings, mostly of basalt.
- The area is heavily faulted, with northwest trending faults that have been softened by erosion and 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 big fault block mountains and a valley, and to the north the lava plateau is mostly unbroken by faulting (Alt and Hyndman, 1990).
- Depth to shallow groundwater near the target areas 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 non-saline/alkaline water is much deeper (250 ft below ground surface), as this area is overlain by basalt. Groundwater from the deeper artesian water bearing zone is thought to feed portions of the Hutton Springs located north of the two target areas.
- There are numerous private groundwater wells within the 795,056-acre COGR. Most of the wells are used for irrigation purposes and are completed in deep aquifers. There are a

number of groundwater monitoring wells located near the target areas at Alkali Lake Disposal Site.

Surface Water

- The COGR is located within the Summer Lake and Lake Abert Watersheds.
- Because of the flat topography, there is little developed stream drainage 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 is thought to be some surface water to shallow groundwater communication. 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 groundwater into deeper water bearing units with higher groundwater quality.

Terrestrial Exposure

- Based on the size and population of Lake County, Oregon, the population density is less than 1 person per square mile. There are no residences or schools/day care facilities in the vicinity of the two target areas at Alkali Lake.
- The following table lists potential endangered or threatened wildlife and vegetation that may be found within or near the former COGR area. The Oregon Department of Fish and Wildlife (DFW), Oregon Department of Agriculture, and the U.S. Fish and Wildlife (USFWS) are being contacted to provide specific information about the site. The table below lists the endangered or threatened species that may be in the area.

Endangered or Threatened Wildlife	Endangered or Threatened Vegetation
Oregon Chub Hutton Tui Chub Foskett Speckled Dace Warner Sucker Lost River Sucker Shortnose Sucker Bald Eagle Fairy Shrimp	Malheur wire-lettuce

- The northern and southern air-to-ground target areas are near Hutton Springs, which is a primary habitat of the Hutton Tui Chub. The Hutton Tui Chub is classified as a threatened subspecies by the USFWS and Oregon DFW.
- Specific archeological sites located within the COGR are not known. The State Historic Preservation Office (SHPO) is being contacted to provide up-to-date information on the presence of historic or archeological sites.

Air

- The nearest individual is approximately 10 miles from the two air-to-ground targets. The town of Lakeview is approximately 70 miles southwest of the two target areas. Occasional human contact from property users (ranchers and recreationists) does occur.
- The predominate wind direction in the vicinity of Alkali Lake is to the north-northeast.

Conceptual Site Model

*Site Inspection
Central Oregon Gunnery Range*

*Technical Project Planning Meeting
July 17, 2006*

Overview

A site-specific CSM summarizes available site information and identifies relationships between exposure pathways and associated receptors. A CSM is used to determine the data types necessary to describe site conditions and quantify receptor exposure, and discusses the following information:

- Current site conditions and future land use;
- Potential contaminant sources (e.g., lead projectiles in an impact berm);
- Affected media;
- Governing fate and transport processes (e.g., surface water runoff and/or groundwater migration);
- Exposure media (i.e., media through which receptors could contact site-related contamination);
- Routes of exposure (e.g., inhalation, incidental ingestion, and dermal contact); and
- Potential human and/or representative ecological receptors at the exposure point. Receptors likely to be exposed to site contaminants are identified based on current and expected future land uses.

The CSM is evaluated for completeness and further developed as needed through TPP meetings. Based on a review of documents and the discussion during the TPP meeting, the following AOC was identified within the COGR FUDS:

- Air-to-Air Gunnery Range.

The Air-to-Air Gunnery Range includes the air-to-ground target areas.

On agreement between stakeholders at the TPP meeting, locations within the COGR that likely were occupied solely during the 1943 Northwest Maneuvers are not included in the COGR FUDS, but will be included as part of the 1943 Northwest Maneuvers FUDS SI.

The following presents the CSM for the COGR FUDS.

Conceptual Site Model – Air-to-Air Gunnery Range AOC

The CSM evaluates potential exposure pathways related to range operation and configuration relative to physical features and land use. Based on the CSM, sampling schemes are proposed for each area to evaluate potential human health and ecological impacts. Historical photos of the ranges (if available) are carefully examined for possible disturbances or other site features of interest in order to focus the efforts on areas where MC contamination is most likely to occur.

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 795,056-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 2 shows the location of the air-to-ground gunnery target areas. In addition, unregulated practice bombing occurred at the FUDS and practice bombs have been found at the FUDS.

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 is not known, other than it was near Alkali Lake. These activities will be evaluated in the SI for the Northwest Maneuver Area FUDS.

Current and Future Land Use

- 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.

Potential Contaminant Sources – Air-to-Air Gunnery Range AOC

- 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 target remnants have been reported. The air-to-ground practice is supported by the wooden targets on the southern and northern target areas. Although not identified in the ASR or ASR Supplement AN-MK 5, AN-MK 23, and AN-MK 43 practice bomb have also been found throughout the FUDS.
- DoD records indicate that small arms and medium caliber munitions were used at the FUDS. Predominantly, 50-caliber, and 20-mm ammunition were used.
- Reported MEC includes a belt of live 50-caliber ammunition found in the northern part of the FUDS (Figure 1) and elsewhere (based on reports from the BLM archeologist) and expended AN-MK 5, AN-MK 23, and AN-MK 43 practice bombs.
- The 50-caliber rounds had tracers that may have contained perchlorate.

MEC Evaluation

Types of MEC

- Potential MEC within the Air-to-Air Gunnery Range AOC are 50-caliber and 20-mm ammunition and practice bombs. An explosive hazard from the 50-caliber and 20-mm ammunition is not expected. However, an explosive hazard does exist for the practice bombs, primarily from the 10 gauge shotgun shell and red or white phosphorous pyrotechnic.

Surface Exposure Pathway

- The potential route of human exposure to MEC or munitions debris includes direct contact by vehicles, foot traffic, or handling. This would include BLM and ranch workers, and recreationists.
- The potential route of wildlife exposure to MEC or munitions debris would be by directly walking on them.

Subsurface Exposure Pathway

- The potential routes of human exposure to MEC or munitions debris would be by intrusive drilling or digging activities. This includes BLM, ranch workers, and recreationists.
- The potential route of wildlife exposure to MEC or munitions debris would be by burrowing activities.

An analysis of the exposure pathways and receptors for MEC is provided in Table 2.

MEC Evaluation/Investigation Needed

- No visual reconnaissance surveys will be completed within the air-to-air gunnery range because of the expansive area to be surveyed (1,242 square miles). MEC in the form of ammunition belts and expended practice bombs have been found on the FUDS.
- A visual (magnetometer assisted) reconnaissance survey will be completed at two air-to-ground gunnery range target areas. This survey will be completed to clear soil and sediment sampling sites.

MC Evaluation

Types of MC

- The anticipated MC at the COGR is lead and steel from projectiles, brass from spent cartridges, and cast iron or sheet metal from practice bombs.
- Metal contaminants of concern from these munitions include chromium, copper, lead, and nickel.
- The propellants were either single base or double base type. However, the munitions were fired from aircraft and any residue from the firing would be distributed over a wide area because of dispersion in the air.

- Tracers were used in the 50-caliber rounds, potentially containing perchlorate.

Overview of Pathways

Affected media and potential pathways for MC include:

- **Soil:** At the COGR, soil is the primary medium of concern because of possible MC in the soil from training activities. The soil also serves as a secondary source of potential sediment/surface water, groundwater, or air contamination.
- **Sediment/Surface Water:** Surface water may act as a migration pathway to humans and ecological receptors from potential sources in soils and sediments. Accumulation of metals in the sediments in pond and lake bottoms may occur. There is no developed surface water drainage between the ponds and lakes and high evaporation rates in the summer reduce the size of the ponds and lakes in the summer.
- **Groundwater:** Groundwater is considered a potentially affected media because of the near surface upper water bearing zone.
- **Air:** Air is a potential media of concern because of the possibility of inhalation of contaminated soil particles. Air is an affected media because of the potential for dust entrainment during high winds.

Exposure media at the COGR include soil, sediment/surface water, groundwater, and air. A pathway evaluation for each media is discussed below and provided in Table 2.

Figure 3 illustrates the conceptual site model for the Air-to-Air Gunnery Range and potential pathways of MC contamination.

Soil Exposure Pathway

Exposure Routes

- The potential routes of human exposure to contaminated soils include incidental ingestion of and dermal contact with contaminated media, as well as inhalation of soil particulates during intrusive work.
- The potential routes of wildlife exposure to contaminated soils include ingestion of and direct contact with contaminated media. Plants may uptake MC and then subsequently be eaten by wildlife. Burrowing animals may ingest MC-contaminated soil and subsequently be eaten by predators.

Receptors

- Workers (BLM and ranch workers).
- Recreationists.
- Wildlife.

MC Soil Evaluation/Investigation Needed

- No soil samples will be collected from the larger air-to-air gunnery range because of the size and inability to focus on one specific area to sample. Sampling activities will be focused on the two air-to-ground targets containing the highest density of activity. These two locations are where the highest level of training activity occurred. Air-to-air

gunnery training and unregulated practice bombing was conducted over the entire 795,056-acre FUDS and MC sampling over this larger area would not be productive.

- Three soil samples are proposed to be collected from each of the two target areas near Alkali Lake.
- All samples to be analyzed for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel). One soil sample from each target area will also be analyzed for explosives including nitroglycerine. The above list of metals for analysis was developed from the expected common components of projectiles, lead and steel (chromium, copper, iron, lead, molybdenum, and nickel). In addition, aluminum and manganese will be analyzed for to aid in background comparisons using geochemical methods.
- Sampling for perchlorate in soils is not warranted. The source for perchlorate would be from incomplete ignition and burning of the perchlorate containing tracers in the 50 caliber ammunition fired from aircraft. While incomplete ignition and burning may occur, once the ammunition reached the surface 60 years of precipitation would have dissolved the perchlorate and no residual would remain in the soil.

