FINAL

MUNITIONS AND EXPLOSIVES OF CONCERN ENGINEERING EVALUATION/COST ANALYSIS REPORT

FOREST PARK

FUDS #B07M0098800

St. Louis, Missouri

Prepared by

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OMAHA DISTRICT

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ACRONYMS AND ABBREVIATIONS

AOC	Area of Concern
ASR	Archive Search Report
CWA	Clean Water Act
CWM	Chemical Warfare Materiel
DDESB	Department of Defense Explosive Safety Board
DERA	Defense Environmental Restoration Account
DERP	Defense Environmental Restoration Program
DNR	Department of Natural Resources
DoD	Department of Defense
DOJ	Department of Justice
DQO	Data Quality Objective
DSMOA	DoD and State Memorandum of Agreement
EE/CA	Engineering Evaluation/Cost Analysis
EOD	Explosive Ordnance Disposal
EPA	Environmental Protection Agency
ESS	Explosive Safety Submission
FM	titanium tetrachloride
FS	sulfur trioxide and chlorosulfonic acid mixture
FUDS	Formerly Used Defense Sites
GIS	Geographic Information System
HC	grained aluminum, zinc oxide, and hexachloroethane (C_2Cl_{16})
INPR	Inventory Project Report
KJ	stannic chloride
LTM	Long-Term Management
MCX	Mandatory Center of Expertise
MEC	Munitions and Explosives of Concern
MOA	Memorandum of Agreement
MSD	Minimum Separation Distance
NC	chloropicrin and stannic chloride
NCP	National Contingency Plan
NDAI	No DoD Action Indicated
NGVD	National Geodetic Vertical Datum

ACRONYMS AND ABBREVIATIONS

NOES	Non Ordnance-Related Scrap
NPL	National Priorities List
OE	Ordnance and Explosives
OERIA	Ordnance and Explosives Risk Impact Assessment
OES	Ordnance-Related Scrap
PDT	Project Delivery Team
ppm	parts per million
QC	Quality Control
RA	Response Action
RD	Response Design
SARA	Superfund Amendments and Reauthorization Act
SOW	Scope of Work
TH3	68.7% thermite, 29% barium nitrate, 2% sulfur, and 0.3% oil
TOP	Total Obscuring Power
TPP	Technical Project Planning
USACE	United States Army Corps of Engineers
UXO	Unexploded Ordnance
WP	White Phosphorous

ES. EXECUTIVE SUMMARY

ES.1 INTRODUCTION

This report is the Engineering Evaluation/Cost Analysis (EE/CA) for the Forest Park Area of Concern (AOC). Forest Park is one of the largest urban parks in the United States and is located in the west central portion of St. Louis, Missouri.

ES.2 PURPOSE

The purpose of this EE/CA is to determine the most appropriate response action for the Forest Park AOC to address Munitions and Explosives of Concern (MEC) risk at the site. The following tasks were performed to achieve this purpose:

- Implemented the Technical Project Planning (TPP) process
- Conducted a site visit to the Forest Park AOC
- Prepared the EE/CA Work Plan
- Characterized the site through existing data and historical information (no field investigation)
- Performed a qualitative evaluation of MEC risk present
- Developed, assessed, and compared response action alternatives
- Recommended a risk reduction alternative
- Prepared the EE/CA report

ES.3 MILITARY USE

Documented military use of Forest Park began during World War I and continued through World War II. The only known military use of Forest Park was for public demonstrations and bivouacs, which were temporary encampments. In July 1942, the Army was granted permission to use 17 acres in the southeastern corner of Forest Park for a U. S. Army recreation camp. The camp was in operation for the duration of World War II and was closed in July 1948.

ES.4 MEC FOUND ON SITE

There have been five individual instances when MEC has been located within the Forest Park AOC. All five instances of MEC being found on the site occurred during ground intrusive construction activities. Four Stokes Mortars and one Livens Projector were discovered within the Forest Park AOC.

ES.5 CURRENT AND FUTURE LAND USE

Forest Park is currently used as an urban park for citizens of, and visitors to, the City of St. Louis. Activities occurring within the park include golfing, biking, jogging, and winter sports. Access is essentially unlimited throughout the park. Forest Park is expected to remain an urban park for the foreseeable future.

ES.6 RESPONSE ACTION ALTERNATIVES

The following four alternatives were defined and evaluated individually and comparatively to determine the most appropriate response action. The alternatives are:

- Alternative 1, No Department of Defense Action Indicated (NDAI)
- Alternative 2, Institutional Controls
- Alternative 3, Comprehensive Surface Clearance with Institutional Controls
- Alternative 4, Comprehensive Subsurface Clearance with Institutional Controls

The term comprehensive in Alternatives 3 and 4 is meant to indicate that 100% of the AOC will be scanned or investigated.

ES.7 RECOMMENDATION

The four alternatives listed above were evaluated individually and comparatively based on the following criteria:

- Effectiveness
- Implementability
- Cost

Based on the evaluation of the response action alternatives, the recommended response action is Alternative 2, Institutional Controls. Further detail on the controls recommended is included in Chapter 6. This alternative was determined to be the preferred response action after comparative evaluation of all the response action alternatives.

1 INTRODUCTION

1.1 PROJECT AUTHORIZATION AND REGULATORY FRAMEWORK

1.1.1 In 1986, Congress established the Defense Environmental Restoration Program (DERP) under 10 U.S.C. 2701 et.seq. DERP directs the Secretary of Defense to "carry out a program of environmental restoration at facilities under the jurisdiction of the Secretary."

1.1.2 In 1990, the Environmental Protection Agency (EPA) issued a revised National Contingency Plan (NCP). Under 40 CFR 300.120, the EPA designated the Department of Defense (DoD) to be the removal response authority for incidents involving DoD military weapons and munitions under the jurisdiction, custody, and control of the DoD.

1.1.3 Since the beginning of this program, the United States Army Corps of Engineers (USACE) has been the agency responsible for environmental restoration at Formerly Used Defense Sites (FUDS). In 2003, the Omaha District of USACE was designated as a Design Center for Ordnance and Explosives. For the Forest Park FUDS property, the Omaha District Ordnance and Explosives Design Center is the district responsible for preparing this EE/CA Report. The Kansas City District of USACE is the district in charge of project management at the Forest Park FUDS property.

1.2 PURPOSE AND SCOPE

1.2.1 The purpose of this Engineering Evaluation/Cost Analysis (EE/CA) is to characterize the nature, location, and concentration of munitions and explosives of concern (MEC) that may remain on site from former military activities at Forest Park, St. Louis, Missouri, and its affect on human use of the site. Reasonable risk management alternatives have been identified and response action alternatives have been developed to reduce MEC-related risks to human health and the environment. Costs associated with the various response action alternatives are included in the EE/CA Report. From these alternatives, a recommended response action is selected. Public comments and participation will be solicited during the draft final phase of this EE/CA report.

1.2.2 No fieldwork involving the detection, location, and mapping of MEC was required under the Forest Park EE/CA Scope of Work (SOW; Appendix A). The Project Delivery Team (PDT) based its investigation on the evaluation of archival data and information gathered during the Technical Project Planning Process. This EE/CA report, which includes an Ordnance and Explosives Risk Impact Assessment (OERIA), has been prepared based on information gathered from interviews and literature searches performed by the PDT. An Explosive Safety Submission (ESS) will be prepared and submitted to the Department of Defense Explosive Safety Board (DDESB) for approval. Upon completion of the EE/CA and approval of the ESS, an Action Memorandum that identifies the response action to be taken and the rationale behind the response action selection will be prepared.

1.2.3 The Area of Concern (AOC) investigated under the SOW is the Lower 9 of the former Forest Park Golf Course, now the Norman K. Probstein Community Golf course. This area includes Art Hill and the upper northwest part of Forest Park, north of Lagoon and Fine Arts Drive and west of Grand Drive. The total area is approximately 125 acres.

1.3 TECHNICAL PROJECT PLANNING TEAM

1.3.1 The Forest Park EE/CA PDT includes members from both USACE, Omaha District, and USACE, Kansas City District. The Missouri Department of Natural Resources (DNR) and the St. Louis Department of Parks, Recreation, and Forestry were also invited to participate in the TPP process to identify project objectives and design a data collection program to meet those objectives. The PDT used the Technical Project Planning (TPP) Process published in Engineer Manual 200-1-2 and Interim Guidance Document 01-02 from the USACE Ordnance and Explosive Center of Expertise. TPP is a four-phase process designed to identify project objectives and define the best methods for achieving those objectives. The details of the TPP process are recorded in the Forest Park EE/CA Work Plan (Appendix H; USACE, 2004). Members of the TPP team include the customer, project manager, regulators, and stakeholders.

1.3.1.1 The customer for this project is USACE, Kansas City District. USACE, Omaha District, was tasked by Kansas City District to complete this EE/CA investigation. Josephine Newton-Lund is the project manager from USACE, Kansas City District. Ms. Newton-Lund managed the funds and information exchange between the two districts. Joe Slattery is the ordnance and explosives project manager from USACE, Omaha District Design Center. Mr. Slattery coordinated the efforts of the PDT to deliver the EE/CA on time and within budget constraints.

1.3.1.2 Regulators involved in this project are the Missouri DNR and the EPA. The project manager from the Missouri DNR is Mark Ort. The project manager from the EPA is Diana Bailey. The EPA provided oversight and technical assistance if requested, but deferred decision-making to the Missouri DNR.

1.3.1.3 The stakeholders for this project are represented by the landowner, the City of St. Louis. The entire Forest Park site is owned by the City of St. Louis and is operated by the St. Louis Department of Parks, Recreation, and Forestry. The Norman K. Probstein Municipal Golf Course, a primary AOC at Forest Park, is operated by this department. Jeff Raffelson is the golf course representative who participated in this EE/CA investigation. The elected and appointed officials of the City of St. Louis indirectly represent the members of the public who utilize Forest Park. Members of the public will also have the opportunity to review, comment, and modify courses of action at Forest Park as part of the EE/CA process.

1.4 PUBLIC PARTICIPATION

1.4.1 The Forest Park EE/CA Report will be made available to the public for a thirty-day review and comment period at the draft final stage. This thirty-day public comment period is scheduled to occur from 13 July 2004 to 13 August 2004. A public availability session will occur during this public comment period. A public availability session allows concerned

members of the public to make comments and voice their concerns about the proposed course of action. The public availability session is scheduled for 13 July 2004. Notices will be published in St. Louis area newspapers to notify the public of the availability of the EE/CA report and the public availability session.

1.4.2 A responsiveness summary will be included in the Final Forest Park EE/CA Report. The purpose of the responsiveness summary is to respond to substantive comments received from the public during the thirty-day public comment period. Copies of the Final Forest Park EE/CA Report will be available at the Forest Park information repository located at the Central Branch of the St. Louis Public Library. Copies of the report can be transferred to other St. Louis Public Library branches throughout the city.

1.5 OTHER ENVIRONMENTAL CONTAMINATION

Two federal investigative documents have been produced for Forest Park. In 1995, an Inventory Project Report (INPR) was produced by USACE, Kansas City District, which included a site visit. In 1997, an Archive Search Report (ASR) was conducted by USACE, St. Louis District. No environmental contamination was identified from the site visit or literature review in either of these investigative efforts. In 2004, USACE, Omaha District, performed a site visit as part of this EE/CA investigation. No environmental contamination was observed during the site visit nor were concerns about environmental contamination raised during interviews with stakeholders. Based on best available information, there are no concerns related to other environmental contamination at Forest Park. This EE/CA is intended to address only MEC related concerns at the Forest Park AOC. If environmental contamination is discovered, it will be addressed under a different response action.

2 SITE DESCRIPTION

2.1 SITE LOCATION AND MAILING ADDRESS

Forest Park is located within the west central portion of the City of St. Louis, approximately 5 to 6 miles west of the downtown area. Forest Park is bordered by Highway I-64, Kingshighway Boulevard, Lindell Boulevard, and Skinker Boulevard (Figure 2-1). Forest Park is accessed from downtown St. Louis by taking I-64 West to Exit 34D (Forest Park/Museums) and continuing north into Forest Park. The Forest Park mailing address is 5600 Clayton Ave., St. Louis, MO, 63110.

2.2 PHYSICAL DESCRIPTION

2.2.1 Topography and Drainage

2.2.1.1 The topography of Forest Park and surrounding area is of the gently-rolling prairie type, with low rounded hills and broad shallow valleys. The Mississippi River to the east, the Missouri River to the north, and the Meramec River to the south have cut large valleys. Flowing into these rivers are numerous small tributaries with shallow valleys separated by low ridges.

2.2.1.2 The elevation in Forest Park varies from nearly 600 feet National Geodetic Vertical Datum (NGVD) on the southwest to about 460 feet NGVD on the north and east. The elevation throughout most of the park exceeds 500 feet NGVD.

2.2.1.3 Surface drainage is by sheet flow to the park's streets, then via the storm sewer system to the River des Peres. The River des Peres drains most of the northwest and west metropolitan St. Louis area, and has regularly flooded portions of Forest Park during the park's first half-century of existence. A bond issue, passed in 1923, allowed the stream to be put entirely underground in twin 23 feet high by 29 feet wide horseshoe-shaped storm sewers. Construction was completed in 1930. The river is now underground for its entire path through the park.

2.2.1.4 Flood waters are confined to the sewers except during rare high precipitation events when sewer surcharging and ponding within low areas of the park can occur. These ponds are within and near the old channel of the River des Peres, which is now used as a chain of recreation lakes. These areas generally extend along the north and east sides of the park. Ponding from River des Peres surcharging is of short duration, generally for less than 24 hours. Known or suspected MEC sites are generally believed to be on some of the higher areas of the park and are not expected to be impacted by occasional flooding. There are no hydrologic records of River des Peres or the unnamed small tributaries within the park boundary. All runoff from the park eventually flows into the Mississippi River via the River des Peres.

2.2.2 Climate

2.2.2.1 The City of St. Louis is near the confluence of the Missouri and Mississippi Rivers, and is also near the geographical center of the United States. Because of its central U.S. location, St. Louis feels the effects of warm moist air moving north from the Gulf of Mexico and cold air

masses moving south from Canada. The conflict along the frontal zones of these invading air masses provides a variety of weather conditions.

2.2.2.2 Winters are brisk with temperatures dropping to 0°F or below generally 2 or 3 days per year. The record low temperature at the current weather station site is –18°F, occurring in January 1985, although temperatures as low as –22°F have been measured at other area sites. Daily temperatures of 32°F or less occur less than 25 days per year, while temperatures of 90°F or higher occur approximately 35 to 40 days a year. The record high temperature for the area is 115°F, occurring in July 1954. Temperatures exceeding 100°F generally occur every other year, although some years may see 15 or more days with temperatures exceeding 100°F. The prevailing wind direction is from the south between May and November and from the northwest between December and April.

2.2.2.3 Precipitation averages approximately 36 inches per year. The winter months are the driest while the months of May through July are the wettest. Snowfall averages about 20 inches per season. Rainfall can be severe at times with as much as 8 inches of rain recorded in a 24-hour period in 1957. Thunderstorms occur between 40 and 50 days per year, with a few being severe, causing hail, damaging winds and tornadoes. Tornadoes have produced damage and loss of life in the St. Louis area. Climatological data for the area has been summarized in Table 2-1. This data was collected at the National Weather Service meteorological station at Lambert-St. Louis International Airport, approximately 8 to 9 miles north-northwest of the Forest Park site.

Table 2-1: Climatological Data, St. Louis, Missouri

Month	Temperature (^{0}F)			Precipitation	Wind Velocity	Wind Direction
	Average Daily		Average Monthly			
	Min	Max	Mean	Average (in.)	(mph)	
January	19.9	37.6	28.8	1.90	10.6	NW
February	24.5	43.1	33.8	2.14	10.8	NW
March	33.0	53.4	43.2	3.36	11.8	WNW
April	45.1	67.1	56.1	3.63	11.4	WNW
May	54.7	76.4	65.6	3.93	9.5	S
June	64.3	85.2	74.8	3.78	8.8	S
July	68.8	89.0	78.9	3.99	8.0	S
August	66.6	87.4	77.0	2.78	7.6	S
September	58.6	80.7	69.7	2.85	8.1	S
October	46.7	69.1	57.9	2.77	8.9	S
November	35.1	54.0	44.6	3.13	10.1	S
December	25.7	42.6	34.2	2.54	10.4	WNW
Annual	45.3	65.5	55.4	36.66	9.7	S

Source: NOAA, 1992, Local Climatological Data of St. Louis, Missouri and NWS 1995, St. Louis WSCMO AP, St. Louis County, Missouri

2.2.3 Site Geology

2.2.3.1 The City of St. Louis lies at the northeast tip of the Ozark Uplift and is bordered on the north and east by areas altered by glaciers. The bedrock underlying the St. Louis area consists essentially of flat-lying sedimentary formations, mostly limestone. Bedrock formations exposed in the St. Louis area represent three separate geologic systems, the Ordovician, Mississippian, and Pennsylvanian, each of which was formed at a different interval of time in the earth's history. The Ordovician rocks include (from oldest to youngest) massive sandstone, dolomite, and moderate solution limestone. Overlying these formations are rocks of Mississippian age including cherty limestone, shale, and extensive solution limestone. Almost all of the bedrock formations in the St. Louis area have been covered by extensive deposits of windblown silt (loess) carried from the flood plains of the Missouri and Mississippi Rivers and deposited on the upland during post-glacial time. Residual clays formed in place on weathered bedrock are found where the loess cover is relatively thin. Recent unconsolidated deposits of sands, silts and gravels have been deposited by the Missouri and Mississippi Rivers since they began flowing through their present valleys thousands of years ago.

2.2.3.2 Forest Park site soils fall into three different soil profiles. These profiles are quite similar, and are intermingled with each other throughout the park. In general, the permeability of the site soils is moderately slow, and the depth to bedrock is 60 inches or greater.

2.2.3.3 The first profile consists of deep, moderately well drained soils in upland areas. These soils are generally comprised of 37 to 40 inches of reworked loess used as fill material, and consist of multicolored silty clay containing fragments of brick, glass, cinders, and other manmade materials. The upper 4 inches of the reworked fill material is brown silty clay. Below the reworked fill material to a depth of approximately 60 inches is dark yellowish-brown, mottled, firm silty clay.