Sediment/Surface Water Exposure Pathway

Exposure Routes

- The potential routes of human exposure to contaminated sediment/surface water include incidental ingestion and dermal contact with surface water.
- The potential routes of wildlife (including aquatic organisms) exposure to contaminated sediment/surface water include ingestion of and direct contact with surface water present at or near the AOC.
- A potential exposure point is at Hutton Springs located north of the target areas. The springs are a critical habitat for the Hutton Tui Chub, a threatened species.

Receptors

- Workers (BLM and ranch workers).
- Recreationists.
- Wildlife.

MC Sediment/Surface Water Evaluation/Investigation Needed

- One sediment sample will be collected from ponds or lakes located near each of the two target areas.
- If water is present in the ponds or lakes sampled near the target areas, water samples will be collected.
- One water sample will be collected from Hutton Springs located north of the target areas.
- Sediment samples to be analyzed for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives including nitroglycerine.

- Water samples from small ponds and lakes to be analyzed for select total and dissolved metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel), explosives, and perchlorate.
- Water sample from Hutton Springs to be analyzed for perchlorate only.

Groundwater Exposure Pathway

Exposure Routes

- The potential routes of human exposure to contaminated groundwater include ingestion of and dermal contact with groundwater.
- Wildlife exposure to groundwater is not anticipated.
- A potential exposure point for groundwater surfacing is at Hutton Springs located north of the target areas. The springs are a critical habitat for the Tui Chub, a threatened species. Evaluation of the springs is addressed above under the Sediment/Surface Water Exposure Pathway.

Receptors

- Workers (BLM and ranch workers).

MC Groundwater Evaluation/Investigation Needed

- One groundwater sample will be collected from a well located adjacent to the southern target. The well is part of the monitoring well network for the adjacent Alkali Lake Disposal Site.
- The groundwater sample will be analyzed for perchlorate only.
- Analysis for metals will not be completed. Discussions at the TPP meeting indicated that metals in groundwater were not a concern due to the relatively low mobility of the metals in the semi-arid environment at the COGR. In addition, there is a contaminated groundwater plume (phenols, and 2,4-toluenediamene) from a nearby chemical waste disposal site that runs under the two target areas. The plume has degraded the groundwater quality to above accepted regulatory standards.

Air Exposure Pathway

Exposure Routes

- The potential route of human exposure to contaminated air includes inhalation during times of blowing dust.
- The potential route of wildlife exposure to contaminated air includes inhalation of air during times of blowing dust.

Receptors

- Workers (BLM and ranch workers).
- Wildlife.

MC Air Evaluation/Investigation Needed

- No air samples will be collected from the COGR. Analytical results from soil samples will be used in the evaluation of the air pathway. The U.S. Environmental Protection Agency (USEPA) Region 9 Preliminary Remediation Goals (PRGs) (USEPA, 2004) incorporate dust exposure into the values and additional exposure data beyond soil data is not required.

Data Gaps

- SI being performed for the COGR will identify MEC and MC impacts to soil and sediments/surface water at the former range.
- The presence of MEC has been established at the COGR by the discovery of scattered 50-caliber ammunition belts and practice bombs over the 1,242-square mile COGR. The likely source was from being dropped from aircraft flying over the area.
- No other MEC has been reported.

Results of the current status of data requirements with respect to MEC and MC for the AOCs located at the former COGR are summarized below:

AOC	Presence of MEC	Presence of MC	Proposed Inspection Activities
Air-to-Air Gunnery Range (includes air-to-ground training)	Established, scattered finds of 50-caliber ammo belts and practice bombs	Unknown	Collect soil, sediment/surface water, and groundwater samples at target areas to determine presence of MC

Background data for soils have been provided by ODEQ. However, no background data exist for metals in sediments, surface water, or groundwater or for perchlorate in surface water and groundwater.

Proposed Sampling Scheme

*Site Inspection
Central Oregon Gunnery Range*

*Technical Project Planning Meeting
July 17, 2006*

Proposed Field Investigation

The proposed field investigation sampling to be conducted at the former COGR is detailed below. The investigation approach will be defined in more detail in an SSWP that will be submitted to ODEQ and other stakeholders for review. The SSWP will reference technical details including sampling and analytical methods that are described in the *Type I Work Plan, Site Inspections at Multiple Sites*, prepared by Shaw and submitted to USACE as final in February 2006.

Reconnaissance

A visual reconnaissance of the air-to-ground target areas will be performed prior to any sampling. Although MEC is not expected to be present on the land surface, a magnetometer-assisted, visual inspection will be conducted by a qualified UXO technician at proposed sampling locations within the AOC. A global positioning system (GPS) receiver unit will be used to record discovered MEC, munitions debris, and sample point locations. Digital photographs will be taken to document significant features.

Soils

Proposed SI sampling at the two air-to-ground target areas will consist of the collection of six composite surface soil samples. Three soil samples will be collected near each of the two targets. Surface soil samples will be composite samples (7-point, wheel pattern with 2-ft radius). All samples will be analyzed for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel). One sample from each target area will also be analyzed for explosives including nitroglycerine. The proposed sampling for the COGR is summarized in Table 3.

Sediment/Surface Water

One sediment sample will be collected near each of the two air-to-ground gunnery range targets. Sediment samples will be discrete grab samples. If water is present, one surface water grab sample will be collected from the ponds or lakes sampled for sediment near each of the target areas. The sediment samples will be analyzed for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) and explosives. The surface water samples will be analyzed for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel), explosives including nitroglycerine, and perchlorate. The proposed sampling for the COGR is summarized in Table 3.

One surface water sample will be collected from Hutton Springs to evaluate the potential groundwater to surface water pathway. The sample will be analyzed for perchlorate only.

Groundwater

One groundwater sample will be collected from a monitoring well located near the southern target. The well is part of the Alkali Lake Disposal Site groundwater monitoring network. The sample will be analyzed for perchlorate only.

Analyses

Metals analyses (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel) for soil, sediment, surface water, and groundwater will be by USEPA SW-846 Method 6020A.

Soil and sediment explosives analyses will be by USEPA SW-846 Method 8330A. Nitroglycerin analysis will be by USEPA SW-846 Method 8330A (Modified). Soil and sediment samples may have been impacted by small arms fire will be passed through an ASTM No. 10 (2-mm) wire mesh sieve at the laboratory prior to analysis for metals in order to remove coarser particles and foreign objects, including large metallic fragments from bullets, which have a low degree of bio-availability (Interstate Technical and Regulatory Council, 2003, *Characterization and Remediation of Soils at Closed Small Arms Firing Ranges*).

The surface water samples will be analyzed for select total and dissolved metals by USEPA SW-846 Method 6020A. Surface water samples to be analyzed for explosives will be by USEPA SW-846 Method 8330A. Nitroglycerin analysis will be by USEPA SW-846 Method 8330A (Modified). Water samples to be analyzed for perchlorate will be by liquid chromatography/mass spectrometry (LC/MS) using DataChem Standard Operating Procedure Document Control # LCMS-CL04-Rev 2, *The Determination of Perchlorate in Water, Soil and Biota by LC/MS*, dated July 19, 2006.

Background Sampling

There is existing soil background data for the vicinity. The existing soil background data will be used to develop an upper tolerance limit for comparison of metals soil concentrations at the target areas.

One background sediment sample will be collected from Alkali Lake south of the target areas. The sample will be analyzed for metals. One surface water sample will be collected from Alkali Lake and analyzed for metals and perchlorate. One background groundwater sample will be collected from an upgradient groundwater monitoring well located at the Alkali Lake Disposal Area, and will be analyzed for perchlorate.

During the TPP Meeting it was agreed that a background water sample would be collected from a spring located upgradient and within the same hydrogeologic system as Hutton Springs. At the time of the meeting it was suggested that "XL Spring" may be an appropriate location. However, after evaluation of the spring location it was concluded that the water at the spring was not within the same hydrogeologic system as Hutton Spring. Discussions with the ODEQ, which has done geologic studies for the Alkali Lake Disposal Area, indicated that there was no nearby spring that could be used as a background sample location. It was suggested that a groundwater sample be collected from the nearby "SY" deep well (250 ft below ground surface) (Figure 2) that is thought to penetrate the same aquifer that feeds Hutton Springs via a fault zone. One groundwater sample will be collected from this well and the sample will serve as a background sample for both Hutton Springs and groundwater. The sample will be analyzed for perchlorate only.

The background sediment and water sample data will provide data for direct comparison of sediment and water sample data to background values. Collection of a large data set (i.e. 10 samples) to determine metals background for sediment and surface water is not cost effective when only two sediment samples are to be collected. The proposed background sampling is summarized in Table 3.

TPP Notes and Data Quality Objectives

*Site Inspection
Central Oregon Gunnery Range*

*Technical Project Planning Meeting
July 17, 2006*

Technical Project Planning and Development of Data Quality Objectives

- The USACE TPP process is a four-phase process:
 - Identify the current project,
 - Determine data needs,
 - Develop data collection options, and
 - Finalize data collection program.
- The purpose of TPP is to develop DQOs that document how the project makes decisions.
- DQOs are intended to capture project-specific information such as the intended data use(s), data needs, and how these items will be achieved.
- Information captured through DQOs will be used as a benchmark for determining whether identified objectives are met.

TPP Phases

Phase I: Identify the Current Project

1. Team members identified to date include: USACE – representatives from the Omaha Design Center and the Seattle District, Shaw as a USACE contractor, ODEQ, BLM, and USEPA Region 10.

Question: Is there any person or organization missing from this Team?

Potential need for tribal involvement. USACE to contact local tribe.

2. The one AOC is identified as:

- Air-to-Air Gunnery Range, including the air-to-ground gunnery range.

The ASR Supplement identified the air-to-air gunnery range as the only AOC. However, the air-to-ground range was included in it. The locations of the air-to-air and air-to-ground gunnery ranges are known. Based on information gathered during the TPP meeting, the FUDS was also used for unregulated practice bombing. The air-to-air gunnery range is known to contain MEC, based on a finds of 50-caliber ammunition belts and practice bombs. Explosive MEC has not been located air-to-ground target area. Munitions debris (projectiles and cartridge casings) have been identified at the air-to-ground gunnery range. A RAC score of 4 was assigned to the site. Records indicate that only 50-caliber and 20-mm ammunition were used at the target areas. Records indicate that the range was used on a daily basis.

Question: Are there any other AOCs to be identified?

No additional AOCs.

Does it make sense to separate the air-to-ground range from the air-to-air range?

No.

Is there sufficient evidence that there was a ground-to-air range use at the FUDS and where was it located?

The ground-to-air range was likely used during the 1943 Northwest Maneuvers and will be addressed under that FUDS.

3. Based on information available about the site and shared through discussions with USACE, concerns about this area have been expressed by the ODEQ or USEPA, as well as by landowners.

Question: Are there additional concerns or issues from landowners or other stakeholders regarding the COGR area?

The target areas may be classified as historical sites because of their use for WWII military training. Need to contact the BLM archeologist prior to sampling.

Field work must be performed during the months of mid-May to November because of the likelihood of snow cover in the other months.

Fire restrictions during the summer and early fall months may impact ability to work in the field. Sampling is expected to occur in early November time frame and this is likely not a concern.

Question: Are there any administrative or stakeholder concerns or constraints that would prevent site inspection activities from going forward on the decision path for this site?

None.

Phase II: Determine Data Needs

4. Existing site information includes an ASR and ASR Supplement both prepared by the USACE in 1995 and 2004, respectively.

Question: Are there any other pertinent documents relating to the site available?

Archeological survey reports to be made available by BLM.

Hazardous Waste Landfill Site reports to be made available by ODEQ.

Southeast Oregon soil background data to be made available by ODEQ.

5. The site-specific approach for this SI involves collating and assessing available site information, to include site geology, hydrogeology, groundwater, surface water, ecological information, human use/access, and current and future land uses; as well as considering conduct of site inspection and sampling activities.

Question: Are there any other site aspects/information that should be considered?

BLM provided the “Lakeview Resource Management Plan and Record of Decision” (BLM, 2003).

BLM is to provide the Oregon National Guard report for potential use of the site for training activities.

6. Soil is the primary affected medium at the COGR. Sediment/Surface water is a potential pathway of MC because of the existence of livestock grazing in the area. Air is also a potential pathway if soil particles become airborne. Considering current and future land use, primary receptors of any contaminants that may be present would most likely be individuals and animals using the area for ranching and grazing and human recreational activities.

Question: Do team members concur with the CSM?

- **MEC and MC will only be evaluated in the air-to-ground target areas.**
Agreement.
- **MC contaminants of concern are metals.**
Also include explosives in soil, sediment, and water. Include perchlorate in water samples.
- **Exposure pathways are through soils and sediments/surface water.**
Also include air from blowing dust and groundwater (for perchlorate only).

Collect surface water sample from Hutton Springs located north of target areas. Springs contain threatened species (Hutton Tui Chub).

7. Technical considerations and/or constraints need to be identified and addressed before conducting any additional sampling, and would depend on the approach and additional data needs decided upon by team members.

Questions:

- **Are any data missing?**
Yes.
- **What is the nature of needed data?**
Soil, sediment, surface water, and groundwater data.

- **What information is necessary to support a decision of No Department of Defense Action Indicated (NDAI) or further action with regards to MEC. Is reconnaissance during the SI, together with the historical record of a munitions clearance at the time of range closure and a period of approximately 60 years without known MEC-related incidents considered sufficient to determine the need for NDAI versus further action with respect to MEC.**

Agreement.

- **What data gaps would additional data meet for making a decision about the site?**

Make recommendation in SI to look at other locations within the COGR (e.g., report of machine gun practice and ground-to-ground rocket firing, and UXO find in northern portion of COGR) be incorporated into the Northwest Maneuver Area FUDS. The other locations were likely associated with the maneuvers.

- **Are there any considerations/constraints that need to be addressed for collecting additional data?**

None.

Phase III: Develop Data Collection Options

8. Proposed approach:

1. Conduct surface reconnaissance in the air-to-ground gunnery range AOC.
2. Find suitable soil background sample locations (3 total) and sample.
3. Find suitable sediment background sample location (1 total) and sample.
4. Collect three composite soil samples from the each of the two air-to-ground gunnery range targets and analyzed for select metals (aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel).
5. Collect sediment sample from two ponds near target areas and analyze for select metals.

Question: Are the stakeholders in agreement with the sampling approach program?

Soil background data to be provided from a USGS study currently being completed. No additional soil background data necessary.

Collect one surface water background sample from Alkali Lake. Collect one water sample from a nearby spring located upgradient from Hutton Springs. Collect one groundwater sample from Oregon State monitoring well located at adjacent Alkali Lake Disposal Site.

Collect one surface water sample from Hutton Springs; the Hutton Tui Chub is a threatened species and potential receptor. Analyze for perchlorate only.

Collect one groundwater sample from nearby groundwater well located downgradient from targets; analyze for perchlorate only.

Sediment background sample to be analyzed for metals only.

Question: Are the stakeholders in agreement with the proposed approach for collecting background data?

Yes.

Phase IV: Finalize Data Collection Program

9. What concentrations of PCOCs (metals and explosives) lead to decision end-points?
Note: Oregon state standards for human health screening values are provided in Tables 4, 5, and 6. Ecological screening toxicity values are provided in Tables 7, 8, and 9.

Question: Are these the correct standards to be applied as screening values for human health and ecological risk assessment?

ODEQ will review and comment in Draft TPP Memorandum.

Question: Are there any additional sampling and analysis methodologies needed for all team members to arrive at a decision end-point?

None.

Question: Given the additional sampling and analysis methodologies, are there impacts to the project schedule that need to be accommodated?

None.

Data Quality Objectives

Upon agreement at the TPP meeting, the following decision rules will be applied with regard to MC sampling results:

- Below risk-based screening levels = NDAI;
- Above risk-based screening levels and background = RI/FS.

The following expanded project objectives have been 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 the air-to-ground gunnery range CSM are identified.
 - No evidence of MEC, munitions debris, or magnetic anomalies are identified.
- If there is indication of an imminent MEC hazard, the site may be recommended for a time-critical 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. 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, 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 ecological screening values and background values, additional evaluation of the data will be conducted in conjunction with the stakeholders to determine if additional investigation is warranted.

Objective 3: Obtain data required for HRS scoring.

Data required for HRS scoring are identified in the HRS Data Gaps worksheet.

Objective 4: Obtain data required for MRSPP ranking.

Data required for MRSPP ranking are identified in the MRSPP worksheet.

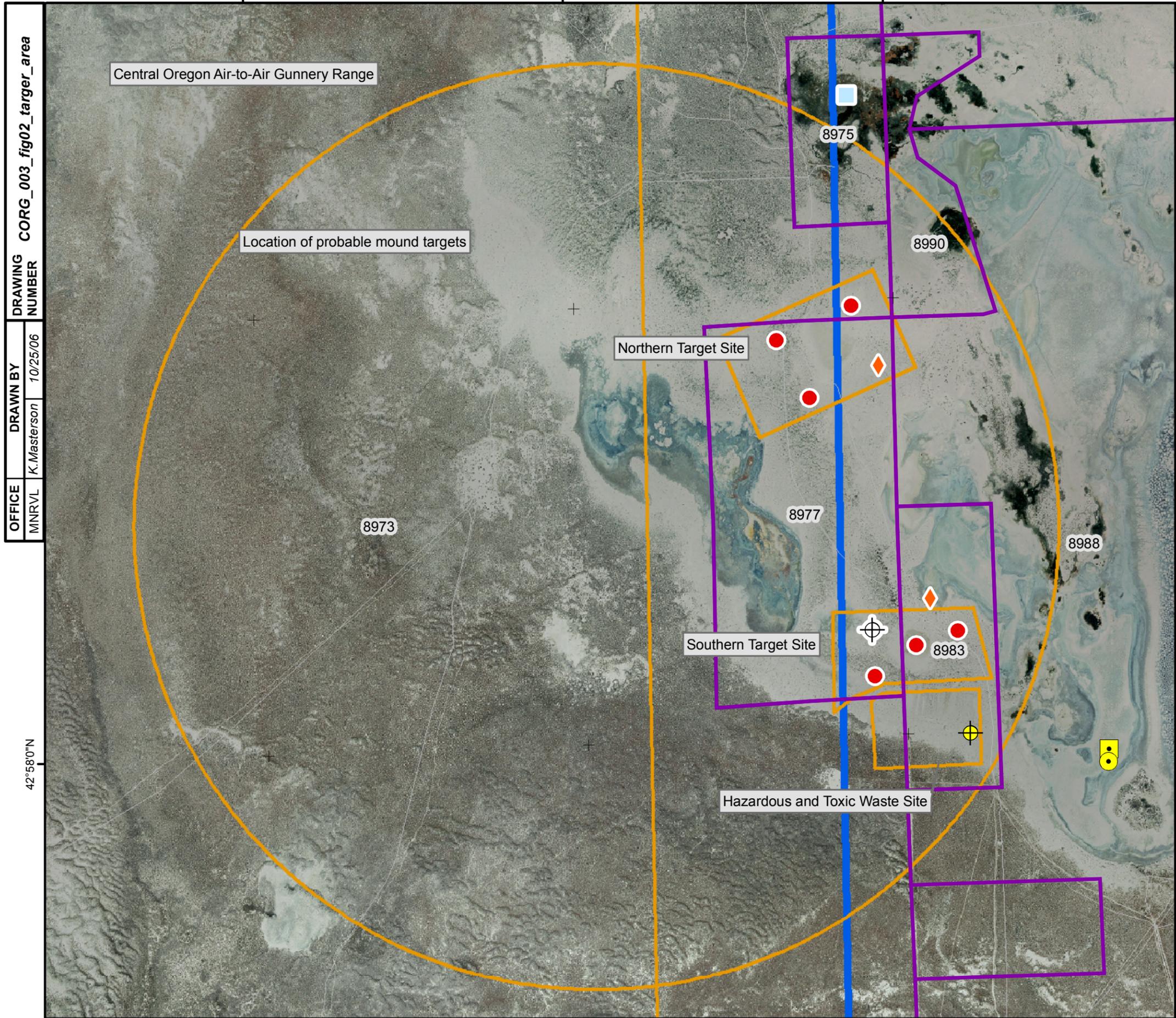
Next Steps

- Shaw will prepare the TPP Memorandum and distribute for concurrence.
- The USACE will provide additional documents identified during the TPP meetings.
- Shaw will prepare the SSWP for review and comment.
- The USACE will provide ROE for landowners.
- Shaw will conduct SI activities.
- Shaw will prepare the SI Report.