2.2.3.4 The second soil profile that is commonly encountered within the site area is similar to the above profile, except the natural topography has not been altered appreciably by urban development. This profile consists of moderately to strongly sloping well-drained soil. The surface layer is dark yellowish-brown clay to a depth of approximately 9 inches. The subsoil is dark yellowish-brown silty clay to a depth of approximately 60 inches.

2.2.3.5 The third soil profile is again similar to the above two profiles. The surface layer is dark brown silty clay to a depth of approximately 5 inches. The subsurface layer is yellowish-brown silty clay to a depth of approximately 60 inches.

2.3 SITE HISTORY

2.3.1 Forest Park (Figure 2-2) is one of the largest urban parks in the country at 1,371 acres. It was dedicated at a large public ceremony on 24 June 1876. The Louisiana Purchase Exposition (also known as the 1904 World's Fair) used almost the entire western half of Forest Park and brought more than 19 million visitors to St. Louis. Of the structures built for the fair, only the Palace of Fine Arts (now the St. Louis Art Museum) and the birdcage in the St. Louis Zoo were built as permanent structures. The others were constructed with Plaster of Paris mixed with fibers, and were completely demolished after the fair ended. The River Des Peres, an original

feature of Forest Park, was forced underground in a wooden channel to make way for fair structures and exhibits. In 1923, the river was moved underground permanently.

2.3.2 Between 1911 and 1930, active recreation facilities were brought into the park. In 1995, the City of St. Louis adopted the Forest Park Master Plan to integrate the park's natural and man-made systems into a cohesive and mutually beneficial ecosystem. The Master Plan for the rehabilitation of Forest Park is continuing with an estimated cost of approximately $100 million.

2.3.3 Currently, more than 12 million visitors a year visit Forest Park. Facilities at the park include the St. Louis Zoo, the St. Louis Science Center, the Jefferson Memorial Building, the St. Louis Art Museum, one 9-hole golf course, one 18-hole golf course, 19 tennis courts, numerous baseball fields, and many other attractions.

2.3.4 Due to the nature of this document, the remaining portion of the site history text will highlight historical military activities and the discovery of military munitions in Forest Park. Documented military use of Forest Park began with World War I. The only known military use of Forest Park was for public demonstrations and bivouacs. The following is a list of events that highlight military activities and the discovery of military munitions:

- A 6 April 1917 photograph shows members of 'A' Battery firing a cannon salute in Forest Park.
- In 1917, the Army tank 'Britannia' gave a demonstration in the park. Thousands of patriotic citizens followed the tank around the park.
- A 16 September 1917 photograph shows the 3rd Battalion, 5th Infantry marching through Forest Park.
- On 7 April 1918, a Liberty Parade and Mass Meeting was held at Art Hill in Forest Park.
- On 26 August 1918, the British Aviation Mission landed six aircraft in Forest Park as part of a demonstration.
- Fourth of July celebrations were held at Art Hill during World War I. These were of a patriotic nature and included the presence of the Armed Forces.
- In September of 1926, the city of St. Louis held the St. Louis Exposition. As part of the Exposition, Army troops from Jefferson Barracks, would present a mock World War I battle daily. On opening day, 4 September 1926, there was to be a parade and the exploding of 13 bombs to start the afternoon festivities. On 12 September 1926, an Army Dirigible was to land at the Exposition. During the Exposition, complaints were made concerning the loud retort of the "French" 75mm cannons. The officer in charge of the battery agreed to reduce the charges for the remainder of the Exposition. After the Exposition, the area was cleared of buildings and debris. The entire field was then plowed and reseeded for use in baseball games the following spring.
- In 1940, after the start of World War II, Fourth of July celebrations were held on Art Hill to demonstrate patriotism. These were similar to the celebrations held during World War I.
- On 4 July 1942, more than 5,000 troops came to Forest Park from Fort Leonard Wood to participate in a Fourth of July parade and rally. Many of the men camped in or near the park.

- In July 1942, the Army was granted permission to use 17 acres in the southeastern corner of Forest Park for a recreation camp. The camp accommodated approximately 1,500 men and was to operate for the duration of the war. By 1947, the camp was abandoned and contracts were made by the government to restore the southeast corner of the park. By 1 July 1948, restoration was completed and formal acceptance of the property was given to the government.
- On 8 August 1943, a mock battle took place around the Art Hill area of Forest Park, with soldiers from Jefferson Barracks. This mock battle included 350 soldiers, amphibious jeeps, a smoke screen, and a final assault up Art Hill. Prior to the public demonstration, the soldiers were encamped in a 15-acre bivouac area.
- In May 1988, workers installing a sprinkler system on the 3rd fairway of the 9-hole golf course uncovered a live 3" phosphorus Stokes mortar round. The workers thought the mortar round was a remnant from the 1904 World's Fair. The round was given to an individual, who thought it was a type of time capsule. The next week the individual tried opening the round and caused the phosphorus to ignite. The Maplewood Fire Department responded and was able to contain the phosphorous by burying the round. Army Captain Hank Counts of the Granite City Illinois Support Center, 50th Explosive Ordnance Disposal Detachment, responded to the incident. He recovered the round and disposed of it. He examined the site where the round was uncovered and visually identified what appeared to be fragments of other rounds.
- In December 2001, a 3" or 4" Stokes mortar was found by a bulldozer worker who was moving dirt. The police removed the round and it was later found to contain white phosphorus (WP).
- In May 2002, a 3" or 4" Stokes mortar was excavated by an irrigation-trenching machine at a depth of 18". The round was empty, but was presumed by the police department to have contained WP.
- In June 2002, a 4" Stokes mortar was found. Police removed it from the site.
- In July 2002, a construction worker excavated a Livens Projector during renovation work at the Grand Basin. The item was determined to be empty by the St. Louis Police Department Bomb and Arson Squad.

Incident Reports are included as Appendix J.

2.4 CURRENT AND PROJECTED FUTURE SITE USE

2.4.1 Current Site Use

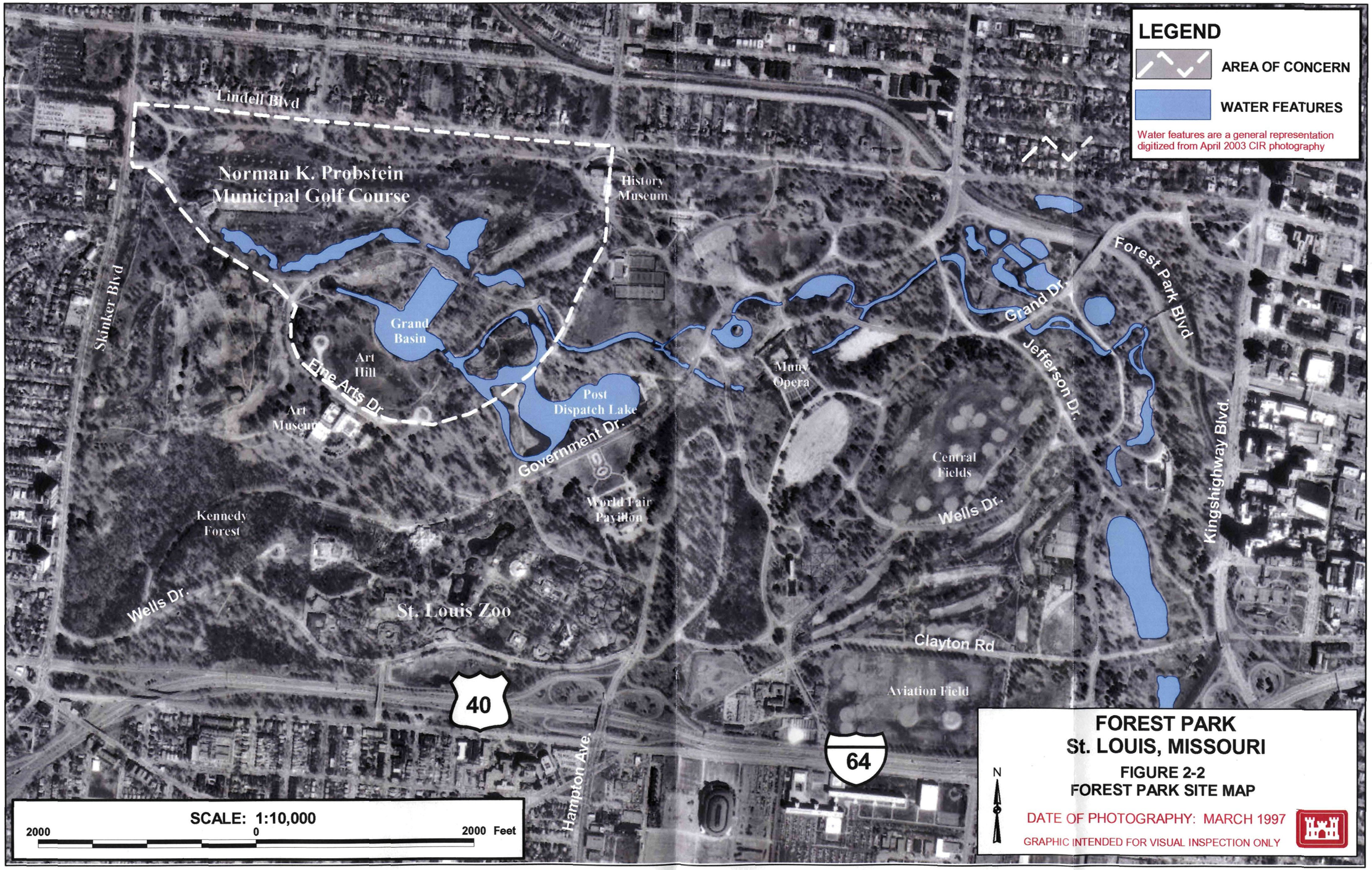
Forest Park is currently used as a recreation area for the City of St. Louis. Facilities at the park include the St. Louis Art Museum, the St. Louis Zoo, the Missouri Historical Museum (Jefferson Memorial Building), the St. Louis Science Center, three 9-hole golf courses, 19 tennis courts, an ice and roller skating rink, and many other attractions.

2.4.2 Projected Land Use

The projected land use is as a park for recreational use by the people of the City of St. Louis. As discussed in the site history section, the City of St. Louis adopted the Forest Park Master Plan in 1995 to integrate the park's natural and man-made systems into a cohesive and mutually beneficial ecosystem. The Master Plan for the rehabilitation of Forest Park is continuing with an estimated cost of approximately $100 million. Therefore, it is expected that Forest Park will remain a recreation area for the foreseeable future.

FOREST PARK
St. LOUIS, MISSOURI

FIGURE 2-1
FOREST PARK VICINITY MAP


LEGEND
AREA OF CONCERN
WATER FEATURES
Water features are a general representation digitized from April 2003 CIR photography
Lindell Blvd
Norman K. Probstein Municipal Golf Course
History Museum
Skinker Blvd
Grand Basin
Art Hill
Fine Arts Dr.
Art Museum
Post Dispatch Lake
Government Dr.
World Fair Pavilion
Kennedy Forest
Wells Dr.
St. Louis Zoo
Muny Opera
Grand Dr.
Jefferson Dr.
Forest Park Blvd
Kingshighway Blvd.
Central Fields
Wells Dr.
Clayton Rd
Aviation Field
40
64
Hampton Ave.
SCALE: 1:10,000
2000 0 2000 Feet
N
FOREST PARK
St. LOUIS, MISSOURI
FIGURE 2-2
FOREST PARK SITE MAP
DATE OF PHOTOGRAPHY: MARCH 1997
GRAPHIC INTENDED FOR VISUAL INSPECTION ONLY

B07MO09

3 PROJECT OBJECTIVES

3.1 OVERALL PROJECT GOALS

The overall goals of the Forest Park EE/CA are to:

- Characterize the nature, location, and concentration of MEC within the site
- Provide a description of MEC-related problems affecting human use of the site
- Identify and analyze reasonable risk management alternatives
- Recommend a proposed alternative
- Seek public comments and participation
- Provide a convenient record of the process for use in final decision-making and judicial review, if necessary

3.1.1 Additional Project Objectives

Additional project objectives include:

- Continuing to allow public access to the site while reducing hazards associated with MEC
- Achieving site closeout in fiscal year 2004
- Identifying and outlining long-term monitoring procedures in a Memorandum of Agreement (MOA) between USACE and the City of St. Louis
- Establishing an information repository where the public can access information about the Forest Park project

3.2 REGULATORY/OTHER STAKEHOLDER CONCERNS

Concerns regarding Forest Park include ensuring that the property is safe for the intended use. Additional concerns expressed by stakeholders involved with activities occurring at Forest Park include interruptions to operations as a result of uncertainty with respect to MEC risk and the EE/CA process, and the potential for recurring reviews to interrupt the operations of city entities. These concerns were specifically noted by representatives involved in the day-to-day operations of the golf course. The golf course recently underwent a multi-million dollar renovation and any interruption of operations could have financial implications.

3.3 CONSTRAINTS

3.3.1 Funding is a potential constraint on the completion of the EE/CA process for Forest Park. The project funding was estimated based on quarterly funding levels and should be adequate for completion of the project. However, if unforeseen circumstances arise as a result of the EE/CA process, additional funding may be required to complete the project.

3.3.2 Public involvement and information obtained through public interviews could potentially act as a constraint on completion of this project. For example, if members of the public describe additional AOCs within Forest Park, the scope of the EE/CA report would need to be expanded and completion postponed. This outcome is not expected to occur at Forest Park.

3.3.3 The EE/CA report and associated documentation are scheduled for completion in September 2004. This schedule is extremely aggressive and requires participation and concurrence from several federal and local government agencies. Delay of the schedule for this project is not expected to occur.

3.3.4 The entirety of Forest Park is currently accessible to the public and is developed for current land use. If a determination were made to conduct surface or subsurface removal of MEC items, many areas of Forest Park would be closed to public access.

3.4 POSSIBLE RESPONSE ALTERNATIVE ACTIONS

3.4.1 The possible response action alternatives evaluated for Forest Park are:

- No Department of Defense Action Indicated (NDAI)
- Institutional Controls
- Comprehensive Surface Clearance with Institutional Controls
- Comprehensive Subsurface Clearance with Institutional Controls

3.4.2 No MEC response action, even using the best available technology, can completely remove all MEC risk for Forest Park. However, all of the MEC response actions considered (with the exception of NDAI) reduce the potential risks posed to the public by inadvertent ordnance detonation, resulting in a reduction of the MEC risk.

3.5 DATA QUALITY OBJECTIVES

3.5.1 The Data Quality Objective (DQO) for survey of the site was to obtain data to delineate the site that was Class I, third order or better, based on the North American Datum of 1983 and the Universal Transverse Mercator Grid System. This DQO was met.

3.5.2 The DQO for collection of historical information was met. Historical information was collected from the ASR for Forest Park, the INPR for Forest Park, and other documents. Interviews were conducted with stakeholders and individuals connected to Forest Park. The archives of the Missouri Historical Society and Washington University in St. Louis, Missouri were reviewed to determine if additional information existed regarding military presence and use of Forest Park.

3.5.3 Whether or not the DQO for public participation is met will be determined after the public availability session is conducted in July 2004. No members of the public were interviewed as part of the site visit conducted in February 2004. However, individuals employed by the City of St. Louis and Forest Park were interviewed as part of the site visit.

4 SITE CHARACTERIZATION

4.1 HISTORICAL RECORDS

Historical records reviewed for this EE/CA investigation included the ASR prepared by USACE, St. Louis District (USACE, 1997) and an INPR prepared by USACE, Kansas City District (USACE, 1995). Archives of the Missouri Historical Society and Washington University in St. Louis were also searched for additional information regarding past military usage of Forest Park. Based on the historical records located and reviewed, military usage of Forest Park was limited to bivouacs and demonstrations.

4.2 PERSONAL INTERVIEWS CONDUCTED

Several personal interviews were conducted with individuals employed by the City of St. Louis and Forest Park during a PDT site visit to Forest Park from 23-26 February 2004. Two interviewees referred to other individuals to be contacted. Those additional individuals were contacted. No new information was obtained from these personal interviews. Forms documenting the interview questions and answers provided are included as Appendix I of this EE/CA.

4.3 AERIAL PHOTOGRAPHY

Aerial photographs for the Forest Park site were obtained from the TerraServer web site, which can be accessed at http://terraserver.microsoft.com/default.aspx. Additional analysis of aerial photographs is ongoing and will be included as part of the information repository when completed. This additional analysis is being conducted as a separate action by the USACE, Engineer Research and Development Center, Topographic Engineering Center. Selected historical aerial photos for years covering expected use of Forest Park by the U.S. military will be analyzed. Although not part of this EE/CA project, this analysis is being performed as an additional source of information. Due to scheduling constraints, this action cannot be completed in conjunction with the Final EE/CA Report. If additional MEC areas are located as part of this action, the recommendations from this report will be revisited to ensure they are still protective.

4.4 SITE INVESTIGATIONS PERFORMED

This EE/CA relied on historic records review and qualitative site assessment to obtain additional information concerning past use of Forest Park. A geophysical or intrusive investigation to characterize the nature and extent of MEC was not performed at the AOC. Historic records indicate temporary structures used in the 1904 World's Fair were razed and buried in place on the Park grounds following the fair. Traditional geophysical techniques cannot distinguish between MEC and construction material, and no useful information could be obtained. In addition, fill material from what is now the Grand Basin was used to landscape the AOC during golf course construction and renovations. This fill material would make detection more difficult or impossible without digging into the ground surface. Cut and fill diagrams of the golf course

are included as Appendix K. The risk impact assessment reported in section 5 of this report concludes low baseline risk from MEC at the site based on sparse density and expected depth to MEC at the AOC do not warrant a geophysical investigation. Geophysical or intrusive investigations would disrupt current land use and require temporarily closing all or part of the golf course.

4.4.1 Instrumentation

As no geophysical instruments were used for this EE/CA investigation, this section is not applicable.

4.4.2 Quality Control of Geophysical and Positioning Instruments

As no geophysical and/or positioning instruments were used for this EE/CA investigation, this section is not applicable.

4.4.3 Unexploded Ordnance

MEC is identified as Unexploded Ordnance (UXO) if the recovered item is "a military munition that contains explosive, pyrotechnic, or a chemical agent and has been primed, fuzed, armed, or otherwise prepared for action, and which has been fired, placed, dropped, launched, projected, and remains unexploded by design or malfunction" (USACE, 1998b). Five MEC items were identified from historical research performed during this EE/CA investigation (Figure 4-2).