Figures

*Site Inspection
Central Oregon Gunnery Range*

*Technical Project Planning Meeting
July 17, 2006*



OFFICE: MNRVL
 DRAWN BY: K. Masterson
 DRAWING NUMBER: CORG_003_fig02_target_area
 DATE: 10/25/06

Legend

- Central Oregon Gunnery Range Property Boundary
- Central Oregon Air-to-Air Gunnery Range - AOC
- Taxlot Parcel
- Well (Water Resources Dept)
- Prop Surface Wat
- Proposed Background Surface Water
- Proposed Sediment Sample
- Proposed Background Sediment
- Proposed Soil Sample
- Proposed Background Groundwater Sample
- Proposed Groundwater Sample

NOTES:

- 1) AOC boundaries were derived from the Central Oregon Gunnery Range ASR Supplement.
- 2) Groundwater well data were obtained from Oregon State Water Resources Dept and approximated to the nearest 1200 meters.
- 3) These ranges are located within the Summer Lake and Lake Albert watersheds.
- 4) 2005 Aerial photo was obtained from the Oregon Department of Environmental Quality.

N

0 700 1,400 Feet

REFERENCE/PROJECTION: NAD 83 UTM Zone 10N

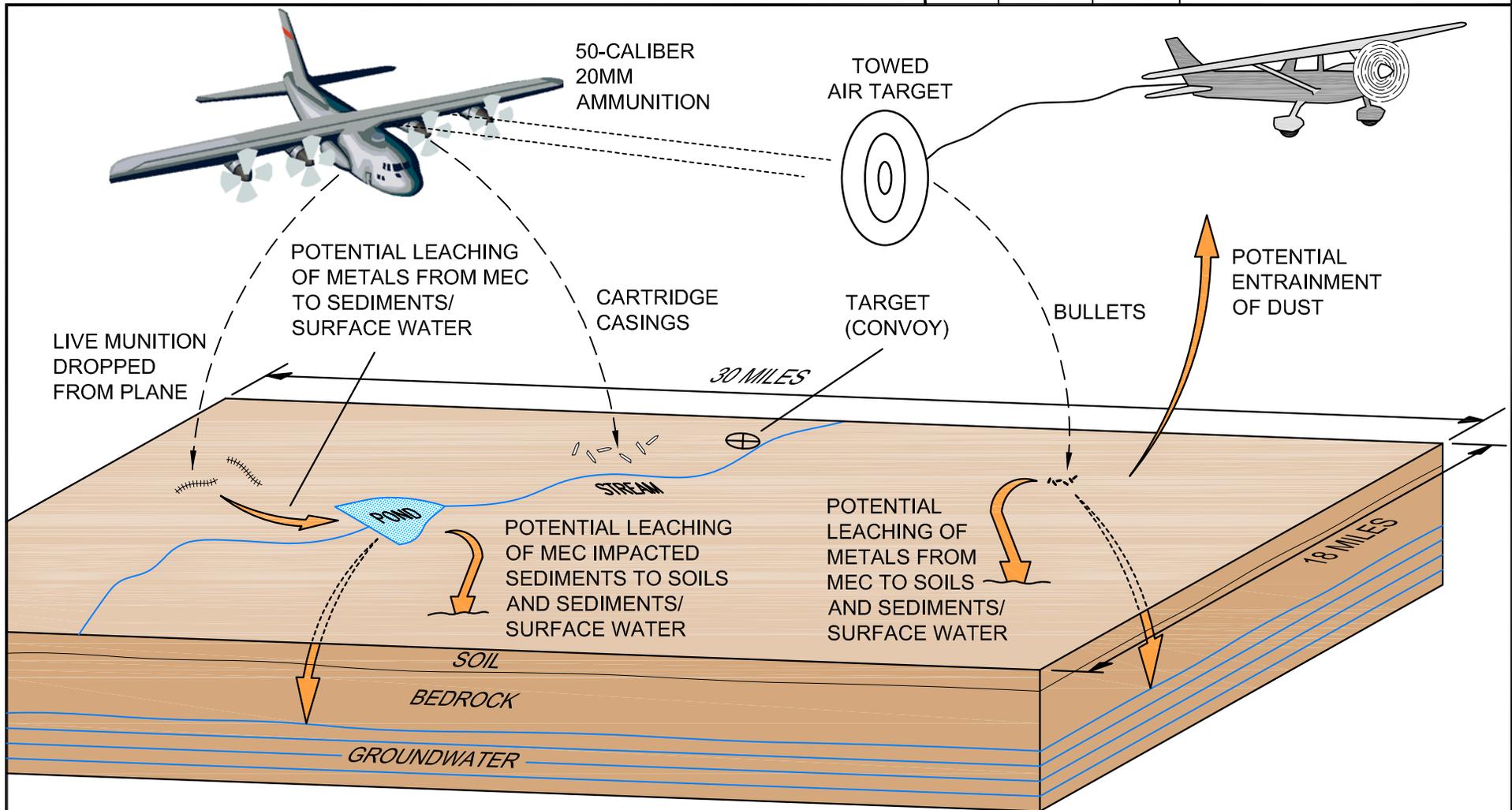
U.S. ARMY CORPS OF ENGINEERS
OMAHA DESIGN CENTER

FIGURE 2
AIR TO GROUND TARGET AREAS
CENTRAL OREGON GUNNERY RANGE

Shaw Shaw Environmental, Inc.

OFFICE	DRAWN BY	DRAWING NUMBER
SJ	K. Black	7-15-06

116188SJ-A52



RECEPTORS:

- BLM Workers/Ranch Workers
- Local Residents
- Biota (Wildlife/Livestock)



U.S. ARMY CORPS OF ENGINEERS
OMAHA DESIGN CENTER

FIGURE 3
CONCEPTUAL SITE MODEL
AIR-TO-AIR AND AIR-TO-GROUND
GUNNERY RANGES
CENTRAL OREGON GUNNERY RANGE

Tables

***Site Inspection
Central Oregon Gunnery Range***

***Technical Project Planning Meeting
July 17, 2006***

**Table 1
Potential MEC and MC at Central Oregon Gunnery Range**

Area of Concern	Munitions	Munitions Constituents	Land Use Controls
Air-to-Air Gunnery Range	50-caliber machine gun	Lead, single- (nitrocellulose) or double-base (nitrocellulose and nitroglycerin) propellant, perchlorate	No
	20-mm ball M55A1, MK1	Steel, double-base (nitrocellulose and nitroglycerin) propellant	No
	AN-MK 5, AN-MK 23, and AN-MK 43 practice bombs	Cast iron, sheet metal, 10 gauge shotgun shell with single- (nitrocellulose) or double-base (nitrocellulose and nitroglycerin) propellant, red and white phosphorus	No

**Table 2
MEC and MC Exposure Pathway Analysis**

Range Area & Type	MMRP Concern	Potential Contaminant of Concern (PCOCs)	Affected Media (Potential Contaminant Sources) (Fate and Transport)	Exposure Routes and Potential Receptors			Data Gaps	Activities to Address Data Gaps (i.e., Sampling)
				Site Workers/ Contractor Personnel	Residents/ General Public	Ecological (Biota)		
Air-to-Air Gunnery Range & Air-to-Ground Gunnery Range	MEC	MEC in the form of unfired 50-caliber and 20-mm ammunition may exist within the 795,056-acre range and two target areas. Dud AN-MK 5, AN-Mk23, and AN-MK 43 practice bombs may exist	Surface Soil <ul style="list-style-type: none"> MEC (unfired ammunition or dud practice bombs) are a hazard. MEC found on surface. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Vehicle & foot traffic. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Vehicle & foot traffic. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Foot traffic. 	<ul style="list-style-type: none"> None; MEC has been reported. 	Air-to-Air Gunnery Range <ul style="list-style-type: none"> None; very low likelihood of finding MEC over the 795,056-acre site. Air-to-Ground Gunnery Range <ul style="list-style-type: none"> Visual (magnetometer assisted) reconnaissance of the two target areas.
			Subsurface Soil <ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Incomplete pathway. 	<ul style="list-style-type: none"> Not applicable. 	<ul style="list-style-type: none"> None; subsurface burial not documented. 	<ul style="list-style-type: none"> Historical documents do not indicate ranges have buried MEC.
	MC	Metals, explosives, and perchlorate from 50-caliber and 20-mm munitions used on ranges	Soil <ul style="list-style-type: none"> Directly affected media. Potential metals and explosives contamination. Fate & Transport: Secondary source of potential surface water, sediment, and air contamination. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of soil particulates during intrusive work. 	<ul style="list-style-type: none"> Potentially complete pathway. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Ingestion, and Direct contact by area fauna. 	<ul style="list-style-type: none"> Analytical data for metals in soil do not exist. Field data for Screening Level Ecological Risk Assessment do not exist. 	Air-to-Air Gunnery Range <ul style="list-style-type: none"> None; very low likelihood of finding impacted soil over the 795,056-acre site. Air-to-Ground Gunnery Range <ul style="list-style-type: none"> Three composite soil samples will be collected near each target area. Soil samples will be analyzed for metals. One sample from each target area will be analyzed for explosives.
			Sediment/Surface Water <ul style="list-style-type: none"> Potentially affected media – ponds, lakes, and springs. Potential metal and explosive contamination in sediments. Potential perchlorate contamination in surface water Fate & Transport: Via surface runoff from impacted soil. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact, and Inhalation of surface water. 	<ul style="list-style-type: none"> Potentially complete pathway. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Ingestion, Direct contact by area fauna, and Direct contact by aquatic organisms. 	<ul style="list-style-type: none"> Analytical data for metals and explosives in sediment/surface water do not exist. Analytical data for perchlorate in surface water do not exist. Field data for Screening Level Ecological Risk Assessment do not exist. 	Air-to-Air Gunnery Range <ul style="list-style-type: none"> None; very low likelihood of finding impacted sediment/surface water over the 795,056-acre site. Air-to-Ground Gunnery Range <ul style="list-style-type: none"> Two sediment samples will be collected from nearby ponds. Samples will be analyzed for metals and explosives. Surface water samples from ponds will be analyzed for metals and explosives Sample from Hutton Springs will be analyzed for perchlorate only.
			Groundwater <ul style="list-style-type: none"> Potentially affected media. Potential perchlorate contamination. Upward flow gradient from deeper aquifer to shallow water bearing zone and surface water and springs. Fate & Transport: Migration of perchlorate directly to groundwater is possible because of high solubility of perchlorate. Transport of metals to groundwater is unlikely because of the low solubility of metals. Transport of explosives to groundwater is unlikely because of assumed low concentrations of explosives in soils. Firing was done from aircraft not from ground. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact 	<ul style="list-style-type: none"> Potentially complete pathway. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Incidental ingestion, Dermal contact 	<ul style="list-style-type: none"> No groundwater analytical data exist for perchlorate. 	<ul style="list-style-type: none"> One groundwater sample will be collected from a nearby well and analyzed for perchlorate.
			Air <ul style="list-style-type: none"> Potentially affected media from blowing soil and dust. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Inhalation 	<ul style="list-style-type: none"> Potentially complete pathway. 	<ul style="list-style-type: none"> Potentially complete pathway. Exposure routes: <ul style="list-style-type: none"> Inhalation 	<ul style="list-style-type: none"> No soil analytical data to evaluate dust impacts. 	<ul style="list-style-type: none"> Will use soil analytical data in risk screening.