4.4.4 Munition Constituents

Munition constituents are defined as any material originating from UXO, discarded or other military munitions, including explosive and non-explosive materials, and emission, degradation, or break down elements of such ordnance or munition. There is no indication that the munitions found were structurally compromised due to weathering; therefore, the munition constituents are assumed to have remained intact within the steel casing. The Stokes round found in 1988 was mistakenly identified as a time capsule and a man was exposed to white phosphorus upon opening the Stokes mortar, which indicates the condition of the mortar. In addition, much of the soil at the site has been moved during the extensive construction activities at this site and the exact location of the munitions (within 1 foot) is not known. Therefore, sampling for munition constituents would not be beneficial at this site.

4.4.5 Munition Debris

Munition debris is defined as remnants of munitions (e.g. penetrators, projectiles, shell casings, links, fins) remaining after munitions use, demilitarization, or use. No munition debris was found during the site visit.

4.4.6 Recovered MEC

Five MEC items were identified from historical research performed during this EE/CA investigation.

4.4.7 Munition Debris Disposal

Munition debris disposal procedures are not covered because the EE/CA investigation required no fieldwork and no munition debris was found.

4.4.8 Surface Soil Sampling

No soil samples were collected for this EE/CA.

4.5 SOURCE, NATURE AND EXTENT OF MEC

The source, nature, and extent of MEC have been defined based on the findings and conclusions of the final ASR, historical records, and the TPP process.

4.5.1 Source

The ASR describes the source of the 3" or 4" Stokes mortars as one of the many public demonstrations held in and around the Art Hill area (Figure 4-1). The Stokes mortars were found on the Lower 9 of the Forest Park Golf Course, now the Norman K. Probstein Golf Course. This golf course was first established in 1916, which pre-dates the use of the Stokes mortar. The possibility that a civilian buried the round is remote. The course is in use during the day and the grounds keepers would have noticed nighttime burials the following day. The possibility that the Army buried the rounds after a demonstration is equally remote. A military burial would have been in cooperation with the grounds keepers and would not have been on a fairway. Therefore, the source for the MEC is unknown.

4.5.2 Nature

The MEC consists of four Stokes mortars and one Livens Projector. There are no historic documents, anecdotal references, or other indications that chemical warfare materiel (CWM) was used at Forest Park. The MEC found in Forest Park has been either empty or filled with white phosphorus.

4.5.3 Extent

The distribution of MEC at Forest Park is consistent with the known AOC, the Norman K. Probstein Municipal Golf Course and Art Hill area. The probability is low that additional MEC will be found in Forest Park. It is believed that the MEC was moved during past renovations of the golf course and surrounding areas. The historical use of MEC in Forest Park was not extensive and was only used for military demonstration exercises. Due the extensive renovation and regrading conducted on the park, it is not expected to find MEC on the surface. There are no anticipated major renovations in the future, only maintenance of the grounds. A map showing the location of MEC found at Forest Park is included as Figure 4-2.

4.6 DESCRIPTION OF HAZARDS OF SPECIFIC MEC ENCOUNTERED

MEC items encountered at Forest Park and dates of discovery are provided in Table 4-1. A description of each type of ordnance is provided in the following sections.

Table 4-1: MEC Encountered at Forest Park

Date	Ordnance Found
May 1988	3" Stokes mortar
December 2001	3" or 4" Stokes mortar
May 2002	3" or 4" Stokes mortar
June 2002	4" Stokes mortar
July 2002	Livens Projector

4.6.1 3" Stokes Mortar

The 3" Stokes mortar is often referred to as the Trench mortar. A diagram of the Stokes mortar is provided in Figure 4-3. A description of possible shells associated with this mortar follows.

4.6.1.1 The Mark I Shell is made up of a cylindrical steel casing, into which a forged steel base and head are screwed. To the base is attached a short steel tube, or cartridge container, which has 16 holes drilled in it to permit the flash from the cartridge to ignite the powder rings. The head has a hole through the center that permits the insertion of the drawn steel booster casing and has a threaded recess for the fuze. This recess is plugged with a threaded fuze hole plug to protect the threads from dirt and damage during storage and shipping.

4.6.1.2 The Mark II Shell differs from the Mark I only in the shell body construction, as the casing, head, and base are welded together. Both shells are loaded with a high explosive charge of either TNT or Nitrostarch.

4.6.1.3 The Mark III Practice Shell is made up of a cast-iron body with a threaded hole in the upper end for assembling a dummy fuze similar to the trench-mortar fuze, Mark VI. The complete round consists of one Shell, Mark III, a dummy fuze, and propellant charges as used with the high explosive round.

4.6.1.4 The Mark VI Fuze is an "all-ways acting" fuze, designed to function upon impact, regardless of the manner in which the shell strikes the ground. The safety pin is withdrawn by means of a safety pin ring immediately before dropping the shell into the muzzle of the gun.

4.6.1.5 The Mark I Booster is made up in cartridge form and is placed in the body casing in the shell, upon assembling the round immediately before firing. The booster consists of a paper cartridge that supports the detonator. The detonator is a commercial detonator or a No. 8 blasting cap.

4.6.1.6 The propellant charge consists of one green paper brass-tipped cartridge, loaded with 120 grains of sporting ballistite powder, and from one to three ring-shaped silk bags, each containing 110 grains of M.R. 31 ballistite powder.

4.6.2 4" Stokes Mortar

The complete 4-inch Stokes mortar consists of the shell body, burster, fuze, propellant charge, and filling. The projectile body is a cylinder, 4 inches in diameter, fabricated from drawn steel tubing or rolled metal with an overlapped weld.

4.6.2.1 The body contains a forward disk and a base disk. The forward or nose disk was machined to 4.178 inches in diameter and designed to retain the forward end of the burster tube and fuze. The base disk was also machined to 4.178 inches and designed to support the aft end of the burster tube and accommodate the cartridge container. The cartridge container is a steel cylinder 2.875 inches in length, 1 inch in diameter, and perforated with 16 holes to provide outlets for the gases generated by the propellant. The forward end (or nose disk) and base disk serve as guides when the round is expelled from the mortar barrel. (Note: U.S. used British version as well as U.S. version of Stokes mortar).

4.6.2.2 The total body length of the body assembly varied, depending on the type of filling that was required. For example, the 4-inch Stokes mortar round filled for smoke was 18.56 inches long; and the round designed for incendiary was 17.56 inches long. A diagram of the 4" Stokes mortar is included as Figure 4-4. Fill and weight specifications are provided in Table 4-2.

Table 4-2: Fill and Weight Specifications for 4" Stokes Mortar

Type of Fill	Fill Weight		Total Weight with Fill	
	Kilograms	Pounds	Kilograms	Pounds
TH3 (Thermite)	See Note	See Note	See Note	See Note
WP (White Phosphorous)	See Note	See Note	See Note	See Note

Note: The Stokes mortar round fill weight was between 6.3 and 9.5 pounds (2.8 to 4.3 kg). The weight depended on the chemical agent in the round. A 4-inch Stokes mortar round filled and completely assembled could weigh up to 25 pounds (11.36 kg).

4.6.2.3 Tabulated Data

Length: 17.56 inches (44.6 cm) – 19.56 inches (49.68 cm) (depending on lot)

Diameter: 4.178 inches (10.61 cm) (end and base disks)
4 inches (10.16 cm) (body)

4.6.2.4 Description of Fills

4.6.2.4.1 TH3

TH3 is a mixture of 68.7% thermite, 29% barium nitrate, 2% sulfur, and 0.3% oil. It was used, primarily, in incendiary magnesium bombs. The TH3 is ignited by a primer, which burns, melts, and ignites the magnesium body.

4.6.2.4.2 White Phosphorous (WP)

White Phosphorous is a solid that is used primarily for screening purposes. It also has been used against personnel and fortifications. It burns vigorously when exposed to air and creates a dense, white cloud.

4.6.2.5 Markings

World War I Markings for the 4" Stokes mortar are provided in Table 4-3. World War II markings are provided in Table 4-4.

Table 4-3: World War I Markings, 4" Stokes Mortar

World War I					
Type of Fill	**Color Bands**			**Other**	
	1st Band	**2nd Band**	**3rd Band**	**Body Color**	**Stencil Markings**
TH3 (Thermite)	None	None	None	Gray	THERMITE
WP (White Phosphorous)	Yellow	None	None	Gray	SMOKE

Table 4-4: World War II Markings, 4" Stokes Mortar

World War II					
Type of Fill	**Color Bands**			**Other**	
	1st Band	**2nd Band**	**3rd Band**	**Body Color**	**Stencil Markings**
TH3 (Thermite)	Purple	None	None	Gray	TH, Incendiary
WP (White Phosphorous)	Yellow	None	None	Gray	WP, SMOKE

4.6.2.6 Explosive Train

Fulminate of mercury:	unknown weight
Tetryl:	unknown weight
Black Powder:	0.297 ounce (8.43 g)

4.6.2.7 Fuze

Model Number:	M-X1
Total Weight:	1 pound, 9 ounces (709.4 g)
Overall Length:	2.659 inches (6.75 cm), M-X1, 2.5 inches (6.35 cm)

4.6.2.8 Burster

The burster consists of a detonator, which contains fulminate of mercury, and a 0.5-inch-diameter central tube filled with tetryl.

4.6.2.9 Engineering Data

Body:	drawn steel tubing or rolled metal with an overlapped weld
Wall Thickness:	0.188 inch (4.78 mm)

4.6.3 Livens Projector

4.6.3.1 The body MK II was made of seamless drawn steel tubing 0.188 inches thick with forge-steel welded hemispherical ends. It can be identified by the projections at each end, which were 1.69 inches in diameter and approximately 1 inch long. The projectile had a capacity of approximately 660 cubic inches. A central tube ran the length of the round and was welded into the round at both ends. A steel plug (coupling plug) was welded into the tube to divide it into the section used to receive the burster tube and the section used for filling. The filling passed from the tube into the round through four holes located near the filling end. There were also two vent holes. After filling, the round was sealed by screwing a tapered plug into the filling hole.

4.6.3.2 The MK IIA1 body differed in construction in that the hemispherical ends were closed by fusion welding. The MK IIA1 had a capacity of 716 cubic inches. The remaining details of the MK IIA1 were the same as the MK II. A diagram is included as Figure 4-5.

4.6.3.3 During World War I, titanium tetrachloride (FM) was a common smoke filling in the Livens projectile with a total fill weight of 30 pounds. Fill weights and specifications are provided in Table 4-5.

Table 4-5: Fill and Weight Specifications for Livens Projector

Type of Fill	Fill Weight		Total Weight with Fill	
	Kilograms	Pounds	Kilograms	Pounds
Screening Smoke (HC)	12.72	28	Unknown	Unknown
Titanium Tetrachloride (FM)	13.64	30	28.63	63
FS	12.72	28	27.73	61
Thermite[2]	Unknown	Unknown	Unknown	Unknown
Incendiary Oil[2]	Unknown	Unknown	Unknown	Unknown

[1]French origin, not used by U.S. in World War I. Improved by the U.S. after the war, with some change in components. Became known as HC.
[2]Thermite was used to a limited extent. The chief incendiary fill was an inflammable oil in which balls of cotton were immersed.

4.6.3.4 Tabulated Data

Length:

MK II Shell Body:	21.62 inches (549.1 mm)
MK IIA1 Shell Body	23 inches (584.2 mm)

Diameter:

MK II Shell Body:	7.62 inches (193.5 mm)
MK IIA1 Shell Body	7.75 inches (196.8 mm)

4.6.3.5 Description of Fills

4.6.3.5.1 HC

HC was used as a screening smoke. It is a mixture of grained aluminum, zinc oxide, and hexachloroethane (C_2Cl_{16}). It has a TOP of 2100. It has no physiological action in exposed personnel.

4.6.3.5.2 Titanium tetrachloride (FM)

Titanium tetrachloride is a colorless, highly refractory liquid that boils at 136 degrees C (277 degrees F). It reacts with the moisture in the air and will evolve into dense clouds of acrid white smoke with a TOP of 1900.

4.6.3.5.3 FS

FS is a mixture of sulfur trioxide and chlorosulfonic acid. It is a liquid that freezes at –30 degrees C (-22 degrees F) and boils at 80 degrees C (176 degrees F). When FS is atomized in the air, it hydrolyzes with moisture that is present to produce a smoke with a TOP of 2,550.

4.6.3.6 Markings

Markings for the Livens Projector during World War I (MKII) are provided in Table 4-6. World War II (MK IIA1) markings are provided in Table 4-7.

Table 4-6: World War I Markings, Livens Projector

World War I (MK II)					
Type of Fill	**Color Bands**			**Other**	
	1st Band	**2nd Band**	**3rd Band**	**Body Color**	**Stencil Markings**
Titanium Tetrachloride (FM)	Yellow	Yellow	None	Slate gray	FM, gas
FS	Yellow	Yellow	None	Slate gray	FS, gas
HC	Yellow	None	None	Slate gray	HC, gas

World War I (MK II)					
Type of Fill	Color Bands			Other	
	1st Band	2nd Band	3rd Band	Body Color	Stencil Markings
High Explosive	None	None	None	Slate gray	H.E.
Thermite	Purple	None	None	Slate gray	Incendiary
Incendiary oil	Purple	None	None	Slate gray	Incendiary

Note: Stencil will be in 1-inch block letters, lengthwise of the drums.

Table 4-7: After 1925 Markings, Livens Projector

After 1925 (MK IIA1)				
Type of Fill	Color Bands		Other	
	1st Band	2nd Band	Body Color	Stencil Markings
Titanium Tetrachloride (FM)	Yellow	None	Blue-gray	SMOKE
FS	Yellow	None	Blue-gray	SMOKE
HC	Green	None	Blue-gray	SMOKE

4.6.3.7 Explosive Train

Fulminate of mercury: unknown
Tetryl: unknown
Black Powder: 0.297 ounce (8.43 g)

4.6.3.8 Fuze

Model Number: Bickford
Total Weight: unknown

4.6.3.9 Burster

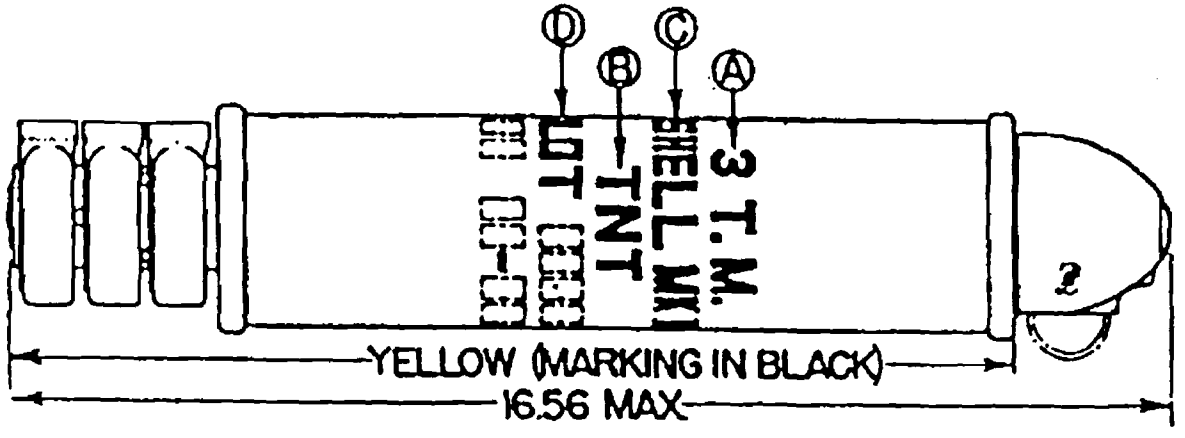
Model Number: M1
Diameter: unknown
Length: length of interior shell
Explosive type: TNT
Explosive weight: 2.11 ounces (59.87 g)

4.6.3.10 Engineering Data

Body: seamless drawn steel tubing
Wall Thickness: 0.188 inch (4.78 mm)

B07MO098801_02.16_0001_a

B07MO098801_02.16_0001_a



A - CALIBER OF MORTAR

B - TYPE OF FILLER

C - MODEL OF SHELL

D - AMMUNITION LOT NUMBER

FIGURE 4-3

3" STOKES MORTAR

Forest Park EE/CA
St. Louis, MO

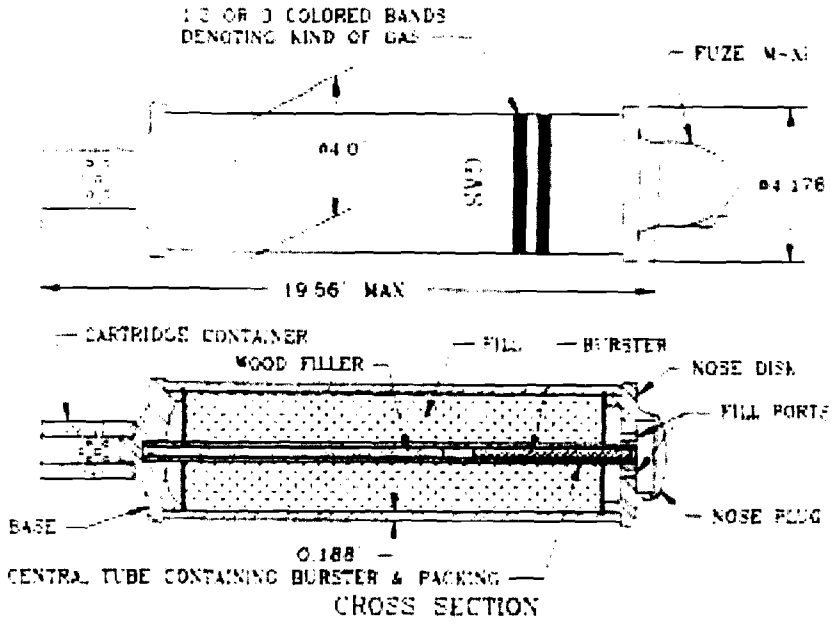


FIGURE 4-4

4" STOKES MORTAR

Forest Park EE/CA
St. Louis, MO

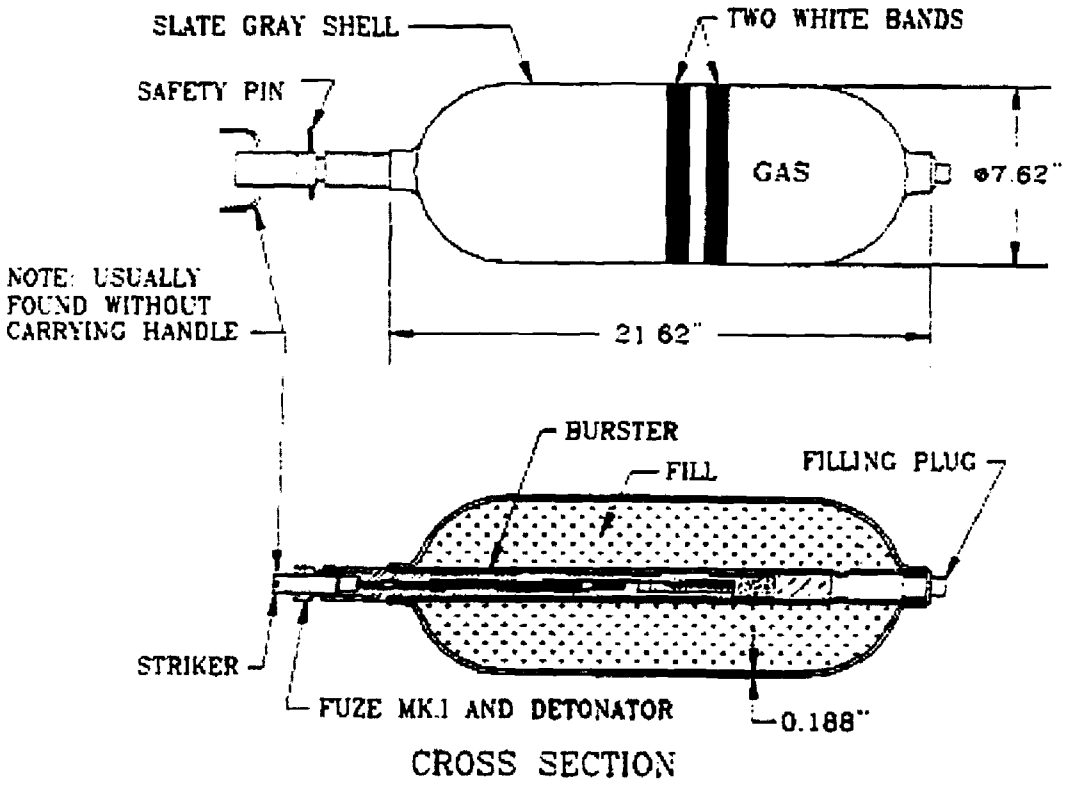


FIGURE 4-5

LIVENS PROJECTOR

Forest Park EE/CA
St. Louis, MO

5 RISK EVALUATION

5.1 CONCEPTUAL SITE MODEL

5.1.1 The Conceptual Site Model (CSM) for Forest Park was developed during the TPP Process and refined during the EE/CA to describe the exposure routes for MEC to a human receptor. It is depicted graphically in Figure 5-2 and described here. The potential for an explosive safety risk depends upon the presence of three elements: a source, a receptor, and an interaction between the source and the receptor. There is no risk if any one element is missing. Each of the three elements provides a basis for implementing effective risk-management response actions.

5.1.2 Human activity at Forest Park is substantial with millions of people visiting one or more attractions annually, and as many as 80,000 rounds of golf are played each year. In addition to golfers, the AOC is regularly maintained and the grounds keeper is included in the CSM. Forest Park is undergoing renovations and may do so again, so a construction worker is also included in the CSM.

5.1.3 The exposure route for MEC to a receptor is primarily direct contact as a result of some human activity. MEC will tend to remain in place unless disturbed by human activities, such as agriculture, or natural forces, such as erosion. Movement of MEC may increase the probability for direct human contact but not necessarily result in a direct contact or exposure.

5.1.4 The source area of MEC risk to humans is MEC in the subsurface at the Lower 9 of the Forest Park Municipal Golf Course and Art Hill. MEC is not expected to exist on the surface of the golf course so pathways to human exposure from MEC on surface soil are considered incomplete. If MEC exists, it would be in the subsurface, occurring at depths greater than six inches below the ground surface.

5.1.5 The golfer and grounds keeper as well as other visitors to Forest Park are not expected to engage in activities that expose the subsurface material under ordinary circumstances. Their activities include golfing, mowing, walking, picnicking, and sightseeing among many other recreation possibilities. The construction worker is likely to dig below the ground surface to install utilities, grade the surface, or build foundations for permanent structures. The CSM shows incomplete pathways for golfers and grounds keepers, and potentially complete exposure pathways for constructions workers.

5.2 RISK IMPACT ASSESSMENT

Risk Impact Assessment is a tool used to evaluate safety hazards to people posed by MEC. The risk impact assessment was performed in accordance with Interim Guidance 01-01, Ordnance and Explosives Risk Impact Assessment, from the U.S. Army Engineering and Support Center (USACE 2001). Risk impact assessment is a stakeholder-friendly method of risk assessment for use during MEC site EE/CA evaluations. Statistically based risk assessment techniques are not possible for this EE/CA because no geophysical data was collected. This method uses direct

evaluation of site conditions and human issues that create MEC risk. The results of the risk impact assessment are an input into the evaluation of the effectiveness criterion of the EE/CA response alternatives evaluation. The three processes in the risk impact assessment method are:

- Evaluate base risk factors
- Perform a baseline risk assessment
- Assess response action alternatives

5.3 BASE RISK FACTORS

The potential risk posed by MEC was characterized qualitatively by evaluating the presence of MEC factor, site characteristics factor, and human factor. By qualitatively assessing these three factors, an overall assessment of the safety risk posed by MEC was evaluated. The following sections describe the components of each of the primary risk factors. An overview of the risk evaluation factors is included as Figure 5-1.

5.3.1 Presence of MEC Factor

Four categories are used to evaluate the presence of MEC risk factor: MEC type, sensitivity, density, and depth distribution.

5.3.1.1 Type

MEC type affects the likelihood of injury and the severity of exposure. If multiple MEC items are identified in an area, that item which poses the greatest risk to public health is selected for risk evaluation. There are four subcategories of MEC type, as described in Table 5-1. These subcategories are presented in order of severity from highest to lowest risk.

Table 5-1: MEC Type

Category		Description
Most severe	3	MEC that may be lethal to an individual if detonated by an individual's activities
Moderately severe	2	MEC that may cause major injury to an individual if detonated by an individual's activities
Least severity	1	MEC that may cause minor injury to an individual if detonated by an individual's activities
No injury	0	Ordnance scrap (inert), will cause no injury

5.3.1.2 Sensitivity

MEC sensitivity affects the likelihood of detonation and the severity of exposure. Sensitivity is a factor of fuzing. MEC in the environment is subject to conditions such as weathering and

movement by erosion. There are four subcategories of MEC sensitivity. The category of sensitivity is based on the results of the EE/CA investigation as well as the results of archival searches. The subcategories of sensitivity are defined and presented in order from highest to lowest in Table 5-2.

Table 5-2: MEC Sensitivity

Category		Description
Very Sensitive	3	MEC that is very sensitive, i.e. electronic fuzing, land mines, booby traps
Less sensitive	2	MEC that has standard fuzing
Insensitive	1	MEC that may have functioned correctly, or is unfuzed, but has a residual risk
Inert	0	Ordnance scrap (inert), will cause no injury

5.3.1.3 Density

MEC density affects the likelihood that an individual will be exposed to MEC. There is a direct relationship between density and the potential for harm. More ordnance per acre means a greater likelihood of exposure. Density can be estimated either qualitatively or quantitatively.

5.3.1.4 Depth Distribution

MEC depth distribution refers to where the MEC is located vertically in the subsurface. The MEC depth distribution affects the likelihood that an individual will be exposed to MEC. There is an inverse relationship between the depth at which MEC are found and the likelihood of exposure to the MEC. The deeper the MEC is located, the lower the risk of exposure. There are two subcategories within the MEC depth distribution category: surface and subsurface. The surface subcategory includes those items recovered either on the ground surface, protruding from the ground surface, or beneath the leaf litter. The subsurface subcategory includes those items recovered from beneath the ground surface.

5.3.2 Site Characteristics Factor

Two categories are evaluated in the site characteristics factor. These are site accessibility and site stability.

5.3.2.1 Site Accessibility

The accessibility of a site affects the likelihood of encountering MEC. Natural or physical barriers can limit accessibility. Natural barriers include the terrain or topography of the site as well as the vegetation. Physical barriers include walls and fences that limit the public's accessibility to the site. Both physical and natural barriers found are considered when evaluating this category. Site accessibility has three subcategories. These subcategories are presented in the Table 5-3.

Table 5-3: Site Accessibility

Category	Description
No Restriction	No man-made barriers Gently sloping terrain Vegetation that restricts access Water that restricts access
Limited Restriction	Man-made barriers Vegetation that restricts access Water, snow or ice cover, and/or terrain restricts access
Complete Restriction	All points of entry are controlled

5.3.2.2 Site Stability

This category relates to the probability of being exposed to MEC by natural processes. These natural processes include recurring natural events (e.g. erosion and frost heave) or extreme natural events (e.g., severe wind and flash floods). The local soil type, topography, climate, and vegetation all affect the stability of the site. Soil type and climate will affect the depth of penetration of MEC. Over time, the soil type and climate will also affect the degree of erosion that takes place at a site. Topography and vegetation in the area will also affect the rate of erosion. Site stability has three subcategories, which are listed in the Table 5-4.

Table 5-4: Site Stability

Category	Description
Site Stable	MEC should not be exposed by natural events
Moderately Stable Site	MEC may be exposed by natural events
Site Unstable	MEC most likely will be exposed by natural events

5.3.3 Human Factors

Two categories are evaluated in the primary human risk factor. These are site activity and population.

5.3.3.1 Site Activity

The types of activities performed at a site affect the likelihood of encountering MEC. The site activity category examines whether the impact from MEC on an activity is significant, moderate, or low. Activities may be generally classified as recreational and occupational. Occupational activities include construction, archaeology, grounds keeping, manufacturing, and farming. Occupational activities are characterized by frequent site visits, stationary tasks, and possibly ground intrusion that could uncover MEC. Recreational activities include child play, picnics, short cuts, hunting, fishing, hiking, swimming, jogging, and golfing. The depth of the MEC affects the likelihood of people encountering it and is considered in the site activity category. Three depth intervals are considered. One is surface depth, which is on or protruding the ground to the top six inches of ground, another is below six inches but less than twelve inches deep, and

the third is greater than twelve inches deep. General guidelines for site activity assessment are presented in Table 5-5.

Table 5-5: Site Activity

Contact Level	Depth of MEC	Site Activities
Significant	Surface	All occupational and recreational activities
Moderate	Below surface – 12 inches	All occupational activities and recreational activities such as camping and metal detecting
Low	Below surface – 12 inches	Occupational activities
	Greater than 12 inches	All occupational and recreational activities

5.3.3.2 Population

This category refers to the number of people that potentially access Forest Park on a daily basis. The number of people accessing the site affects the likelihood of encountering MEC. A direct relationship exists between the number of people and the risk of exposure. An estimate of the number of people accessing the site on a daily basis was made using the best professional judgment based on knowledge of the type of site, land use, and site accessibility.

5.4 FOREST PARK RISK IMPACT ASSESSMENT

Each of the base factors identified above was evaluated using data collected during the EE/CA investigation and data presented in the ASR. The following sections discuss the risk evaluation by each of the primary risk factors discussed above.

5.4.1 Presence of MEC Factor

The ASR and other sources document the discovery of four Stokes mortars and one Livens Projector on five separate occasions in the Norman K. Probstein Municipal Golf Course area between 1998 and 2002. In all instances the discovery was during construction activities as part of park renovations. The origin of the MEC is unknown but is likely one or more of the mock battles and military parades conducted at Forest Park between 1900 and 1950.

5.4.1.1 Type

The type of ordnance that has been discovered at Forest Park is a mortar projectile containing WP, which is designed to produce a large quantity of benign smoke when detonated. However, WP reacts violently when exposed to air, and people near munitions would be subject to blast injuries and burns if detonation occurred uncontrolled. Therefore, MEC at the AOC is type category 2, moderately severe, because an uncontrolled detonation is capable of producing major human injury from burns to people nearby.

5.4.1.2 Sensitivity

Stokes Mortars and Livens Projectors discovered at the AOC are believed to be MEC that were either used as intended and malfunctioned or unintentionally left in place. The former are fuzed, and the latter may or may not be fuzed. Because the MEC are likely fuzed as well as old and weathered, moving or altering the item can potentially detonate it. The MEC at the AOC is categorized in the highest sensitivity category, 3, very sensitive.

5.4.1.3 Density

The Forest Park AOC is approximately 125 acres, and five MEC discoveries have occurred. The AOC is in a highly populated urban area on land that has been developed and improved on several occasions, most recently for the extensive renovation in 2000 as part of the Forest Park Master Plan. All five discoveries appear arbitrarily distributed in the AOC (see Figure 4-1). No munitions storage, stockpiling, distribution, or impact areas have been identified at Forest Park. The discoveries have all occurred during activities not intended to locate MEC. Density is sparse, one random MEC in 25 acres.

5.4.1.4 Depth Distribution

The five MEC items discovered at Forest Park have been recovered from excavations during construction. All parts of the AOC have been walked over by countless numbers of golfers, groundskeepers, and construction workers since Forest Park was established. Park goers would have discovered MEC on the ground surface. In addition, much of the AOC has been covered with fill material borrowed from an adjacent cut area or the Grand Basin area during the renovation in 2000 (see Appendix K). Therefore, MEC that exists at the AOC is not expected on the ground surface. Any MEC that exists at the AOC is expected to be below the ground surface.

5.4.2 Site Characteristics Factor

Forest Park was established as a public park by the City of St. Louis in 1876 at the time on undeveloped farmland two miles west of the city. St. Louis has grown to completely surround the park with urban development. Forest Park is operated by the St. Louis City Department of Parks, Recreation, and Forestry, who has developed nearly all the park for public recreational use, with a small area in the southwest corner preserved as a forest. Future use is expected to continue as a public park with land uses not changing.

5.4.2.1 Site Accessibility

Access to the park is generally unrestricted to park goers. The AOC is the Norman K. Probstein Municipal Golf Course, which is open to the public. Access to the fairways is restricted to paid users and employees of the golf course. All areas of the AOC are developed for the golf course and are maintained. The AOC is generally flat and open with man-made water breaks, extensive landscaping, and roads and buildings. The site accessibility factor is limited restriction to access.

5.4.2.2 Site Stability

The climate in the St. Louis area is subject to occasional severe thunderstorms during the spring rainy season and ground freezing during the winter dry season. A storm sewer system and flood control system exists and the River de Perez was channeled underground in 1930, preventing

flooding except for extreme rainfall events in the last half century. Erosion is minimized by grounds maintenance and landscaping. MEC should not be exposed by natural events and the site stability category is stable.

5.4.3 Human Factor

Forest Park attracts more than 12 million visitors annually. Attractions at the park include the St. Louis Zoo, the St. Louis Art Museum, the Missouri History Museum, the St. Louis Science Center, and Muny Theater. Forest Park also serves as a sports center for such activities as golf, tennis, baseball, bicycling, boating, fishing, handball, ice-skating, roller blading, jogging, cricket, and rugby. Monuments, historic buildings, wildlife, waterways, and landscapes combine to form a treasured resource for the entire St. Louis area. General public activities are recreational and include the Art Museum and Grand Basin waterway in the area of Art Hill, and golfing and biking in the area of the Norman K. Probstein Municipal Golf Course.

5.4.3.1 Site Activities

The activities performed at the AOC combined with the depth of the MEC determine contact level for the site activities factor. Maintenance and operation of the park facilities, including grounds keeping for Norman K. Probstein Golf Municipal Course, are occupational activities. Periodic construction of park facilities is also an occupational activity. Park goes and golfers engage in recreational activities and are less likely to encounter MEC than groundskeepers or construction workers. Depth to MEC is expected to be greater than twelve inches for the entire AOC. For occupational and recreational activities at this AOC, the contact level is low.

5.4.3.2 Population

The Forest Park population typically consists of hikers, runners, golf course employees, and golfers. Forest Park is open year-round, receives more than 12 million visitors annually, and employs hundreds of people. The park is surrounded by urban land use including residential development, although no residences are present on the AOC. The population factor is hundreds of people daily every day of the year.

5.4.4 Baseline Risk Impact Assessment

The baseline risk impact assessment lists the factors described in sections 5.4.1 through 5.4.3. The baseline assessment is used as the standard to compare and assess the remedial alternatives on Table 5-6. Overall risk to humans and the environment is low based on sparse density of MEC discoveries, the depth below the ground surface it occurs, the unlikelihood that many if any still occur. The area is heavily used and has been for decades, is actively maintained for its current land use, and has been extensively renovated recently. These factors indicate that MEC that may exist has already been discovered.

5.5 RESPONSE ALTERNATIVE EVALUATION

Each response alternative is ranked using the base factors identified in section 5.2. The baseline risk impact assessment described in section 5.3 represents existing conditions. Each response alternative has been assigned an impact assessment score of "No Impact" or an alphabetical rank

from "A" to "D" relative to the baseline and other alternatives. A response alternative with a ranking of "A" has the greatest risk reduction relative to the baseline and the other alternatives. A response alternative with a ranking of "C" has the lowest risk reduction relative to the baseline and the other alternatives. The MEC risk impact assessment for each response alternative is presented in Table 5-6. The response alternatives being assessed in this EE/CA are:

- No DoD Action Indicated (NDAI)
- Institutional Controls
- Comprehensive Surface Clearance with Insititutional Controls
- Comprehensive Subsurface Clearance with Institutional Controls

The response alternatives are described briefly in the following sections. More details for the alternatives are provided in Chapter 6 of this report.