**Table 3
Proposed Sampling Approach**

Area of Concern	Media	Contaminants of Concern			Comments
		Metals *	Explosives**	Perchlorate	
Air-to-Air and Air-to-Ground Gunnery Range	Soil	6	2	--	Air-to-Air Gunnery Range - No sampling; very low likelihood of finding impacted soil over the 795,056-acre site. Air-to-Ground Gunnery Range - MC not previously assessed. Composite soil samples will be collected around the target areas.
	Sediment	2	2	--	Air-to-Air Gunnery Range - No sampling; very low likelihood of finding impacted sediment over the 795,056-acre site. Air-to-Ground Gunnery Range - Sediment samples will be collected from nearby ponds.
	Surface Water	2	2	3	Air-to-Air Gunnery Range - No sampling; very low likelihood of finding impacted surface water over the 795,056-acre site. Air-to-Ground Gunnery Range - Surface water samples will be collected from nearby ponds if water is present. One sample to be collected from nearby Hutton Springs and analyzed for perchlorate only.
	Groundwater	--	--	1	Sample from nearby Alkali Lake Disposal Site monitoring well.
Background	Soil	--	--	--	Existing soil background data set will be used.
	Sediment	1	--	--	Sediment background sample will be collected from Alkali Lake.
	Surface Water	1	--	2	Surface water sample will be collected from Alkali Lake for metals and perchlorate. Background sample for Hutton Springs will be collected from the background groundwater sample well ("SY" Well). Well is thought to be completed in same aquifer as spring source water. Sample analyzed for perchlorate only.
	Groundwater	--	--	2	Collect from nearby State of Oregon well ("SY" well), and an upgradient well located in the Hazardous Waste Disposal Area, and analyze for perchlorate only.
Sample Totals		12	6	7	

Notes:

* Metals to be analyzed include aluminum, chromium, copper, iron, lead, manganese, molybdenum, and nickel.

** Explosives analysis will include nitroglycerin.

Quality control samples will be addressed in the SSWP.

Surface soil samples are composite samples (7-point, wheel pattern with 2-foot radius). All other samples are discrete grab samples.

Table 4
Human Health Soil/Sediment Screening Values at Oregon Sites ^a

Potential Contaminant of Concern	Abbreviation	CAS No.	Laboratory Method Detection Limit (mg/kg)	USEPA Region 9 Human Health Screening Values		
				Residential PRG ^b (mg/kg)	SSLs ^c DAF=1 (mg/kg)	SSLs ^c DAF=20 (mg/kg)
Hexahydro-1,3,5-trinitro-1,3,5-triazine	RDX	121-82-4	0.075	4.4		
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	HMX	2691-41-0	0.050	3,100		
2,4,6-Trinitrotoluene	2,4,6-TNT	118-96-7	0.040	16		
1,3,5-Trinitrobenzene	1,3,5-TNB	99-35-4	0.020	1,800		
1,3-Dinitrobenzene	1,3-DNB	99-65-0	0.020	6.1		
2,4-Dinitrotoluene ^d	2,4-DNT	121-14-2	0.040	0.72	0.00004	0.0008
2,6-Dinitrotoluene ^d	2,6-DNT	606-20-2	0.040	0.72	0.00004	0.0008
2-Amino-4,6-dinitrotoluene	2-Am-DNT	35572-78-2	0.040	12		
2-Nitrotoluene	2-NT	88-72-2	0.075	0.88		
3-Nitrotoluene	3-NT	99-08-1	0.050	730		
4-Amino-2,6-dinitrotoluene	4-Am-DNT	19406-51-0	0.040	12		
4-Nitrotoluene	4-NT	99-99-0	0.040	12		
Nitrobenzene	NB	98-05-3	0.020	20	0.007	0.1
Methyl-2,4,6-trinitrophenylnitramine	Tetryl	479-45-8	0.065	610		
Nitroglycerin	NG	55-63-0	10	35		
Aluminum	Al	7429-90-5	20.0	76,000		
Chromium ^e	Cr	7440-47-3	1.0	210	2	38
Copper	Cu	7440-50-8	1.0	3,100		
Iron	Fe	7439-89-6	15.0	23,000		
Lead	Pb	7439-92-1	1.0	400		
Manganese	Mn	7439-96-5	0.5	1,800		
Molybdenum	Mo	7439-98-7	0.5	390		
Nickel	Ni	7440-02-0	1.0	1,600	7	130

DAF = Dilution Attenuation Factor

MDL = Method Detection Limit

PQL = Practical Quantitation Limit

PRG = Preliminary Remediation Goal

QA/QC = Quality Assurance/Quality Control

SSL = Soil Screening Level

mg/kg = milligrams per kilogram.

^a Screening value is shown in bold face if it is less than the PQL. If the laboratory cannot achieve PQL at or below the screening values with routine methodology, as supported by MDLs that are no greater than 1/3 PQL, the laboratory's PQL must be identified in the Analytical Data QA/QC Report as failing to meet the applicable screening value. Some screening values cannot be obtained with routine methodology. In those cases, the PQL achievable by routine methodology is acceptable..

^b PRGs from EPA Region 9 PRG Table dated October 2004 and addendum dated 28 December 2004, based on single chemical.

^c SSLs from EPA Region 9 PRG Table dated October 2004 and revision note dated 28 December 2004.

^d Carcinogenic DNT mixture values used if more conservative than noncarcinogenic isomer-specific values.

^e Total chromium values used.

Table 5
Human Health Surface Water Screening Values at Oregon Sites ^a

Analyte	Abbreviation	CAS Number	Laboratory Method Detection Limit (µg/L)	USEPA Region 9 Tap Water PRG ^b (µg/L)	Oregon DEQ Water Quality Criteria ^c	
					Water and Fish Ingestion ^d (µg/L)	Fish Consumption Only ^e (µg/L)
Hexahydro-1,3,5-trinitro-1,3,5-triazine	RDX	121-82-4	0.8	0.61		
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	HMX	2691-41-0	0.4	1,800		
2,4,6-Trinitrotoluene	2,4,6-TNT	118-96-7	0.3	2.2		
1,3,5-Trinitrobenzene	1,3,5-TNB	99-35-4	0.2	1,100		
1,3-Dinitrobenzene	1,3-DNB	99-65-0	0.2	3.6		
2,4-Dinitrotoluene ^f	2,4-DNT	121-14-2	0.3	0.099	0.11 ^g	9.1 ^g
2,6-Dinitrotoluene ^f	2,6-DNT	606-20-2	0.3	0.099		
2-Amino-4,6-dinitrotoluene	2-Am-DNT	35572-78-2	0.2	7.3		
2-Nitrotoluene	2-NT	88-72-2	0.4	0.049		
3-Nitrotoluene	3-NT	99-08-1	0.8	120		
4-Amino-2,6-dinitrotoluene	4-Am-DNT	19406-51-0	0.2	7.3		
4-Nitrotoluene	4-NT	99-99-0	0.4	0.66		
Nitrobenzene	NB	98-05-3	0.2	3.4	19,800	
Nitroglycerin	NG	55-63-0	0.75	4.8		
Methyl-2,4,6-trinitrophenylnitramine	Tetryl	479-45-8	1.3	360		
Aluminum	Al	7429-90-5	6.0E-02	36,000		
Chromium ^h	Cr	7440-47-3	2.0E-03	110	50	
Copper	Cu	7440-50-8	3.0E-03	1,500		
Iron	Fe	7439-89-6	5.0E-02	11,000	300	
Lead	Pb	7439-92-1	1.0E-03		50	
Manganese	Mn	7439-96-5	2.0E-03	880	50	100
Molybdenum	Mo	7439-98-7	5.0E-03	180		
Nickel	Ni	7440-02-0	1.0E-03	730	13.4	100
Perchlorate	ClO ₄	14797-73-0	3.0	24 ⁱ		

MCL = Maximum Contaminant Level

MDL = Method Detection Limit

PQL = Practical Quantitation Limit

PRG = Preliminary Remediation Goal

QA/QC = Quality Assurance/Quality Control

µg/L = micrograms per liter

^a Screening value is shown in bold face if it is less than the PQL. If the laboratory cannot achieve PQL at or below the screening values with routine methodology, as supported by MDLs that are no greater than 1/3 PQL, the laboratory's PQL must be identified in the Analytical Data QA/QC Report as failing to meet the applicable screening value. Some screening values cannot be obtained with routine methodology. In those cases, the PQL achievable by routine methodology is acceptable.

^b EPA Region 9 PRG Table dated October 2004 and revision note dated 28 December 2004, based on single chemical.

^c Values from Oregon DEQ Water Quality Criteria (OAR 340 Division 41, Table 20).

^d Values represent the maximum ambient water concentration for consumption of both contaminated water and fish or other aquatic organisms.

^e Values represent the maximum ambient water concentration for consumption of fish or other aquatic organisms.

^f Carcinogenic DNT mixture values used if more conservative than noncarcinogenic isomer-specific values.

^g Value is based on a cancer risk of 1.0 x 10⁻⁶.

^h Because the form of chromium has not yet been determined, the values for Chromium VI are used as a conservative measure.

ⁱ Value based on memorandum from Department of Defense entitled "Policy on DoD Required Actions Related to Perchlorate", dated 26 January 2006.

Table 6
Human Health Groundwater Screening Values at Oregon Sites ^a

Potential Contaminant of Concern	Abbreviation	CAS No.	Laboratory Method Detection Limit (µg/L)	USEPA Region 9 Tap Water PRG ^b (µg/L)	Federal Drinking Water Criteria MCLs ^c (µg/L)
Hexahydro-1,3,5-trinitro-1,3,5-triazine	RDX	121-82-4	0.8	0.61	
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine	HMX	2691-41-0	0.4	1,800	
2,4,6-Trinitrotoluene	2,4,6-TNT	118-96-7	0.3	2.2	
1,3,5-Trinitrobenzene	1,3,5-TNB	99-35-4	0.2	1,100	
1,3-Dinitrobenzene	1,3-DNB	99-65-0	0.2	3.6	
2,4-Dinitrotoluene ^d	2,4-DNT	121-14-2	0.3	0.099	
2,6-Dinitrotoluene ^d	2,6-DNT	606-20-2	0.3	0.099	
2-Amino-4,6-dinitrotoluene	2-Am-DNT	35572-78-2	0.2	7.3	
2-Nitrotoluene	2-NT	88-72-2	0.4	0.049	
3-Nitrotoluene	3-NT	99-08-1	0.8	120	
4-Amino-2,6-dinitrotoluene	4-Am-DNT	19406-51-0	0.2	7.3	
4-Nitrotoluene	4-NT	99-99-0	0.4	0.66	
Nitrobenzene	NB	98-05-3	0.2	3.4	
Methyl-2,4,6-trinitrophenylnitramine	Tetryl	479-45-8	0.75	360	
Nitroglycerin	NG	55-63-0	0.5	4.8	
Aluminum	Al	7429-90-5	6.0E-02	36,000	50 ^e
Chromium ^f	Cr	7440-47-3	2.0E-03	110	100
Copper	Cu	7440-50-8	3.0E-03	1,500	1,000 ^e 1,300 ^g
Iron	Fe	7439-89-6	5.0E-02	11,000	300 ^e
Lead	Pb	7439-92-1	1.0E-03		15 ^g
Manganese	Mn	7439-96-5	2.0E-03	880	50 ^e
Molybdenum	Mo	7439-98-7	5.0E-03	180	
Nickel	Ni	7440-02-0	1.0E-03	730	
Perchlorate	ClO ₄	14797-73-0	3.0	24 ^h	

MCL = Maximum Contaminant Level
MDL = Method Detection Limit
PQL = Practical Quantitation Limit
PRG = Preliminary Remediation Goal
QA/QC = Quality Assurance/Quality Control
µg/L = micrograms per liter

^a Screening value is shown in bold face if it is less than the PQL. If the laboratory cannot achieve PQL at or below the screening values with routine methodology, as supported by MDLs that are no greater than 1/3 PQL, the laboratory's PQL must be identified in the Analytical Data QA/QC Report as failing to meet the applicable screening value. Some screening values cannot be obtained with routine methodology. In those cases, the PQL achievable by routine methodology is acceptable.

^b EPA Region 9 PRG Table dated October 2004 and revision note dated 28 December 2004, based on single chemical.

^c Primary MCL from the 2004 Edition of the Drinking Water Standards and Health Advisories, dated Winter 2004, unless otherwise indicated.

^d Carcinogenic DNT mixture values used if more conservative than noncarcinogenic isomer-specific values.

^e Secondary MCL from the 2004 Edition of the Drinking Water Standards and Health Advisories, dated Winter 2004.

^f Total chromium values used if available.

^g Action level from the 2004 Edition of the Drinking Water Standards and Health Advisories, dated Winter 2004.

^h Value based on memorandum from Department of Defense entitled "Policy on DoD Required Actions Related to Perchlorate", dated 26 January 2006.

Table 7
Selection of Ecological Soil Screening Toxicity Values for Constituents of Potential Ecological Concern (Oregon Sites)

Parameter	ODEQ Level II Screening Level ^a	Proposed Benchmarks											Potential Bioaccumulative Constituent? ^h	Final Ecological Screening Value Soil ⁱ (mg/kg)	Practical Quantitation Limit (mg/kg)	
	Lowest Value for Plants/Inverts./ Birds/Mammals (mg/kg)	Region 5 ESLs ^b (2003) (mg/kg)	Dutch intervention value (2000) (mg/kg)	Adjusted Dutch intervention (mg/kg)	Region 7 ^c (mg/kg)	Region 8 ^d (mg/kg)	Region 10 ^e (mg/kg)	Other Values: Talmage et al. (1999) ^f or LANL (2005) ^g (mg/kg)								
Metals/Inorganics																
Aluminum	50	NVA			50	EPA-R4	NVA		50		EPA-R4	5.5	LANL		50	20.0
Chromium (total)	0.4	0.4			26	SSL	26	SSL	26		SSL	2.3	LANL	Yes	0.4	1.0
Copper	50	5.4	190	19	60	ORNL	190	Dutch	60		ORNL	10	LANL	Yes	50	1.0
Iron	10	NVA			200	EPA-R4	NVA		200	200	EPA-R4	NVA			10	15.0
Lead	16	0.0537	530	53	11	SSL	11	SSL	11		SSL	14	LANL	Yes	16	1.0
Manganese	100	NVA			100	EPA-R4	NVA		100		EPA-R4	50	LANL		100	0.5
Molybdenum	2	NVA			2	ORNL	2	ORNL	2	2	ORNL	NVA			2	0.5
Nickel	30	13.6	210	21	30	ORNL	30	ORNL	30		ORNL	20	LANL	Yes	30	1.0
Explosives																
2,4-Dinitrotoluene	NVA	1.28			1.28	EPA-R4	NVA		1.28		EPA-R4	0.52	LANL		1.28	0.040
2,6-Dinitrotoluene	NVA	0.0328			0.0328	EPA-R4	NVA		0.0328		EPA-R4	0.37	LANL		0.0328	0.040
2-Amino-4,6-Dinitrotoluene	NVA	NVA			NVA	NVA	NVA		NVA	NVA		2.1	LANL		2.1	0.040
4-Amino-2,6-Dinitrotoluene	NVA	NVA			NVA	NVA	NVA		NVA	NVA		0.73	LANL		0.73	0.040
1,3-Dinitrobenzene	NVA	0.655			0.655	EPA-R4	NVA		0.655		EPA-R4	0.073	LANL		0.655	0.020
HMX	NVA	NVA			NVA	NVA	NVA		NVA	NVA		27	LANL		27	0.050
Nitrobenzene	8	1.31			1.31	EPA-R4	NVA		1.31		EPA-R4	2.2	LANL		8	0.020
RDX	NVA	NVA			NVA	NVA	NVA		NVA			7.5	LANL		7.5	0.075
1,3,5-Trinitrobenzene	NVA	0.376			0.376	EPA-R4	NVA		0.376		EPA-R4	6.6	LANL		0.376	0.020
2,4,6-Trinitrotoluene	NVA	NVA			NVA	NVA	NVA		NVA	NVA		6.4	LANL		6.4	0.040
2-Nitrotoluene	NVA	NVA			NVA	NVA	NVA		NVA			2.0	LANL		2.0	0.075
3-Nitrotoluene	NVA	NVA			NVA	NVA	NVA		NVA			2.4	LANL		2.4	0.050
4-Nitrotoluene	NVA	NVA			NVA	NVA	NVA		NVA			4.4	LANL		4.4	0.040
Nitroglycerin	NVA	NVA			NVA	NVA	NVA		NVA			71	LANL		71	10
Tetryl	NVA	NVA			NVA	NVA	NVA		NVA			0.99	LANL		0.99	0.065

NVA: No value available

^a Oregon Department of Environmental Quality Screening Level Values (December 2001).

^b Ecological Screening Levels (ESLs), US EPA Region V, August 2003.

^c USEPA Region 7: Catherine Wooster-Brown (Eco Risk Assessor) recommends the following hierarchy: USEPA EcoSSLs; ORNL Efrogmson values; USEPA Region 4 values; other published values.

^d USEPA Region 8: Dale Hoff (Eco Risk Assessor) recommends the following hierarchy: USEPA SSLs; Dutch Intervention Values or ORNL Efrogmson values.

^e USEPA Region 10: Joseph Goulet (Eco Risk Assessor) says Region 10 has no recommended hierarchy, therefore, values from the USEPA Region 7 Approach were used.

^f Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F.M. Cretella, P.H. Reno, and F.B. Daniel, 1999. Nitroaromatic Munition Compounds: Environmental Effects and Screening Values, **Rev. Environ. Contam. Toxicol.**

^g Los Alamos National Laboratory (LANL), Eco Risk Database, Release 2.2, September 2005.

^h Potential bioaccumulative constituents will be evaluated in more detail, as some screening values do not take into account bioaccumulation.

Potential bioaccumulative potential from: *Bioaccumulation and Interpretation for the Purposes of Sediment Quality Assessment: Status and Needs* (USEPA, 2000) and ODEQ EQSLVs (ODEQ, 2001).

ⁱ Final Screening Value selected using the following hierarchy:

1. State Value (Oregon)
2. USEPA Region State Located In (USEPA Region 10)
3. Lower of Talmage et al. (1999) or LANL (2005) values.

EPA-R4=USEPA Region 4

LANL= Los Alamos National Laboratory

SSL=USEPA Eco Soil Screening Levels

Dutch=Dutch Intervention Values

ORNL= Oak Ridge National Laboratory Ecological PRGs (Efrogmson et al)

Other References:

U.S. Environmental Protection Agency, 2005. *Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs)* . Office of Solid Waste and Emergency Response, Website version last updated March 15, 2005: <http://www.epa.gov/ecotox/ecoss>.