Table 5-6: Risk Impact Assessment

Alternative	Presence of MEC				Site Characteristics		Human		Rank
	Type	Sensitivity	Density	Depth	Access	Stability	Activity	Population	
Baseline	2 Moderately severe	3 very sensitive	0.04 MEC per acre	Greater than 12 inches	Limited restrict-ions to AOC	Stable	Low contact level	Hundreds of people daily	
No DoD Action Indicated (NDAI)	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	No Impact	**D**
Institutional Controls	No Impact	No Impact	No Impact	No Impact	C	No Impact	C	No Impact	**C**
Comprehensive Surface Clearance with Institutional Controls	No impact	No Impact	B	No Impact	B	No Impact	B	No Impact	**B**
Comprehensive Subsurface Clearance with Institutional Controls	A	A	A	A	A	No Impact	A	No Impact	**A**

5.5.1 No DoD Action Indicated (NDAI)

NDAI is the same as the baseline. NDAI is the condition where this EE/CA concludes that no MEC exists or that MEC that exists does not pose hazards to humans or the environment. NDAI has been assigned an overall ranking of D and offers the lowest risk reduction of all alternatives evaluated. With this alternative, no response is implemented and risk to public safety from MEC is unchanged.

5.5.2 Institutional Controls

5.4.2.1 Institutional Controls has been assigned an overall relative ranking of C. Institutional Controls are legal, physical, and educational mechanisms that protect property owners and the public from MEC hazards at a site. Effectively used, Institutional Controls prevent human exposure to MEC by restricting land use or providing a physical barrier between human receptors and the hazard, or alert people to the proper safe response if MEC is encountered. For the OERIA, the Institutional Controls alternative assumes that the mechanisms implemented would be as effective as removing the hazard, but does not consider which mechanisms are implemented. Site access characteristics and human activitey base factors are affected by this alternative by restricing access to the subsurface for some activities.

5.4.2.2 During the TPP process and stakeholder interviews, it was determined that this response action would be the most acceptable action to the stakeholders. The site is an active golf course that has recently finished major renovations. There are no anticipated intrusive operations in the future other than regular course maintenance. The only time that MEC was found on site was during the renovation.

5.5.3 Comprehensive Surface Clearance

Comprehensive Surface Clearance has been assigned an overall relative ranking of B. The clearance activities may find a remove MEC hazard on the surface in the AOC and lessens the presence of MEC base factor. The Institutional Controls component of this alternative restricts access to the subsurface mitigating MEC hazard from items that may exist in the subsurface.

5.5.4 Comprehensive Subsurface Clearance

Comprehensive Subsurface Clearance has been assigned an overall relative ranking of A and offers the greatest risk reduction among the alternatives evaluated. This alternative consists of detection and investigation of all subsurface metallic anomalies within the AOC and removal of MEC items found. The limits of anomaly detection are generally four feet below ground surface. MEC may exist at depths greater than 4 feet due to human activities either intentionally, such as a disposal method, or unintentionally, such as land development where fill material was added. Hazards from MEC that exists more than four feet below ground surface would be mitigated by Institutional Controls. The MEC presence factor is therefore impacted, removing explosive risk by removing the source. The AOC would be restored and site characteristics and human factors would be unchanged. Human activity base factor is affected by Institutional Controls that restrict access to soil greater than four feet that may contain MEC.

5.6 CONCLUSION

The response alternatives evaluated in order of reducing MEC hazards are:

1. Comprehensive Subsurface Clearance with Insitutional Controls
2. Comprehensive Surface Clearance with Institutional Controls
3. Institutional Controls

4. NDAI

This conclusion is based on the ability of each alternative to mitigate hazards to park visitors and employees from existing MEC at Forest Park and is relative to the other alternatives.

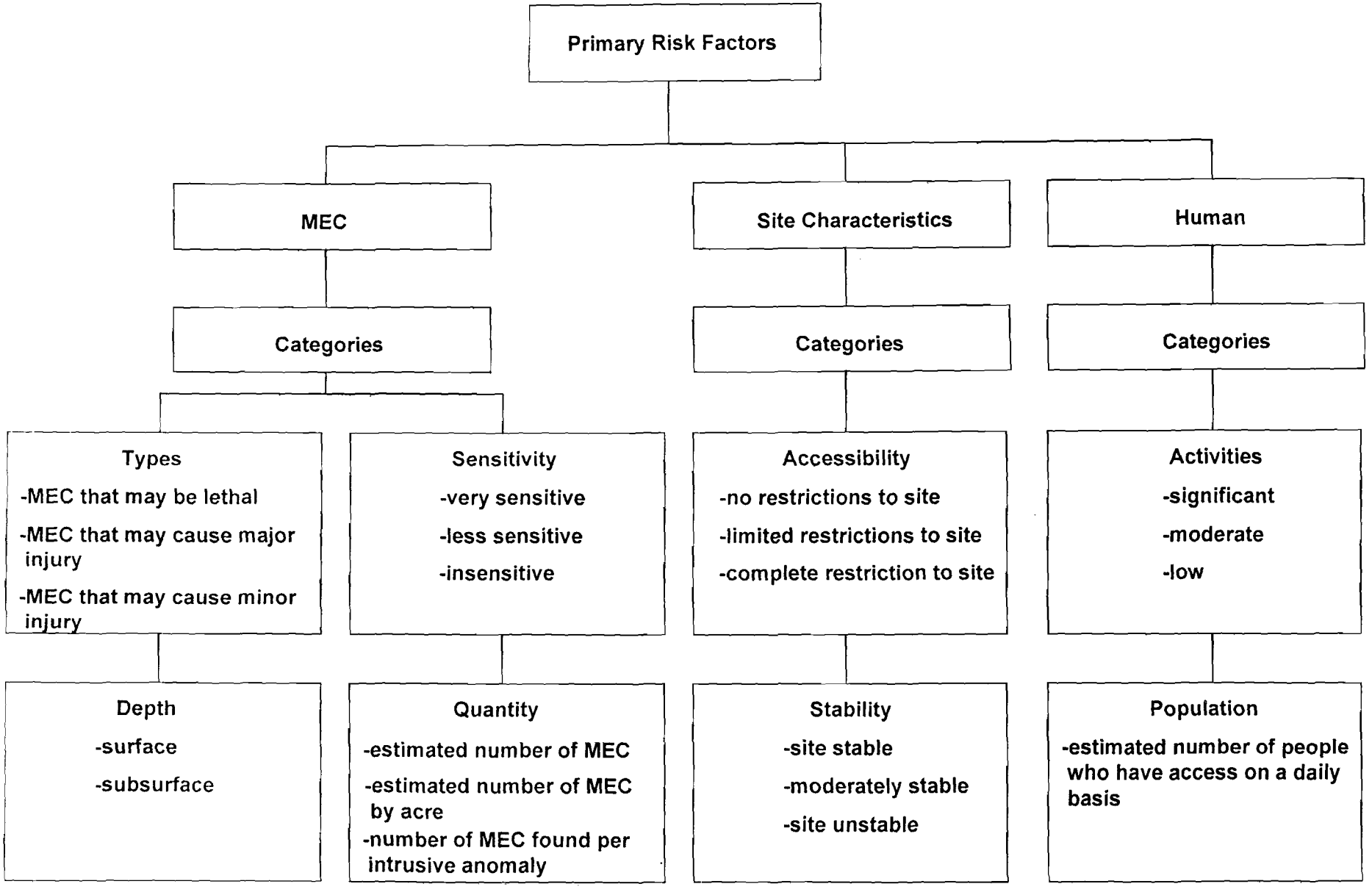


Figure 5-1: OERIA Risk Factors

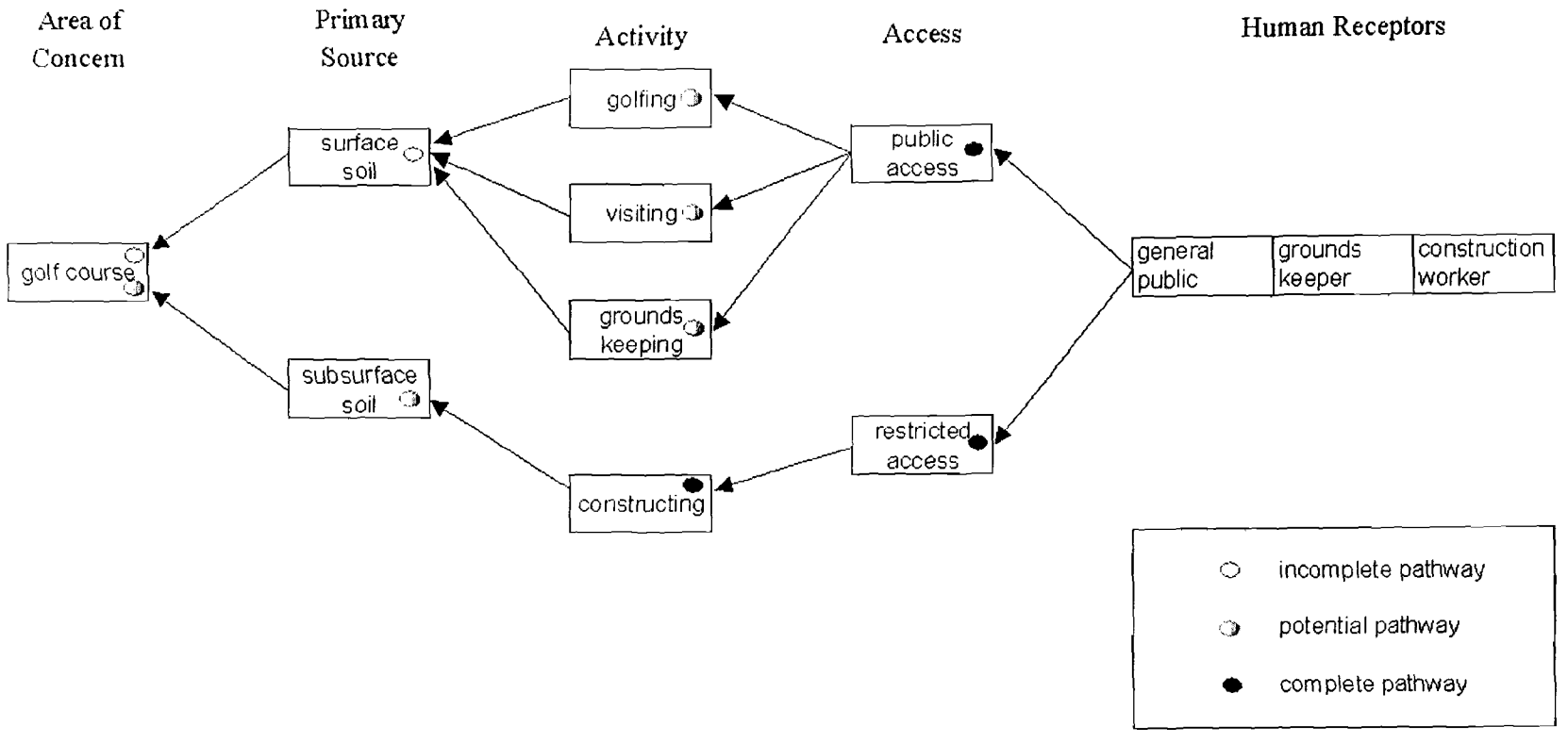


FIGURE 5-2

CONCEPTUAL SITE MODEL

Forest Park EE/CA
St. Louis, MO

6 RESPONSE ALTERNATIVES EVALUATION

6.1 INTRODUCTION

6.1.1 In this chapter, the response alternatives selected for the Forest Park site are identified and analyzed according to the evaluation criteria of effectiveness, implementability, and cost.

6.1.2 The four response alternatives were identified based on the nature, extent, and analysis of MEC occurrence at the site, intended future land use, and explosive hazard reduction for members of the public and workers at Forest Park. Response alternatives for Forest Park can be categorized as either non-removal based or removal based.

Non-removal based alternatives are:

- NDAI
- Institutional Controls

Removal based alternatives are:

- Comprehensive Surface Clearance with Institutional Controls
- Comprehensive Subsurface Clearance with Institutional Controls

6.2 ALTERNATIVES SCREENING PROCESS DESCRIPTION

Each of the above response alternatives was screened according to the evaluation criteria categories of effectiveness, implementability, and cost. These categories are described in further detail below.

6.2.1 Effectiveness

This criterion applies to the capability of a response alternative to reduce explosive safety risk to members of the public, Forest Park workers, and the environment. Specific factors evaluated as part of the effectiveness criterion are described below.

6.2.1.1 Overall protection of human health and the environment

This factor addresses explosive safety risk that exists as a result of MEC being present at the site and assesses the ability of the response action alternative to mitigate that risk.

6.2.1.2 Achievement of response action objectives

This factor addresses the objectives of the response action as determined in the TPP Process and whether those objectives are achieved. Response action objectives identified in the TPP Process include:

- Characterization of the nature, location, and concentration of MEC including a description of the MEC related problems affecting human use of the site

- Identify and analyze reasonable risk management alternatives
- Recommend a proposed alternative for this particular site
- Seek public comment and participation
- Provide a convenient record of the process for use in final decision making and judicial review, if necessary

6.2.2 Implementability

This criterion addresses whether or not the response alternative can be implemented with regard to technical and schedule constraints that may exist. Additionally, public and regulatory/ administrative acceptance are specific factors that are evaluated as part of the implementability criteria. Specific factors evaluated as part of the implementability criterion are described below.

6.2.2.1 Technical feasibility

This factor addresses the availability of existing technologies required to complete the response action and meet response action objectives. If required technology does not currently exist or effectiveness of the response action cannot be monitored, the ability to undertake future risk-reduction actions should be considered in this analysis.

6.2.2.2 Schedule requirements

This factor analyzes the availability of equipment and personnel required to complete the response action. Additionally, impacts to existing land use are evaluated with regard to the response action.

6.2.2.3 Public and regulatory/administrative acceptance of alternative

This factor evaluates the concerns and level of acceptance by members of the public with regard to the response action. Concerns and issues that the EPA, Missouri Department of Natural Resources, and St. Louis/Forest Park entities may have regarding the response action are also addressed in this analysis.

6.2.3 Cost

This factor analyzes the funding required to complete the response action. Costs for each alternative are based on detailed cost estimates, which are included as Appendix E.

6.3 SCREENING OF RESPONSE ALTERNATIVES

6.3.1 Alternative 1, No DoD Action Indicated (NDAI)

The NDAI alternative is included for evaluation to provide a baseline for comparison to the other response action alternatives. No non-removal or removal activities are included in this alternative. As a result, no explosive risk reduction is expected to occur if this alternative is implemented. The NDAI alternative is most appropriate for sites where MEC has not been found and is not expected to exist based on evidence, or for sites where the occurrence of MEC

poses a minimal threat (e.g., sites with extremely limited access, sites with MEC at significant depth).

6.3.1.1 Effectiveness

This alternative is not considered effective with regard to overall protection of human health and the environment and achievement of response action objectives.

6.3.1.1.1 Overall protection of human health and the environment

The NDAI alternative results in no reduction of explosive safety risk to members of the public or workers conducting intrusive activities on the site. The potential MEC that exists will continue to remain in place and no reduction of risk will occur. Additionally, individuals most likely to encounter MEC will not be made aware of the potential to encounter MEC and how to handle such an encounter.

6.3.1.1.2 Achievement of response action objectives

This alternative does not achieve the response action objectives outlined above in Section 6.2.1.2. As MEC will remain in place and no institutional controls will be implemented to reduce explosive safety risk, this alternative does not achieve response action objectives.

6.3.1.2 Implementability

6.3.1.2.1 Technical feasibility

This alternative involves no action and therefore, technical feasibility is not applicable.

6.3.1.2.2 Schedule requirements

This alternative involves no action and therefore, the availability of personnel and equipment are not required and impacts to existing land use would not occur.

6.3.1.2.3 Public and regulatory/administrative acceptance of alternative

Implementation of this alternative would result in no changes to existing access to Forest Park for members of the public. However, the existence of MEC documented on the site, and no mitigation of the explosive risk are a potential concern for members of the public. Regulatory agencies and city entities are aware of the potential presence of MEC within the AOC. Leaving MEC in place and taking no action to mitigate the explosive safety risk that exists would presumably be unacceptable to regulatory agencies and city entities.

6.3.1.3 Cost

There is no cost associated with this alternative.

6.3.2 Alternative 2, Institutional Controls

A combination of MEC education/awareness materials and an MOA between the City of St. Louis and USACE are included in the Institutional Controls alternative. Although Institutional Controls as a category can include access controls such as fences and administrative limitations such as covenants and deed restrictions, these restrictions are not included as part of Alternative 2 because of Forest Park's current land use as a city park and the expected use of the property as a public park in the future. A more detailed description of Alternative 2 is provided in Appendix E.

6.3.2.1 Effectiveness

6.3.2.1.1 Overall protection of human health and the environment

This alternative results in some reduction of explosive safety risk to members of the public or intrusive workers conducting activities on the site. Although the potential MEC that exists will continue to remain in place, Spanish and English educational/awareness materials will notify site workers of the potential for MEC to be present and what to do if MEC is encountered. An MOA between the City of St. Louis and USACE will ensure that educational/awareness materials are provided to individuals most likely to encounter MEC. The Construction Division of the City of St. Louis will be responsible for distribution of the MEC educational/awareness materials. This city office approves all construction activities within Forest Park.

6.3.2.1.2 Achievement of response action objectives

Response action objectives include minimizing the potential for members of the public and workers on site to be injured or killed as a result of encountering MEC. Education and awareness have been shown to be effective at reducing explosive safety risks to the public and workers at other sites. Establishment of an MOA will ensure that individuals most likely to encounter MEC are aware of the potential and what to do in such an instance.

6.3.2.2 Implementability

6.3.2.2.1 Technical feasibility

This alternative is technically feasible. Production of educational/awareness materials and development of an MOA can be accomplished with existing and readily available technology.

6.3.2.2.2 Schedule requirements

This alternative requires minimal commitment of personnel and equipment to conduct the response action. Additionally, ongoing and future uses of Forest Park would not be impacted as a result of implementation of this response action. Future construction activities within the park would not be restricted, but would require that all individuals performing ground intrusive work receive information regarding the potential for encountering MEC.

6.3.2.2.3 Public and regulatory/administrative acceptance of alternative

Implementation of this alternative would result in no changes to existing access to Forest Park for members of the public. However, the continued existence of MEC documented on the site is a potential concern for members of the public. This alternative does not recommend providing educational/awareness materials to the general public because they are not expected to conduct intrusive activities that could result in contact with MEC. A subset of the public, workers who conduct intrusive activities, would be provided these materials. This would presumably be met with approval by workers conducting intrusive activities, as they would have information available to assist them in making informed decisions if they decide to work at the site. Regulatory agencies and city entities are aware of the potential presence of MEC within the AOC. Leaving MEC in place may not be viewed as a permanent solution and may be deemed unacceptable. However, the significant disruption of traffic and public access that would be required to remove MEC would also have significant impacts on city entities in particular. These impacts are discussed further in the evaluations of Alternatives 3 and 4 below.