U.S. Environmental Protection Agency, 2001. *Supplemental Guidance to RAGS: Region 4 Bulletins, Ecological Risk Assessment* . Originally published November 1995.

Website version last updated November 30, 2001: <http://www.epa.gov/region4/waste/ots/ecolbul.htm>.

Efrogmson, R.A., Suter II, G.W., Sample, B.E. and Jones, D.S., 1997. Preliminary Remediation Goals for Ecological Endpoints. Lockheed Martin Energy Systems, Inc. (ORNL) ES/ER/TM-162/R2.

Dutch Intervention Values:

Swartjes, F.A. 1999. *Risk-based Assessment of Soil and Groundwater Quality in the Netherlands: Standards and Remediation Urgency* . Risk Analysis 19(6): 1235-1249

The Netherlands Ministry of Housing, Spatial Planning and Environment's Circular on target values and intervention values for soil remediation http://www2.minvrom.nl/Docs/internationaal/S_I2000.pdf and Annex A:

Target Values, Soil Remediation Intervention Values and Indicative Levels for Serious Contamination http://www2.minvrom.nl/Docs/internationaal/annexS_I2000.pdf were also consulted.

Table 8
Selection of Ecological Sediment Screening Toxicity Values for Constituents of Potential Ecological Concern (Oregon Sites)

Parameter	ODEQ Screening Level Values ^a (mg/kg) Freshwater	Region 5 Ecological Screening Levels ^b (mg/kg)	EPA Region 7 ^c (mg/kg)	EPA Region 8 ^d (mg/kg)	EPA Region 10 ^e (mg/kg)	Other Ecological Screening Levels ^f (mg/kg)	Potential Bioaccumulative Constituent? ^g	Final Ecological Screening Value Sediment ^h (mg/kg)	Practical Quantitation Limit (mg/kg)				
Metals/Inorganics													
Aluminum	NVA	NVA	NVA	NVA	NVA	NVA		2.80E+02	LANL	2.80E+02	20.0		
Chromium	3.70E+01	4.34E+01	4.34E+01	MAC	4.34E+01	MAC	4.34E+01	MAC	5.60E+01	LANL	Yes	3.70E+01	1.0
Copper	1.00E+01	3.16E+01	3.16E+01	MAC	3.16E+01	MAC	3.16E+01	MAC	1.70E+01	LANL	Yes	1.00E+01	1.0
Iron	NVA	NVA	NVA	NVA	NVA	NVA	NVA	2.00E+01	LANL			2.00E+01	15.0
Lead	3.50E+01	3.58E+01	3.58E+01	MAC	3.58E+01	MAC	3.58E+01	MAC	2.70E+01	LANL	Yes	3.50E+01	1.0
Manganese	1.10E+03	NVA	NVA	NVA	NVA	NVA	NVA	7.20E+02	LANL			1.10E+03	0.5
Molybdenum	NVA	NVA	NVA	NVA	NVA	NVA	NVA	NVA				NVA	0.5
Nickel	1.80E+01	2.27E+01	2.27E+01	MAC	2.27E+01	MAC	2.27E+01	MAC	3.90E+01	LANL	Yes	1.80E+01	1.0
Explosives													
RDX	NVA	NVA	NVA	NVA	NVA	NVA	NVA	1.30E-01	TAL			1.30E-01	0.075
HMX	NVA	NVA	NVA	NVA	NVA	NVA	NVA	4.70E-02	TAL			4.70E-02	0.050
1,3,5-Trinitrobenzene	NVA	NVA	NVA	NVA	NVA	NVA	NVA	2.40E-02	TAL			2.40E-02	0.020
1,3-Dinitrobenzene	NVA	8.61E-03	NVA	NVA	NVA	NVA	NVA	6.70E-02	TAL			6.70E-02	0.020
2,4-Dinitrotoluene	NVA	1.44E-03	NVA	NVA	NVA	NVA	NVA	2.90E-01	LANL			2.90E-01	0.040
2,6-Dinitrotoluene	NVA	3.98E-03	NVA	NVA	NVA	NVA	NVA	1.90E+00	LANL			1.90E+00	0.040
2,4,6-TNT	NVA	NVA	NVA	NVA	NVA	NVA	NVA	9.20E-01	TAL			9.20E-01	0.040
2-Amino-4,6,-Dinitrotoluene	NVA	NVA	NVA	NVA	NVA	NVA	NVA	7.00E+00	LANL			7.00E+00	0.040
4-Amino-2,6,-Dinitrotoluene	NVA	NVA	NVA	NVA	NVA	NVA	NVA	1.90E+00	LANL			1.90E+00	0.040
2-Nitrotoluene	NVA	NVA	NVA	NVA	NVA	NVA	NVA	5.60E+00	LANL			5.60E+00	0.075
3-Nitrotoluene	NVA	NVA	NVA	NVA	NVA	NVA	NVA	4.90E+00	LANL			4.90E+00	0.050
4-Nitrotoluene	NVA	NVA	NVA	NVA	NVA	NVA	NVA	1.00E+01	LANL			1.00E+01	0.040
Nitrobenzene	NVA	1.45E-01	NVA	NVA	NVA	NVA	NVA	3.20E+01	LANL			3.20E+01	0.020
Nitroglycerin	NVA	NVA	NVA	NVA	NVA	NVA	NVA	1.70E+03	LANL			1.70E+03	10
Tetryl	NVA	NVA	NVA	NVA	NVA	NVA	NVA	1.00E+02	LANL			1.00E+02	0.065

NVA = No Value Available

^a Oregon Department of Environmental Quality Screening Level Values (December 2001).

^b Ecological Screening Levels (ESLs), USEPA Region V, August 2003.

^c USEPA Region 7: Catherine Wooster-Brown (Eco Risk Assessor) recommends the following hierarchy: MacDonald Consensus Values (MacDonald, 2000); ORNL Efronymson values (ORNL, 1977).

^d USEPA Region 8: Dale Hoff (Eco Risk Assessor) recommends the following hierarchy: MacDonald Consensus Values (MacDonald, 2000); Canadian ISQG values (CCME, 2003) or ORNL Efronymson values (ORNL, 1977).

^e USEPA Region 10: Joseph Goulet (Eco Risk Assessor) says Region 10 has no recommended hierarchy, therefore, values from the USEPA Region 7 Approach were used.

^f Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F.M. Cretella, P.H. Reno, and F.B. Daniel (TAL), 1999, *Nitroaromatic Munition Compounds: Environmental Effects and Screening Values*, **Rev. Environ. Contam. Toxicol.** or Los Alamos National Laboratory (LANL), Eco Risk Database, Release 2.2, September 2005.

^g Potential bioaccumulative constituents will be evaluated in more detail, as some screening values do not take into account bioaccumulation.

^h Potential bioaccumulative potential from: *Bioaccumulation and Interpretation for the Purposes of Sediment Quality Assessment: Status and Needs* (USEPA, 2000) and ODEQ EQSLVs (ODEQ, 2001).

^h Final Screening Value selected using the following hierarchy:

1. State Value (Oregon)
2. USEPA Region State Located In (USEPA Region 10)
3. Lower of Talmage et al. [TAL] (1999) or LANL (2005) values.

Note: The Talmage [TAL] screening values assume 10% organic carbon in the sediment.

MAC=MacDonald Consensus Values
 EPRGs=Oak Ridge National Laboratory Ecological PRGs
 ISQGs=Canadian Interim Sediment Quality Guideline:
 LANL=Los Alamos National Laboratory
 TAL=Talmage et al (1999)

Other References:

Efronymson, R.A., et al., 1997, *Preliminary Remediation Goals* (EPRGs), ORNL, ES/ER/TM-162/R2,
 Canadian Interim Sediment Quality Guidelines (ISQGs) Summary Table, CCME, December 2003

MacDonald, D.D, C.G. Ingersoll and T.A. Berger, 2000, *Development and Evaluation of Consensus-Based Sediment Quality Criteria for Freshwater Ecosystems*, Archives of Environmental Contamination and Toxicology 39:20-31

Table 9
Selection of Ecological Surface Water Screening Toxicity Values for Constituents of Potential Ecological Concern (Oregon Sites)