6.3.2.3 Cost

The cost associated with this alternative is approximately $15,000 for the first year and $6,000 for subsequent years. First year costs include task management and the development of bilingual educational/awareness materials regarding MEC. These costs are one time costs and would not exist for out years. Costs after year one would only include a production run of the informational materials and a site visit to distribute the materials. Further details regarding the costs of Alternative 2 are included in Appendix E.

6.3.3 Alternative 3, Comprehensive Surface Clearance with Institutional Controls

Comprehensive surface clearance would require UXO specialists, who are trained in MEC recognition, and safety and disposal techniques, to cover 100% of the AOC using a magnetometer to assist in detection of surface metallic anomalies. A magnetometer is an instrument that measures the variations in the earth's magnetic field in order to locate metal objects on or below the ground surface. The primary method of location of MEC on the surface would be visual. A magnetometer would be used in areas where the ground surface was obscured, such as by leaf litter or bushes. Only MEC on or protruding from the ground surface would be removed and disposed. If a magnetometer indicated a metallic anomaly but nothing was visible at the ground surface, the anomaly would be left in place. After completion of the Comprehensive Surface Clearance, a combination of MEC education/awareness materials and an MOA between the City of St. Louis and USACE would serve as Institutional Controls to minimize any residual explosive risk. Although Institutional Controls as a category can include access controls such as fences and administrative limitations such as covenants and deed restrictions, these restrictions are not included as part of Alternative 3 because of Forest Park's current land use as a city park and the expected use of the property as a public park in the future.

This alternative would minimize the risk of incidental contact with MEC to members of the public accessing Forest Park and to workers conducting ground intrusive activities. Due to Forest Park's mostly open space, the fact that the park has been open to the public for more than 100 years without documentation of any MEC surface discoveries, and the use of the park by millions of people each year, the probability of locating significant amounts of MEC on the surface is low. Although no visual inspection of the entire AOC has been completed, the low probability of encountering surface MEC discussed in Chapter 5 precludes the requirement for conducting a visual inspection. MEC trained individuals have been on the site during construction support activities and during responses to MEC discoveries during construction. Institutional Controls described above would ensure that workers conducting ground intrusive activities are aware of the potential for encountering MEC not removed as part of the Comprehensive Surface Clearance. A more detailed description of Alternative 3 is provided in Appendix E.

6.3.3.1 Effectiveness

6.3.3.1.1 Overall protection of human health and the environment

This alternative potentially results in significant reduction of explosive safety risk to members of the public accessing Forest Park. The public is most likely to encounter MEC that is present on the ground surface. This alternative results in some reduction of explosive safety risk to workers conducting ground intrusive activities on the site. Although the potential MEC that exists below

the ground surface will continue to remain in place, Spanish and English educational/awareness materials will notify site workers of the potential for MEC to be present and what to do if MEC is encountered. An MOA between the City of St. Louis and USACE will ensure that educational/awareness materials are provided to individuals most likely to encounter MEC. Previous MEC finds within Forest Park have all occurred during construction that involved ground intrusive activities. Although the probability of encountering MEC on the surface is extremely low, this alternative is included in the evaluation because of the slight potential for encountering surface MEC. If an item were found and removed, it would result in a reduction of explosive risk.

6.3.3.1.2 Achievement of response action objectives

As discussed previously, the probability of encountering MEC on the surface is low. Comprehensive surface clearance is generally considered appropriate in areas where surface MEC has been confirmed or where surface inspections have not occurred. A reduction in explosive risk to members of the public and workers conducting ground intrusive activities would potentially occur, both through the implementation of the surface clearance and subsequent Institutional Controls.

6.3.3.2 Implementability

6.3.3.2.1 Technical feasibility

Implementation of this alternative is technically feasible. Conducting a Comprehensive Surface Clearance with Institutional Controls requires equipment and personnel that are readily available and proven.

6.3.3.2.2 Schedule requirements

Implementation of this alternative is expected to take 12.5 weeks of actual fieldwork. Preparation of documents and project planning would require an additional 3 to 6 months. Equipment and personnel are available to conduct this response action. Impacts to existing land use and scheduled events with implementation of this alternative could be substantial. Road closures and restriction of public access to areas of Forest Park would be expected to occur for at least a portion of the implementation period. Performance of this alternative would be expected to occur in the spring, summer, or fall months, which are also the months with the most intense public usage of Forest Park. The comprehensive surface clearance would presumably not be conducted during the winter months because of the uncertainty associated with snowfall in the St. Louis area. Implementation of the subsequent Institutional Controls would require minimal commitment of personnel and equipment. However, the Institutional Controls component of this alternative would be an ongoing requirement.

6.3.3.2.3 Public and regulatory/administrative acceptance of alternative

Implementation of this alternative could result in substantial changes to existing access to Forest Park for members of the public during the 12.5-week comprehensive surface clearance. Additionally, some residents in close proximity to Forest Park may be required to temporarily vacate their homes if this alternative is selected. These temporary relocations would be required in the event MEC was located in close proximity to homes bordering Forest Park and during demolition operations. The continued existence of subsurface MEC documented on the site is a potential concern for members of the public and workers conducting ground intrusive activities.

However, the Institutional Controls component of this alternative ensures that those most likely to encounter residual MEC are aware of its potential presence below the ground surface. Regulatory agencies and city entities are aware of the potential presence of MEC within the AOC. Leaving MEC in place below the ground surface may not be viewed as a permanent solution and may be deemed unacceptable. However, the significant disruption of traffic and public access that would be required to remove MEC from the surface would also have significant impacts on city entities in particular. City entities have expressed concerns with respect to closure or restriction of the public's movement in Forest Park. The golf course recently underwent a multi-million dollar renovation, and any disruption in the use of the golf course could result in serious financial implications. The St. Louis Art Museum, which is located in close proximity to the site, could also be impacted negatively by implementation of this alternative. Another negative impact regarding this alternative is significant disruption of traffic patterns within and around Forest Park. Forest Park serves as a major traffic thoroughfare for thousands of residents each day. Restrictions on traffic through the park during the comprehensive surface clearance could result in substantial traffic control problems in and around Forest Park.

6.3.3.3 Cost

The cost associated with the comprehensive surface component of this alternative is approximately $600,000. This cost includes a seven-person UXO team and oversight on site for 12.5 weeks. Hotel and per diem costs are also included. The cost associated with the Institutional Controls component of this alternative is approximately $15,000 for the first year and $6,000 for subsequent years. First year costs include task management and the development of bilingual educational/awareness materials regarding MEC. These costs are one time costs and would not exist for out years. Costs after year one would only include a production run of the informational materials and a site visit to distribute the materials. Further details regarding the costs of Alternative 3 are included in Appendix E.

6.3.4 Alternative 4, Comprehensive Subsurface Clearance with Institutional Controls

Comprehensive subsurface clearance would require UXO specialists, who are trained in MEC recognition, safety, and disposal techniques, to cover 100% of the AOC using a magnetometer to detect subsurface metallic anomalies. Each metallic anomaly detected would need to be investigated. Digital geophysical mapping (DGM) is an additional technique that could be employed to locate subsurface anomalies at the Forest Park AOC. DGM is a technique used during MEC clearance actions that provides sensor data that is digitally recorded and geo-referenced. This digital record is then used to determine which anomalies exhibit characteristics of MEC expected at the site. Anomalies exhibiting the signature of MEC expected at the site are subsequently investigated by UXO specialists. In this instance, only anomalies exhibiting the characteristics of MEC expected at the site would be investigated. Implementation of a magnetometer assisted or DGM based clearance would also remove any MEC located on the ground surface. If MEC were detected during the investigation, the item would be handled and disposed of by St. Louis Police Department Bomb and Arson Squad detectives. This alternative would allow for the removal of any MEC reasonably possible to detect and would significantly reduce the explosives risk to members of the public and workers conducting intrusive activities within Forest Park. Although no technology currently exists that will detect 100% of all

subsurface metallic anomalies to all depths, existing technologies are very effective at detecting anomalies at shallow depths. Although some MEC items could potentially remain in place after performance of this response action, subsurface clearance has been shown to contribute significantly to a reduction in explosive safety risk at other sites. After completion of the Comprehensive Subsurface Clearance, a combination of MEC education/awareness materials and an MOA between the City of St. Louis and USACE would serve as Institutional Controls to minimize any residual explosive risk. Although Institutional Controls as a category can include access controls such as fences and administrative limitations such as covenants and deed restrictions, these restrictions are not included as part of Alternative 4 because of Forest Park's current land use as a city park and the expected use of the property as a public park in the future. A more detailed description of Alternative 4 is provided in Appendix E.

Effectiveness

6.3.4.1.1 Overall protection of human health and the environment

This alternative would result in the significant reduction of explosive safety risk to members of the public and ground intrusive workers accessing Forest Park. Removal of a substantial amount of MEC on the site would lower the probability of a worker or member of the public encountering MEC. Previous documented MEC finds within Forest Park have all occurred during construction that involved ground intrusive activities. Although the potential exists for some undetected MEC to remain in place, Spanish and English educational/awareness materials will notify site workers of the potential for MEC to be present and what to do if MEC is encountered. An MOA between the City of St. Louis and USACE will ensure that educational/awareness materials are provided to individuals most likely to encounter MEC.

6.3.4.1.2 Achievement of response action objectives

This alternative significantly limits the potential of future direct contact with MEC, with a corresponding reduction in the potential for injury or death.

6.3.4.2 Implementability

6.3.4.2.1 Technical feasibility

Implementation of this alternative is technically feasible. Conducting a Comprehensive Subsurface Clearance with Institutional Controls requires equipment and personnel that are readily available and proven. Technical constraints with regard to this alternative include the presence of significant amounts of subsurface metallic construction debris associated with the 1904 World's Fair. This metallic debris could serve to shield MEC items from detection and may result in a significant amount of excavations that yield no reduction in explosive risk.

6.3.4.2.2 Schedule requirements

Implementation of this alternative is expected to take 17.5 weeks of actual fieldwork. Preparation of documents and project planning would require an additional 3 to 6 months. Additional time of 1 month would be required to restore the area to its previous condition. Equipment and personnel are available to conduct this response action. Impacts to existing land use and scheduled events with implementation of this alternative could be substantial. Road closures and restriction of public access to areas of Forest Park would be expected to occur for at least a portion of the implementation period. Performance of this alternative would be expected

to occur in the spring, summer, or fall months, which are also the months with the most intense public usage of Forest Park. The comprehensive subsurface clearance would presumably not be conducted during the winter months because of the uncertainty associated with snowfall in the St. Louis area. Implementation of the subsequent Institutional Controls would require minimal commitment of personnel and equipment. However, the Institutional Controls component of this alternative would be an ongoing requirement.

6.3.4.2.3 Public and regulatory/administrative acceptance of alternative

Implementation of this alternative could result in substantial changes to existing access to Forest Park for members of the public during the 17.5-week comprehensive subsurface clearance. Additionally, some residents in close proximity to Forest Park may be required to temporarily vacate their homes if this alternative is selected. These temporary relocations would be required during investigation of some subsurface anomalies, in the event MEC was located in close proximity to homes bordering Forest Park, and during demolition operations. However, the continued existence of MEC documented on the site is a potential concern for members of the public. A subset of the public, workers who conduct intrusive activities, would presumably be in favor of this alternative as it provides substantial reduction in explosive risk for their activities. Additionally, the Institutional Controls component of this alternative ensures that those most likely to encounter undetected MEC are aware of its potential presence below the ground surface. Regulatory agencies and city entities are aware of the potential presence of MEC within the AOC. Removal of all detectable MEC and the corresponding reduction in explosive risk would presumably be the preferential alternative. However, the significant disruption of traffic and public access that would be required to remove MEC from the subsurface would also have significant impacts on city entities in particular. City entities have expressed concerns with respect to closure or restriction of the public's movement in Forest Park. The golf course recently underwent a multi-million dollar renovation, and any disruption in the use of the golf course could result in serious financial implications. The St. Louis Art Museum, which is located in close proximity to the site, could also be impacted negatively by implementation of this alternative. The final negative impact regarding this alternative is significant disruption of traffic patterns within and around Forest Park. Forest Park serves as a major traffic thoroughfare for thousands of residents each day. Restrictions on traffic through the park during the comprehensive subsurface clearance could result in substantial traffic control problems in and around Forest Park.

6.3.4.3 Cost

The cost associated with the comprehensive subsurface clearance component of this alternative is approximately $2,200,000 for a magnetometer clearance and approximately $960,000 for a clearance conducted using DGM. The cost associated with the Institutional Controls component of this alternative is approximately $15,000 for the first year and $6,000 for subsequent years. First year costs include task management and the development of bilingual educational/awareness materials regarding MEC. These costs are one time costs and would not exist for out years. Costs after year one would only include a production run of the informational materials and a site visit to distribute the materials. Further details regarding the costs of Alternative 4 are included in Appendix E.

6.4 COMPARATIVE ANALYSIS OF RESPONSE ACTION ALTERNATIVES

The following sections differ from the previous evaluation of the response action alternatives in that each response action will be evaluated in relation to the other alternatives. The purpose of this analysis is to identify the advantages and disadvantages of each alternative relative to the others. Each alternative is compared with the other alternatives with regard to effectiveness, implementability, and cost. Alternative 1, NDAI, is included in the analysis, but is not considered an acceptable MEC response action. A ranking system is explained and displayed graphically in the following sections to compare the alternatives and to assist in the selection of the recommended response action alternative(s).

6.4.1 Effectiveness

The two factors considered in the effectiveness criteria are overall protection of human health and the environment, and achievement of response action objectives. As presented in Table 5-6: OERIA Risk Evaluation, the alternatives that are most effective at reducing explosive risk are assigned the highest scores for effectiveness. The response action alternatives are assigned a ranking of 1 to 3 relative to the other response action alternatives, 1 being the most effective and 3 being the least effective. After this analysis is complete, alternatives are ranked as to their effectiveness. The results of this analysis are displayed in Table 6-1. Alternative 4, Comprehensive Subsurface Clearance with Institutional Controls, has the most favorable score for effectiveness. Alternative 3, Comprehensive Surface Clearance with Institutional Controls, is considered the second most effective alternative. Alternative 3, Institutional Controls, is considered the least effective. The evaluation factors are discussed in further detail below.

Table 6-1: Effectiveness Criteria Evaluation

	Alternative 1, No DoD Action Indicated (NDAI)	**Alternative 2, Institutional Controls**	**Alternative 3, Comprehensive Surface Clearance with Institutional Controls**	**Alternative 4, Comprehensive Subsurface Clearance with Institutional Controls**
Overall protection of human health and the environment	NA	3	2	1
Achievement of response action objectives	NA	3	2	1
Total	NA	6	4	2
Rank	NC	3	2	1

NA = Not Applicable NC = Not Considered

6.4.1.1 Overall protection of human health and the environment

6.4.1.1.1 Alternative 4, Comprehensive Subsurface Clearance with Institutional Controls, was determined to provide the most overall protection of human health and the environment. Implementing this alternative is expected to provide the maximum removal of MEC items from the site, with a corresponding reduction in explosive risk to the public and intrusive workers.

6.4.1.1.2 Alternative 3, Comprehensive Surface Clearance with Institutional Controls, was determined to provide more overall protection of human health and the environment than Alternative 2, but less than Alternative 4. Although this alternative would remove any MEC items on the ground surface, the probability of finding MEC on the ground surface is low. MEC education/awareness training would be provided for ground intrusive workers. These are the individuals most likely to encounter MEC remaining beneath the ground surface

6.4.1.1.3 Alternative 2, Institutional Controls, was determined to provide the least overall protection of human health and the environment. MEC would potentially remain in place below and at the ground surface. This alternative is considered the least effective with regard to overall protection of human health and the environment.

6.4.1.2 Achievement of response action objectives

The alternative rankings for this factor are the same as those discussed above for reasons similar to those outlined in the above sections.

6.4.2 Implementability

The three factors considered for the implementability criteria are technical feasibility, schedule requirements, and public and regulatory/administrative acceptance of the alternative. The results of this analysis are displayed in the Table 6-2. Alternative 2, Institutional Controls, has the most favorable score for implementability. Alternative 3, Comprehensive Surface Clearance with Institutional Controls, is ranked second for this criterion, and Alternative 4, Comprehensive Subsurface Clearance with Institutional Controls, is considered the least implementable alternative. The evaluation factors are discussed in further detail below.

Table 6-2: Implementability Criteria Evaluation

	Alternative 1, No DoD Action Indicated (NDAI)	**Alternative 2, Institutional Controls**	**Alternative 3, Comprehensive Surface Clearance with Institutional Controls**	**Alternative 4, Comprehensive Subsurface Clearance with Institutional Controls**
Technical feasibility	NA	1	2	3
Schedule requirements	NA	1	2	3
Public and Regulatory/ Administrative	NA	1	2	3

	Alternative 1, No DoD Action Indicated (NDAI)	Alternative 2, Institutional Controls	Alternative 3, Comprehensive Surface Clearance with Institutional Controls	Alternative 4, Comprehensive Subsurface Clearance with Institutional Controls
acceptance				
Total	NA	3	6	9
Rank	NC	1	2	3

NA = Not Applicable NC = Not Considered

6.4.2.1 Technical feasibility

6.4.2.1.1 Alternative 2, Institutional Controls, was determined to be the most technically feasible alternative. Extremely limited equipment and personnel are required for this response action to be conducted.

6.4.2.1.2 Alternative 3, Comprehensive Surface Clearance with Institutional Controls, was determined to be the second most technically feasible alternative. This alternative is technically more difficult to implement than Institutional Controls alone.

6.4.2.1.3 Alternative 4, Comprehensive Subsurface Clearance, was determined to be the least technically feasible alternative. This alternative is considerably more difficult technically than the other alternatives.

6.4.2.2 Schedule requirements

6.4.2.2.1 Alternative 2, Institutional Controls, was determined to have the least impact from schedule requirements. Equipment and personnel required to implement this alternative would be available and Institutional Controls would not impact park access or scheduled events.