Parameter	ODEQ Screening Level Values ^a (mg/L) Freshwater	Region 5 Ecological Screening Levels ^b (mg/L)	EPA Region 7 ^c (mg/L)		EPA Region 8 ^d (mg/L)		EPA Region 10 ^e (mg/L)		Other Ecological Screening Values ^f (mg/L)		Potential Bioaccumulative Constituent? ^g	Final Ecological Value Surface Water ^h (mg/L)	Practical Quantitation Limit (mg/L)
Metals/Inorganics													
Aluminum	8.70E-02	NVA	8.70E-02	AWQC	8.70E-02	AWQC	8.70E-02	AWQC	8.70E-02	LANL		8.70E-02	6.0E-02
Chromium (Cr-III)	7.40E-02	4.20E-02	7.40E-02	AWQC	7.40E-02	AWQC	7.40E-02	AWQC	7.70E-02	LANL	Yes	7.40E-02	2.0E-03
Copper	9.00E-03	1.58E-03	9.00E-03	AWQC	9.00E-03	AWQC	9.00E-03	AWQC	5.00E-03	LANL	Yes	9.00E-03	3.0E-03
Iron	1.00E+00	NVA	1.00E+00	AWQC	1.00E+00	AWQC	1.00E+00	AWQC	1.00E+00	LANL		1.00E+00	5.0E-02
Lead	2.50E-03	1.17E-03	2.50E-03	AWQC	2.50E-03	AWQC	2.50E-03	AWQC	1.20E-03	LANL	Yes	2.50E-03	1.0E-03
Manganese	1.20E-01	NVA	1.20E-01	EPRG	1.20E-01	Tier II	1.20E-01	EPRG	8.00E-02	LANL		1.20E-01	2.0E-03
Molybdenum	3.70E-01	NVA	3.70E-01	EPRG	3.70E-01	Tier II	3.70E-01	EPRG	NVA			3.70E-01	5.0E-03
Nickel	5.20E-02	2.89E-02	5.20E-02	AWQC	5.20E-02	AWQC	5.20E-02	AWQC	2.80E-02	LANL	Yes	5.20E-02	1.0E-03
Perchlorate	NVA	NVA	NVA		NVA		NVA		3.50E+01	LANL		3.50E+01	
Explosives													
RDX	NVA	NVA	NVA		NVA		NVA		1.90E-01	TAL		1.90E-01	8.0E-04
HMX	NVA	NVA	NVA		NVA		NVA		3.30E-01	TAL		3.30E-01	4.0E-04
1,3-Dinitrobenzene	NVA	2.20E-02	NVA		NVA		NVA		2.00E-02	TAL		2.00E-02	2.0E-04
1,3,5-Trinitrobenzene	NVA	NVA	NVA		NVA		NVA		1.00E-02	TAL		1.00E-02	2.0E-04
2-Nitrotoluene	NVA	NVA	NVA		NVA		NVA		8.00E+00	LANL		8.00E+00	4.0E-04
3-Nitrotoluene	NVA	NVA	NVA		NVA		NVA		9.60E+00	LANL		9.60E+00	8.0E-04
4-Nitrotoluene	NVA	NVA	NVA		NVA		NVA		1.70E+01	LANL		1.70E+01	4.0E-04
2,4-Dinitrotoluene	2.30E-01	4.40E-02	NVA		NVA		NVA		3.10E-01	LANL		2.30E-01	3.0E-04
2,6-Dinitrotoluene	2.30E-01	8.10E-02	NVA		NVA		NVA		6.00E-02	LANL		2.30E-01	3.0E-04
2-Amino,4,6-Dinitrotoluene	NVA	NVA	NVA		NVA		NVA		2.00E-02	TAL		2.00E-02	2.0E-04
4-Amino-2,6-Dinitrotoluene	NVA	NVA	NVA		NVA		NVA		8.60E+00	LANL		8.60E+00	2.0E-04
2,4,6-Trinitrotoluene	NVA	NVA	NVA		NVA		NVA		9.00E-02	TAL		9.00E-02	3.0E-04
Nitrobenzene	5.40E-01	2.20E-01	NVA		NVA		NVA		2.70E-01	LANL		5.40E-01	2.0E-04
Nitroglycerin	NVA	NVA	NVA		NVA		NVA		4.30E+02	LANL		4.30E+02	5.0E-02
Tetryl	NVA	NVA	NVA		NVA		NVA		5.80E+00	LANL		5.80E+00	7.5E-04

NVA = No Value Available

^a Oregon Department of Environmental Quality Screening Level Values (December 2001);

^b Ecological Screening Levels (ESLs), USEPA Region 5, August 2003

^c USEPA Region 7: Catherine Wooster-Brown (Eco Risk Assessor) recommends the following hierarchy: National Ambient Water Quality Criteria; ORNL Efromson values (ORNL, 1977);

^d USEPA Region 8: Dale Hoff (Eco Risk Assessor) recommends the following hierarchy: National Ambient Water Quality Criteria; Great Lakes Tier II Value;

Canadian Environmental Quality Guidelines (CCME, 2003) or ORNL Efromson values (ORNL, 1977);

^e USEPA Region 10: Joseph Goulet (Eco Risk Assessor) says Region 10 has no recommended hierarchy, therefore, values from the USEPA Region 7 Approach were used.

^f Talmage, S.S., D.M. Opresko, C.J. Maxwell, C.J.E. Welsh, F.M. Cretella, P.H. Reno, and F.B. Daniel (TAL), 1999 *Nitroaromatic Munition Compounds: Environmental Effects and Screening Values*.

Rev. Environ. Contam. Toxicol.

Los Alamos National Laboratory (LANL), Eco Risk Database, Release 2.2, September 2005.

^g Potential bioaccumulative constituents will be evaluated in more detail, as some screening values do not take into account bioaccumulation.

Potential bioaccumulative potential from: *Bioaccumulation and Interpretation for the Purposes of Sediment Quality Assessment: Status and Needs* (USEPA, 2000) and ODEQ EQSLVs (ODEQ, 2001).

^h Final Screening Value selected using the following hierarchy:

1. State Value (Oregon)
2. USEPA Region State Located In (USEPA Region 10)
3. Lower of Talmage et al. [TAL] (1999) or LANL (2005) values.

AWQC=National Ambient Water Quality Criteria;

LANL= Los Alamos National Laboratory

Tier II=Great Lakes Tier II Water Quality Criteria;

EPRGs=Oak Ridge National Laboratory Ecological PRG;

TAL=Talmage et al (1999)

CCME=Canadian Council of Ministers of the Environment, Environmental Quality Guideline

Other References:

Efromson, R.A., et al., 1997, *Preliminary Remediation Goals* (EPRGs), ORNL, ES/ER/TM-162/R2,

Canadian Environmental Quality Guidelines (for Freshwater) Summary Table, CCME, December 2000;

Great Lakes Tier II Values from Suter, G.W. and C.L. Tsao, 1996, *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Rev*, ES/ER/TM-96/R2.

National AWQC from USEPA Water Quality Criteria Web Site: <http://www.epa.gov/waterscience/criteria/wqcriteria.htm>

Draft Worksheets

Site Information Worksheet ***MRSPP Data Gaps*** ***HRS Data Gaps***

Site Inspection
Central Oregon Gunnery Range

Technical Project Planning Meeting
July 17, 2006

Site Information Worksheet

Site: Air-to-Air Gunnery Range

Project: Central Oregon Gunnery Range

	Site Information Needed^a	Suggested Means to Obtain Site Information	Potential Source(s) of Site Information	Responsible for Obtaining	Deadline for Obtaining Site Information
1	Use existing background values from work being performed nearby	ODEQ protocol	ODEQ will determine	ODEQ	Background data for soils are available from ODEQ; no background available for surface water and groundwater.
2	Background sampling requirements for metals	ODEQ protocol	ODEQ guidance document	ODEQ	Background metals data for soils is available; will collect background samples for perchlorate in surface water and groundwater. No metals background data required for surface water and groundwater per ODEQ.
3	Background metals data	Sampling	Add more samples to field program	Shaw	No additional background metals data are required.
4	Schedule for sampling Oregon sites	Consultation	BLM	Shaw	Prior to field work.
5	Additional historical information	Records review	BLM to provide archeological survey data	Shaw	For inclusion in Site Inspection Report.
6	Oregon HH Screening Standards	ODEQ regulations and consultation	ODEQ	Shaw	For inclusion in TPP Memo.
7	Point of contact for community	Not applicable	USACE Seattle and Portland Districts	USACE	Before start of field work.
8	Access agreements	Letters, call, or visit stakeholders	Letters/conversations with stakeholders	USACE	Before start of field work.
9	Conceptual site model	Report review	Report prepared for target areas near Alkali Lake	Shaw	For inclusion in TPP Memo.
10	Threatened or endangered species within AOC	Phone	OR Fish and Wildlife U.S. Fish and Wildlife	Shaw	For inclusion in TPP Memo.
11	Areas of cultural significance within AOC	SHPO	Phone SHPO	Shaw	For inclusion in Site-Specific Work Plan.

^a Refer to EM 200-1-2, Paragraphs 1.1.3 and 2.2.

Munitions Response Site Prioritization Protocol (MRSPP) Data Gaps
32 CRF Part 179

Installation: Central Oregon Gunnery Range
 AOC: Air to Air Gunnery Range
 RMIS Range ID: F10OR0170

Module	Table No.	Table Description	Data Gap	Potential Source of Information to Fill Data Gap	No Data Gap	Description of Known Data
Explosive Hazard Evaluation (EHE)	1	Munitions Type			x	Small and medium caliber arms
	2	Source of Hazard			x	Air to air, air to ground, and ground to air gunnery range
	3	Location of Munitions			x	Confirmed surface
	4	Ease of Access			x	No barrier
	5	Status of Property			x	Non-DoD control
	6	Population Density			x	< 100 persons per square mile
	7	Population Near Hazard			x	0 inhabited structures w/in 2 miles
	8	Activities/Structures			x	Agricultural - livestock grazing
	9	Ecological and/or Cultural Resources	x	U.S. Fish and wildlife, SHPO		
	10	EHE Module Score				
Chemical Warfare Materiel (CWM) Hazard Evaluation (CHE)	11	CWM Configuration			x	Historical evidence indicates that CWM are not present
	12	Sources of CWM			x	Historical evidence indicates that CWM are not present
	13	Location of CWM			x	Historical evidence indicates that CWM are not present
	14	Ease of Access			x	No barrier
	15	Status of Property			x	Non-DoD control
	16	Population Density			x	< 100 persons per square mile
	17	Population Near Hazard			x	0 inhabited structures w/in 2 miles
	18	Activities/Structures			x	Agricultural - livestock grazing
	19	Ecological and/or Cultural Resources			x	Ecological resources present
	20	CHE Module Score				
Health Hazard Evaluation (HHE)	21	Groundwater Data Element	x	Evaluation Pending		
	22	Surface Water (Human Endpoint) Data Element	x	Evaluation Pending		
	23	Sediment (Human Endpoint) Data Element Table	x	Evaluation Pending		
	24	Surface Water (Ecological Endpoint) Data Element	x	Evaluation Pending		
	25	Sediment (Ecological Endpoint) Data Element	x	Evaluation Pending		
	26	Surface Soil Data Element	x	Evaluation Pending		
	27	Supplemental Contaminant Hazard Factor	x	Evaluation Pending		
	28	HHE Module Score	x	Module Score Pending		
MRS Priority	29	MRS Priority (Based on Highest Hazard Evaluation Module Rating)	x	Final Score Pending		
	A	MRS Background Information	x	Pending		

Central Oregon Gunnery Range HRS Data Gaps

Information required to complete the MEC-HRS data collection form:

Item	Number	Comment – Missing Data Element
1	1.8	Confirm the latitude / longitude of potential source(s) and the accuracy of the information (in meters)
2		Source scale (i.e., 1:24,000, etc.)
3	1.12	Site Permits
4	6	Water use (GW within 4 miles, SW within 15 miles)
5	6.1	Total drinking water population served (by distance)
6	6.2	Type of drinking water supply system (GW or SW?)
7	6.3	Other water uses of GW within 4 miles
8	6.4	Depth to Aquifer
9	6.5	Other surface water uses
10	7.1	Existence of sensitive or potentially vulnerable environment