6.4.2.2.2 Alternative 3, Comprehensive Surface Clearance with Institutional Controls, was ranked as the second most implementable action with regard to schedule requirements. Equipment and personnel could be made available to conduct this action, but impacts to park access and scheduled events could occur during the 12.5-week implementation period.

6.4.2.2.3 Alternative 4, Comprehensive Subsurface Clearance with Institutional Controls, was ranked as the least implementable action with regard to schedule requirements. Equipment and personnel could be made available to conduct this action, but substantial impacts to park access and scheduled events could occur during the 17.5-week implementation period.

6.4.2.3 Public and regulatory/administrative acceptance of alternative

6.4.2.3.1 Alternative 2, Institutional Controls, was determined to be most acceptable with regard to the public, regulatory agencies, and St. Louis City administration. Particular weight

was given to the lack of restrictions on public access and overall lack of disruption to city entities associated with this alternative. Based on experience at other MEC sites, regulatory agencies generally prefer alternatives that remove MEC from the site.

6.4.2.3.2 Alternative 3, Comprehensive Surface Clearance with Institutional Controls, was ranked as the second most acceptable action with regard to the public, regulatory agencies, and St. Louis City administration. Although impacts to park access, traffic, and scheduled events could occur during the 12.5-week clearance implementation period, the implementation period of this action is less than that of Alternative 4. From a risk reduction standpoint, regulatory agencies could presumably prefer this alternative to Alternative 2.

6.4.2.3.3 Alternative 4, Comprehensive Subsurface Clearance with Institutional Controls, was ranked as the least acceptable action with regard to the public, regulatory agencies, and St. Louis City administration. Impacts to park access, traffic, and scheduled events could be substantial during the 17.5-week clearance implementation period. From a risk reduction standpoint, regulatory agencies could presumably prefer this alternative to Alternatives 2 and 3.

6.4.3 Cost

The results of the cost analysis are displayed in the Table 6-3. Alternative 2, Institutional Controls, has the most favorable score for cost. Alternative 3, Comprehensive Surface Clearance with Institutional Controls, is ranked second for this criterion, and Alternative 4, Comprehensive Subsurface Clearance with Institutional Controls, is ranked last. The evaluation is discussed in further detail below.

Table 6-3: Cost Criteria Evaluation

	Alternative 1, No DoD Action Indicated (NDAI)	**Alternative 2, Institutional Controls**	**Alternative 3, Comprehensive Surface Clearance with Institutional Controls**	**Alternative 4, Comprehensive Subsurface Clearance with Institutional Controls**
Total	NA	1	2	3
Rank	NC	1	2	3

NA = Not Applicable NC = Not Considered

6.4.3.1 Cost evaluation

6.4.3.1.1 Alternative 2, Institutional Controls, was determined to be the least costly alternative. Initial costs for this alternative would include development and production of MEC educational/awareness materials and a site visit to distribute them. Subsequent years would only require production of the materials and a site visit to distribute them.

6.4.3.1.2 Alternative 3, Comprehensive Surface Clearance with Institutional Controls, was determined to be the second least costly alternative. A comprehensive surface clearance with institutional controls has higher costs than implementation of institutional controls alone, but lower costs than a comprehensive subsurface clearance with institutional controls.

6.4.3.1.3 Alternative 4, Comprehensive Subsurface Clearance with Institutional Controls, was determined to be the most costly alternative.

6.5 SUMMARY

The results of the comparative analysis of alternatives for effectiveness, implementability, and cost were combined to determine the preferential scores of the alternatives. The lowest score indicates the most preferred alternative, the second lowest score indicates the second ranked in terms of preference, and the highest score indicates the least preferred alternative. It should be noted that effectiveness, implementability, and cost were each given equal weight in this analysis. The preferential scores for the alternatives are displayed in the Table 6-4. Alternative 2 was determined to be the preferred alternative based on this analysis. Alternatives 3 and 4 were ranked equally as lesser-preferred alternatives.

Table 6-4: Preferential Scoring of Alternatives

	Alternative 1, No DoD Action Indicated (NDAI)	**Alternative 2, Institutional Controls**	**Alternative 3, Comprehensive Surface Clearance with Institutional Controls**	**Alternative 4, Comprehensive Subsurface Clearance with Institutional Controls**
Effectiveness	NA	3	2	1
Implementability	NA	1	2	3
Cost	NA	1	2	3
Total	NA	5	6	7
Rank	**NC**	**1**	**2**	**3**

NA = Not Applicable NC = Not Considered

7 INSTITUTIONAL CONTROL PLAN

7.1 GENERAL DESCRIPTION OF SITE BOUNDARIES

The Forest Park AOC encompasses the Lower 9 holes of the Norman K. Probstein Municipal Golf Course and the Art Hill area. Lindell Boulevard borders the northern part of the Lower 9, Lagoon Drive and Fine Arts Drive form the southwest boundary, and a line between the History Museum and the Muny forms the southeast boundary. The Dwight Davis Tennis Courts, Post Dispatch Lake, Boat House, and Upper 9 of the golf course are not included.

7.2 SPECIFIC INSTITUTIONAL CONTROLS

7.2.1 The Institutional Controls program for Forest Park includes three controls that are designed to minimize the potential for members of the public and workers on site to be injured or killed as a result of encountering MEC. These are:

- Zoning and Planning Controls
- Education and Notification Controls
- Annual Site Visit

7.2.2 No engineering controls such as fences or signs are planned. Much of the AOC has engineering controls currently in place in the form of soil and pavement cover.

7.2.3 An MOA will be prepared between USACE and the City of St. Louis that identifies the Institutional Controls and details such as administration, inspection, and enforcement of the program.

7.3 RESIDUAL RISK REDUCTION

The residual risk is the hazard that exists from encountering MEC that may exist at the AOC and subsequent actions that may cause harm. The three control's ability to reduce residual risk is discussed individually in the following sections.

7.3.1 Zoning and Planning Controls Risk Reduction

Zoning and planning controls are governmental controls that will add notice of potential MEC hazard to the Forest Park Master Plan. Incorporating a notice of potential MEC into the Forest Park Master Plan will alerts planners to potential hazards that may exist at the site. As the Master Plan is implemented, planners can account for the hazard and adjust activities as necessary to ensure public safety.

Forest Park is currently zoned recreational by the city zoning department.

7.3.2 Education and Notification Controls

7.3.2.1 Education and notification controls include producing and distributing an educational/awareness pamphlet that describes the types of MEC found at Forest Park and details the actions to take upon discovering them. Recognizing the hazard is essential for implementing appropriate responses to contain and dispose of MEC. Distinguishing between MEC and other debris that may be encountered at Forest Park will ensure that authorities are notified and actions can be taken to dispose of the MEC without harm to anyone involved.

7.3.2.2 The pamphlets will be distributed to any person, company, or agency planning to work within the AOC. Distribution to the public-at-large is unnecessary because under normal use conditions MEC is not expected to be encountered. MEC that may exist is buried as a result of the construction of the golf course and other land uses such as pavement and landscaping. However, the pamphlet will be available to anyone upon request.

7.3.3 Annual Site Visit

The site will be subject to review by the DoD in accordance with the FUDS program to monitor the effectiveness of the Institutional Controls program. Consequently, every year, USACE, Kansas City District, will make a visit to the site to ensure that educational/notification and zoning controls are still in place and effective. If the Institutional Controls are determined to be ineffective or not useful, changes can be made. The site visit program will continue indefinitely until it is determined to be unnecessary. The recurrence interval is every year but may be changed if necessary.

7.4 AGENCIES INVOLVED WITH INSTITUTIONAL CONTROLS

The landowner is the principal agency for effective Institutional Controls. The City of St. Louis owns the entire Forest Park area, including the AOC. As the former owner of the Forest Park Recreation Camp, the DoD has the responsibility to protect the public from MEC hazards for current and future land use. The City of St. Louis will implement the modifications to the Forest Park Master Plan. USACE will reproduce the MEC pamphlets and provide them to the City of St. Louis, Construction Division, for distribution. The five-year reviews will be programmed and budgeted by USACE and performed in cooperation with the St. Louis Department of Parks, Recreation, and Forestry.

7.5 INSTITUTIONAL CONTROLS FUNDING

7.5.1 Short-Term Costs

Short-term costs for implementing Institutional Controls are already programmed into this EE/CA. These costs are summarized in Appendix C of this EE/CA. Short-term costs include the design and production of the MEC pamphlets, coordination and approval of the MOA, solicitation of public participation in the EE/CA process, and site visits to distribute the pamphlets.

7.5.2 Long-Term Costs

Long-term costs include the costs for reproducing fact sheets and performing five-year reviews. These costs are summarized in Appendix C of this EE/CA.

7.5.3 Funding Sources

The DERA account funds the FUDS program. It will provide funding for future five-year reviews. The funding is programmed annually and funded with congressional appropriations. Programming is also reviewed annually and can be modified if necessary.

7.6 REQUIREMENTS AND SCHEDULE

The EE/CA schedule includes the tasks of designing and producing an MEC educational/awareness pamphlet, as well as establishing an MOA between the City of St. Louis and USACE by 30 September 2004.

7.7 DURATION OF INSTITUTIONAL CONTROLS

Institutional Controls will remain in effect until a five-year review determines that they are no longer necessary.

7.8 PROCEDURES FOR MODIFYING OR TERMINATING INSTITUTIONAL CONTROLS

7.8.1 Modifying or terminating the Institutional Controls for Forest Park will involve determining the need for changes in this plan during the five-year review process, then implementing them. The five-year reviews will be performed by USACE, who will document the results of their findings in a report. USACE can recommend changes to the then-current Institutional Controls and provide the opportunity for stakeholder approval and modification.

7.8.2 The Forest Park Master Plan can be changed through coordination with Forest Park Advisory Board. Zoning controls can be modified through coordination with the St. Louis zoning department.

7.8.3 The MEC pamphlet can be modified to add identification of new hazards or provide different response actions. Distribution of the fact sheet can be ceased at any time it is determined to be unnecessary.

7.8.4 Five-year reviews can be discontinued any time that it is determined by the reviewers that a hazard from MEC no longer exists. This may include significant construction activities that uncover any MEC that may exist, or the use of new, currently non-existing technology that can reliably identify the presence or absence of subsurface MEC.

7.9 LAND USE

The land use for the entire site is recreational. Exposure to MEC on the ground surface and in the subsurface is depicted graphically in the conceptual site model included in this EE/CA report. Members of the public and grounds keepers may be exposed to MEC on the ground surface, but are not exposed to subsurface MEC because recreational activities are not intrusive. Construction activities involving earth moving, however, could potentially expose MEC contained in the subsurface. Land use is expected to remain the same for the foreseeable future.

7.10 RESIDUAL RISK

The institutional controls identified in this plan are capable of effectively protecting the human environment from MEC remaining at Forest Park from past DoD operations. Overall risk to humans from MEC exposure is low based on sparse density of MEC discoveries, the depth below the ground surface it occurs, and the unlikelihood that many items remain. Effective institutional controls can ensure future MEC discoveries, if any, would be responded to safely.

8 RECOMMENDED RESPONSE ACTION

8.1 INTRODUCTION

The purpose of this chapter is to recommend a response action. This recommendation is based on the evaluation conducted in Chapter 6. The selected response action is the most preferred alternative based on the three factors of effectiveness, implementability, and cost.

8.2 BACKGROUND

The recommended response action alternative for reducing the explosive safety risk to members of the public and ground intrusive workers represents interpretations and conclusions based on results of the TPP process and the ASR. The risk evaluation conducted in Chapter 5 indicated that risk from MEC within the AOC is extremely low. The current land uses in Forest Park and the concerns of City of St. Louis entities with regard to disruption of those current land uses were a factor in recommending a particular response action alternative.

8.3 RECOMMENDED ALTERNATIVE

The recommended response action alternative for the Forest Park site is Alternative 2, Institutional Controls. The controls associated with this alternative include distributing MEC educational/awareness materials to individuals most likely to encounter MEC (ground intrusive workers), and an MOA between USACE and the City of St. Louis mechanism to ensure such distribution occurs. A draft MEC educational/awareness pamphlet is included as Appendix L. This MOA also ensures that if an MEC item is discovered on site, the item will be handled and disposed of safely and appropriately. This alternative is the preferred and recommended response action because it is considered effective, although not as effective as the clearance based alternatives, most implementable, and least costly to execute.

8.4 IMPLEMENTATION OF THE RECURRING REVIEW PLAN

A recurring review team will be established by USACE and this response action will be reviewed at a minimum of every five years. Additionally, a site visit will be performed each year to ensure MEC educational/awareness materials are being distributed appropriately and consistently. The Draft Recurring Review Plan is included as Appendix G.

8.5 EFFECTIVENESS

Alternative 4, Comprehensive Subsurface Clearance with Institutional Controls, has the most favorable score for effectiveness. Alternative 3, Comprehensive Surface Clearance with Institutional Controls, is considered the second most effective alternative. Alternative 3, Institutional Controls, is considered the least effective of the three alternatives. However, based

on the low probability of encountering MEC on the surface, Alternative 3 is considered effective in reducing the limited explosive risk that exists within the AOC.

8.6 IMPLEMENTABILITY

Alternative 2, Institutional Controls, has the most favorable score for implementability. Alternative 3, Comprehensive Surface Clearance with Institutional Controls, is ranked second for this criterion, and Alternative 4, Comprehensive Subsurface Clearance with Institutional Controls, is considered the least implementable alternative.

8.7 COST

The cost associated with this alternative is approximately $15,000 for the first year and $6,000 for subsequent years. First year costs include task management and development of bilingual educational/awareness materials regarding MEC. These costs are one time costs and would not exist for out years. Costs after year one would only include a production run of the informational materials and a site visit to distribute the materials. These costs, broken down into Response Design (RD), Response Action (RA), and Long-Term Management (LTM) costs, are included as Table 8-1. Further details regarding the costs of Alternative 2 are included in Appendix E.

Table 8-1: Institutional Controls - Costs

Cost Category	Cost
Response Design (RD)	$9,000
Response Action (RA)	$6,000
Long –Term Management (LTM)*	$6,000
Total	$21,000

* Long-Term Management costs are one year of production of educational/awareness materials and site visit to distribute materials. Recurring Review Team and stakeholders will determine how long these costs continue.

9 QUALITY CONTROL (QC)

No fieldwork is being conducted as part of this EE/CA Report. Quality Control (QC) discussions below address document QC only.

9.1 QC METHODS USED

A QC Team was established at USACE, Omaha District, to provide QC review and comment on the Forest Park EE/CA Report. Pre-Draft copies of the report were provided to individual reviewers. Comments provided by the QC Team were tracked and incorporated into the Draft document. All comments were tracked on an internal comment tracking form. Any changes to the Pre-Draft document as a result of comments were also tracked on the form. If the comment did not result in a change to the document, an explanation was provided on the comment tracking form. After the QC review, comment tracking forms and copies of the Draft EE/CA Report were provided to the QC Team for back check regarding comment incorporation. The comment tracking forms are internal and are not included as part of the final document.

9.2 QC RESULTS

QC was conducted as described in the Section 9.1 of this EE/CA Report.

9.3 LESSONS LEARNED

Lessons Learned will be described in the Final EE/CA Report document.

10REFERENCES

10 USC 2701, *Defense Environmental Restoration Program*

16 USC 1531-1544; 50 CFR 17, 401-424, 450-453 *Endangered Species Act*

16 USC 470; 36, CFR 60, 63, 68, 800; Executive Order 11593. *National Historic Preservation Act.*

29 CFR 1910. *Occupational Safety and Health Administration (OSHA) General Industry Standards*

29 CFR 1926. *Construction Industry Standards*

40 CFR 300. *National Oil and Hazardous Substance Contingency Plan*

EPA (U.S. Environmental Protection Agency) 1992. *Guidance on Implementation of Superfund Accelerated Cleanup Model (SACM) under CERLA and NCP*, OSWER Publication 9203-1-03, PB93-963252.

EPA *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA*, EPA/540-R-93-057

DOD (U.S. Department of Defense). *DoD Ammunition and Explosive Safety Standards*, DOD 6055.9 Std.

DOD Directive 1000.3. *Safety and Occupational Health Policy for the Department of Defense*

USACE (U.S. Army Corps of Engineers) 2003. *Safety and Health Requirements Manual*, EM 385-1-1

USACE. *Technical Project Planning (TPP) Process*, Engineer Manual, EM 200-1-2

USACE. *Public Participation in the Defense Environmental Restoration Program (DERP) for Formerly Used Defense Sites (FUDS)*, Engineer Pamphlet, EP 1110-3-8

USACE. *Ordnance and Explosives Response*, EP 1110-1-4009

USACE. *Ordnance and Explosives Response*, EP 1110-1-18

USACE. *Establishing and Maintaining Institutional Controls for OE Projects,* EP 1110-1-24

USACE. *Unexploded Ordnance Support During Toxic and Radioactive Waste and Construction Activities,* EP 75-1-2

USACE. *Basic Safety Concepts and Considerations for Ordnance and Explosive Operations,* EP 385-1-95a

USACE. *Explosive Safety Submissions,* EP 385-1-95b

USACE. *OE Risk Impact Assessment for OE EE/CA Evaluations,* IGD 01-01

USACE. *Implementation of Technical Project Planning (TPP) for Ordnance and Explosives (OE) Formerly Used Defense Sites (FUDS) Projects*, IGD 01-02

USACE (1997), *Archive Search Report, Findings, Forest Park Recreation Camp, St. Louis, MO,* September, 1997

USACE (1995), *DERP-FUDS, Inventory Project Report, Forest Park Recreation Camp, St. Louis, MO,* June 5, 1995

TM 9-1904, *Ammunition Inspection Guide*, March 1944, *Hand Book of the 3-inch Stokes Trench Mortar*, Jul 1921

10.1 APPLICABLE DATA ITEM DESCRIPTIONS:

DID OE-001.01 Type I Work Plan
DID OE-005-02.01 Technical Management Plan
DID OE-005-03.01 Explosives Management Plan
DID OE-005-06.01 Site Safety and Health Plan
DID OE-005-07.01 Location Surveys and Mapping Plan
DID OE-005-08.01 Work, Data, and Cost Management Plan
DID OE-005-09.01 Property Management Plan
DID OE-005-10.01 Sampling and Analysis Plan
DID OE-005-11.01 Quality Control Plan
DID OE-005-12.01 Environmental Protection Plan
DID OE-010.01 Engineering Evaluation/Cost Analysis (EE/CA) Report
DID OE-015.01 Accident/Incident Reports
DID OE-025.01 Personnel and Work Standards
DID OE-030.01 Site Specific Final Report
DID OE-040.01 Disposal Feasibility Report
DID OE-045.01 Report/Minutes, Record of Meetings
DID OE-055.01 Telephone Conversations/ Correspondence Records
DID OE-060.01 Conventional Explosives Safety Submissions (ESS)
DID OE-080.01 Monthly Status Report
DID OE-085.01 Weekly Status Report
DID OE-100 Analysis of Institutional Controls
DID OE-110.01 Recurring Review Plan

APPENDIX A

SCOPE OF WORK

Scope of work included as part of Appendix H: Final EE/CA Work Plan.

APPENDIX B

SCRAP DISPOSITION DOCUMENTATION

Scrap Disposition documentation is not required for this EE/CA report.

APPENDIX C

DEMO ACTIVITY SUMMATION TABLES

Demo Activity Summation Tables are not required for this EE/CA Report.

APPENDIX D

INSTITUTIONAL ANALYSIS REPORT

DRAFT

INSTITUTIONAL ANALYSIS REPORT

FOREST PARK

St. Louis, Missouri

Prepared by

U.S. ARMY CORPS OF ENGINEERS
OMAHA DISTRICT

April 2004

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Figure 4-1: Institutional Controls

1. INTRODUCTION

This Institutional Analysis Report has been prepared to demonstrate what opportunities exist to implement an Institutional Control (IC) program at the Forest Park site. This report also identifies any local, state, federal, or private agencies available to assist in the implementation or maintenance of the IC program. This information supports the development of IC options for the alternatives addressed in Chapter 6 of the EE/CA.

ICs are a component of MEC removal actions intended to mitigate or reduce potential residual risk remaining in lieu of, or in addition to, MEC removal actions. ICs include:

- Legal Mechanisms
- Physical Controls
- Education and Notification Programs

1.1 LEGAL MECHANISMS

Legal mechanisms to implement ICs include restrictive covenants, negative easements, equitable servitude, and deed notices. Administrative mechanisms are related to legal mechanisms and include notices, adopted local land use plans and ordinances, construction permitting, and other land use management systems that ensure compliance with use restrictions.

1.2 PHYSICAL CONTROLS

Physical controls include fences, barriers, and signs. Fences and barriers reduce, limit, or restrict access and possible exposure to MEC, while signs alert individuals to the former use and attendant dangers at the site.

1.3 EDUCATION AND NOTIFICATION PROGRAMS

Education and notification programs are designed normally as an integral part of ICs. Educational programs are intended to inform the public about the ICs, how to identify hazards, and what to do if hazards are discovered.

2. INSTITUTIONAL SUMMARIES

Basic information is needed to determine the jurisdiction, authority, mission, capability, and desire of institutions (i.e., government and private agencies) to implement, maintain, monitor, and enforce ICs. The following discussion presents the major elements needed to analyze the institutions needed to implement, maintain, monitor, and enforce institutional controls at the Forest Park site.

2.1 JURISDICTION

The first major element considered in the institutional analysis is the jurisdiction, or territorial range of authority, of the institution. The geographic jurisdiction refers to the area within the site that an institution has legal authority or jurisdiction over based on political boundaries or ownership.

2.2 AUTHORITY

The second major element in the institutional analysis is the authority of the agencies with jurisdiction. The following questions are considered in determining authority (USACE, 2000b):

- What are the limits of the agency's authority?
- What is the origin of the agency's authority?
- How much control is exercised by the agency?
- Does the agency have enforcement authority?

2.3 MISSION

The third major element in the institutional analysis is determining if, and how, the mission of the agency applies to ICs. The specific mission of the agency is critical to its ability to implement, enforce, or maintain an IC program. The two most critical missions for ICs are public safety and land use control. If the U.S. Army Corps of Engineers (USACE) identifies agencies with these missions, there is reasonable potential that a cooperative IC program can be implemented.

2.4 IMPLEMENTATION

Finally, an institution cannot be an effective member of an institutional control program if the organization does not have the capability or desire to implement the program. Funding augmentation will be needed to enhance the capability of some local institutions.

2.4.1 Local Institution Participation

Support and action by local institutions are critical; therefore, federal institutions must encourage local agencies to participate. If local officials are convinced that participation in an IC program is in their best interests, USACE will have little difficulty in obtaining participation. Resources in the form of funding for the agency's implementation costs can overcome the initial hesitancy of an organization to become involved.

2.4.2 Ability to Partner With Other Agencies

The ability of an organization to work within existing or potential relationships with other government agencies can influence its effectiveness in implementing ICs.

3. SELECTION OF INSTITUTIONS

USACE selected institutions for consideration without imposition of limits or bias. The selection process reflected the inclusion of landowners, local, county, and state agencies. The following institutions were identified for evaluation:

- USACE (Table 3-1)
- U.S. Environmental Protection Agency (EPA) (Table 3-2)
- Missouri Department of Natural Resources (DNR) (Table 3-3)
- St. Louis Department of Parks, Recreation and Forestry Department (Table 3-4)

3.1 USACE

3.1.1 USACE was established in 1775 under the Continental Congress for military and civil works missions. As commander of USACE, the Chief of Engineers leads a major Army command that is the world's largest public engineering, design and construction management agency. The Chief of Engineer's office defines policy and guidance and plans direction for the organizations within the Corps. The Corps is organized geographically into eight divisions in the United States and 41 subordinate districts throughout the United States, Asia, and Europe, which oversee project offices throughout the world. Divisions and districts are defined by watershed boundaries, not by states.

3.1.2 The Defense Environmental Restoration Program (DERP) was established by Section 211 of the Superfund Amendments and Reauthorization Act (SARA) of 1986. SARA §211 was codified in Title 10 of the United States Code (USC) §2701. The scope of the DERP is defined in 10 USC §2701(b), which states that the: "Goals of the program shall include the following: (1) The identification, investigation, research and development, and cleanup of contamination from hazardous substances, and pollutants and contaminants. (2) Correction of other environmental damage (such as detection and disposal of unexploded ordnance) which creates an imminent and substantial endangerment to the public health or welfare or to the environment. (3) Demolition and removal of unsafe buildings and structures, including buildings and structures of the Department of Defense at sites formerly used by or under the jurisdiction of the Secretary."

3.1.3 The demolition and removal of unsafe buildings and structures is not subject to CERCLA unless it involves the need for, or is an integral part of, a response action to address a CERCLA hazardous substance, or a CERCLA pollutant and contaminant that poses an imminent threat to public health or welfare or the environment.

3.1.4 Execution of the FUDS program had been delegated by DoD, through the Headquarters of the Army, to the USACE. The delegation made USACE the chief executor for environmental restoration activities at FUDS, and responsibility at individual sites delegated to the project manager in the geographic district in which the site exists. Forest Park is located in the lower Missouri River drainage basin and is the Kansas City District area.

3.1.5 Environmental restoration requirements are programmed as part of DoD's Planning, Programming, Budgeting, and Execution System. Funds appropriated to environmental restoration accounts including FUDS are fenced, and may only be obligated or expended for environmental restoration functions. Such funds are not available to pay the DoD share of a court judgment or compromise settlements. Such expenses are provided through compromise settlements executed by the Department of Justice (DOJ) pursuant to DOJ's compromise settlement authority.

3.1.6 Sources of information are: U.S. Army Corps of Engineers, www.usace.army.mil; and Management Guidance for the Defense Environmental Restoration Program, https://www.denix.osd.mil/denix/Public/ES-Programs/Cleanup/guida.html; and EC-200-3-7 Official Interim Version Defense Environmental Restoration Program Formerly Used Defense Sites (DERP-FUDS) Program Manual, http://www.nwd.usace.army.mil/pm/derp/fmhome.htm

Table 3-1: Institutional Analysis: USACE

Institutional Analysis Element	Summary
Origin of Institution	Established in 1775 under the Continental Congress for military and civil works missions
Basis of Authority	DERP (USC. Section 2701 et seq.); Executive Order 12580
Authority Limits	Implementing response actions for releases of hazardous substances from each facility that is, or was, under the jurisdiction of the DoD in accordance with DERP and consistent with CERCLA
Amount of Control	Minimal control relative to implementing, maintaining, monitoring, or enforcing institutional controls on non-Federally owned property
Enforcement Authority	Not related to institutional controls at Forest Park
Sunset Provisions	Not applicable
Geographic Jurisdiction	Organized geographically into 8 divisions in the US and 41 subordinate districts throughout the U.S., Asia, and Europe. The districts oversee project offices throughout the world. Divisions and districts are defined by watershed boundaries, not by states. The Forest Park is located in the lower Missouri River watershed in the jurisdiction of Kansas City District of the Northwestern Division of USACE.
Public Safety Function	Mission statement of MEC Mandatory Center of Expertise (MCX) and Design Center: "To safely eliminate or reduce risks from ordnance, explosives and recovered chemical warfare material at current or FUDS."

Institutional Analysis Element	Summary
Land Use Controls	Not an agency mission for private property, although they can perform real estate services for the military and civil works activities of the Army and Air Force, and for other federal agencies as requested
Financial Capability	Defense Environmental Restoration Account (DERA) for environmental restoration activities at non-National Priorities List (NPL) sites, such as Forest Park. DoD and State Memorandum of Agreement (DSMOA) to fund states in identifying, prioritizing, investigating, and remediating FUDS sites in their states
Mission	USACE is a major Army command that provides engineering, design, and construction management services to FUDS sites
Desire to Participate in IC Program	USACE is the lead agency for investigating FUDS and has the resolve to implement ICs as evidenced by this EE/CA and related activities
Constraints to Institutional Effectiveness	Has responsibility, but not local authority, for implementing, maintaining, monitoring, and enforcing ICs

3.2 EPA

3.2.1 In July of 1970, the White House and Congress established the EPA in response to the growing public demand for cleaner water, air, and land. Prior to the establishment of the EPA, the federal government was not structured to make a coordinated attack on the pollutants that harm human health and degrade the environment. The EPA was created to permit coordinated and effective governmental action on behalf of the environment. The EPA was assigned the task of repairing damage already done to the natural environment and establishing new criteria to create a cleaner environment. The EPA endeavors to abate and control pollution systematically, by proper integration of a variety of research, monitoring, standard setting, and enforcement activities. As a complement to its other activities, the EPA coordinates and supports research and anti-pollution activities by state and local governments, private and public groups, individuals, and educational institutions. The EPA also reinforces efforts among other federal agencies with respect to the impact of their operations on the environment. The EPA is specifically charged with making public its written comments on environmental impact statements and with publishing its determinations when a proposal is unsatisfactory from the standpoint of public health, welfare, or environmental quality. The EPA is designed to serve as the public's advocate for a livable environment

3.2.2 Regional Administrators are responsible, within the boundaries of their regions, for the execution of the programs of the EPA and such other responsibilities as may be assigned. Regional Administrators cooperate with federal, state, interstate, and local agencies, industry, and academic institutions, and other private groups to make sure regional needs are considered and federal environmental laws are implemented. Regional Administrators are responsible for

developing, proposing, and implementing regional programs for comprehensive and integrated environmental protection activities; conducting effective regional enforcement and compliance programs; translating technical program direction and evaluation provided by various Assistant Administrators, Associate Administrators and Heads of Headquarters Staff Offices into effective operating programs at the Regional level and assuring that such programs are executed efficiently; exercising approval authority for proposed State standards and implementation plans; and providing overall and specific evaluations of regional programs. The EPA maintains ten regional offices that are based on state boundaries.

3.2.3 EPA works to develop and enforce regulations that implement environmental laws enacted by Congress. The EPA is responsible for researching and setting national standards for a variety of environmental programs, and delegates to states and tribes the responsibility for issuing permits and for monitoring and enforcing compliance. Where national standards are not met, EPA can issue sanctions and take other steps to assist the states and tribes in reaching the desired levels of environmental quality.

3.2.4 CERCLA, commonly known as Superfund, was enacted by Congress on 11 December 11 1980. This law created a tax on the chemical and petroleum industries and provided broad Federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. CERCLA established prohibitions and requirements concerning closed and abandoned hazardous waste sites, provided for liability of persons responsible for releases of hazardous waste at these sites, and established a trust fund to provide for cleanup when no responsible party could be identified.

3.2.5 CERCLA was amended by the Superfund Amendments and Reauthorization Act (SARA) on 17 October 1986. SARA reflected the EPA's experience in administering the complex Superfund program during its first six years, and made several important changes and additions to the program. SARA stressed the importance of permanent remedies and innovative treatment technologies in cleaning up hazardous waste sites; required Superfund actions to consider the standards and requirements found in other State and Federal environmental laws and regulations; provided new enforcement authorities and settlement tools; increased State involvement in every phase of the Superfund program; increased the focus on human health problems posed by hazardous waste sites; encouraged greater citizen participation in making decisions on how sites should be cleaned up; and increased the size of the trust fund to $8.5 billion.

3.2.6 Sources of information: U.S. EPA, http://www.epa.gov/epahome/aboutepa.htm; EPA Region 7, www.epa.gov/region7/

Table 3-2: Institutional Analysis: EPA

Institutional Analysis Element	Summary
Origin of Institution	Established in 1970 by the White House and Congress to protect human health and the environment

Institutional Analysis Element	Summary
Basis of Authority	CERCLA *Code of Federal Regulations*, Title 40: "Protection of the Environment," Chapter I, Parts 1–799 – Environmental Protection Agency
Authority Limits	Protection of human health and the environment
Amount of Control	Control is a function of the Administrative Orders issued
Enforcement Authority	May issue Administrative and Compliance Orders to enforce CERCLA
Sunset Provisions	None
Geographic Jurisdiction	EPA Region 7 has jurisdiction in Missouri, Kansas, Nebraska, and Iowa
Public Safety Function	Regulates other federal agencies, state and local governments, and private interests and develops and enforces regulations to protect human health and the environment under existing environmental laws
Land Use Controls	Provides regulatory oversight of the cleanup of MEC
Financial Capability	DERA for environmental restoration activities at non-National Priorities List (NPL) sites, such as Forest Park
Mission	To protect human health and the environment by administering federal laws and regulations
Desire to Participate in IC Program	Has delegated oversight authority to the TCEQ (formerly TNRCC).
Constraints to Institutional Effectiveness	Has responsibility, but not local authority, for implementing, maintaining, monitoring, and enforcing ICs at Forest Park.

3.3 MISSOURI DNR

3.3.1 The Missouri DNR is an agency of the state government responsible for protecting human health and the environment from threats posed by hazardous waste. The DNR Director is appointed by and reports to the governor of the state of Missouri. The DNR administers several divisions and programs including Air and Land Protection, Environmental Improvement and Energy Resources Authority, the Geological Surveys and Resource Assessment Division, and the Water Protection and Soil Conservation Division. Oversight of this EE/CA is the jurisdiction of the Hazardous Waste Program of the Air and Land Protection Division.

3.3.2 The goal of the Hazardous Waste Program is to protect human health and the environment from threats posed by hazardous waste. To accomplish this goal, the program encourages the reduction of hazardous waste generation; regulates the management of hazardous waste; oversees the cleanup of contamination; promotes property reuse; and regulates the management, removal, and cleanup of petroleum storage tanks in the state. The Hazardous Waste Program consists of eight sections. Oversight of the Forest Park EE/CA is provided by the Federal Facilities Section. This Hazardous Waste Program has RCRA enforcement and regulation authority in the state of Missouri.

3.3.3 The Hazardous Waste Program assists the Missouri Hazardous Waste Management Commission, which was established by state statute. The governor appoints the commission's seven members who each serve a four-year term. By state law, interests in agriculture, the hazardous waste management industry, and the hazardous waste generation industry must be represented on the commission. Members are representative of the general interest of the public and shall have an interest in and knowledge of waste management and the effects of improper waste management on the health and the environment.

Table 3-3: Institutional Analysis: Missouri DNR

Institutional Analysis Element	Summary
Origin of Institution	State of Missouri
Basis of Authority	Sections 260.365, 260.370, and 260.400, RSMo 2000
Authority Limits	Rule making must be approved by Missouri General Assembly
Amount of Control	State Equivalent of EPA
Enforcement Authority	Administers EPA RCRA/non-RCRA programs in Missouri. Enforcement arm can issue binding orders/judgments. Code of State Regulations Title 10 Division 25 (10 CSR 25)
Sunset Provisions	None
Geographic Jurisdiction	Missouri state border
Public Safety Function	Site Inspection and Emergency Response capability only
Land Use Controls	Not applicable
Financial Capability	Publicly funded
Mission	The goal of the Hazardous Waste Program is to protect human health and the environment from threats posed by hazardous waste
Desire to Participate in Institutional Control Program	Participation will be dependant on conclusions from EE/CA.
Ability to Partner With Other Agencies	Participation will be dependant on conclusions from EE/CA.
Constraints to Institutional Effectiveness	Participation will be dependant on conclusions from EE/CA.

3.4 ST. LOUIS DEPARTMENT OF PARK, RECREATION AND FORESTRY

3.4.1 The Charter of the City of St. Louis was adopted by the vote of the citizens on 30 June 1914. The Charter can only be changed by a vote of the people. Since 1914, various parts of the Charter have been changed. The Charter is the constitution of the City of St. Louis and the plan for the government of the city.

3.4.2 The municipal government fills the roles of both city and county in St. Louis, which is administratively independent of any county. Like many cities, St. Louis has a mayor and board of aldermen, all elected for four-year terms. In addition, the city, like Missouri counties, has a sheriff, treasurer, and prosecuting attorney, all of whom are elected to office. The mayor, comptroller, and president of the board of aldermen are all elected at large. The remaining 28 aldermen are elected in their home districts. Citizens of St. Louis elect several other city officers including the Recorder of Deeds. Missouri statute requires the Recorders to preserve and provide public access to public records affecting title to real estate, issuance of marriage license and other legal matters.

3.4.3 The law making body of the City of St. Louis is the Board of Aldermen. There are 28 aldermen, one from each ward in the city, and a president. The Board of Aldermen meets every Friday except during summer recess and on holidays. At these sessions, the Aldermen present the First Readings of a resolution or new board bill and discuss issues raised in these pending bills. After a bill is adopted by the Board of Aldermen and signed by the mayor, it becomes a City Ordinance. Forest Park is located entirely within Ward 28. The Ward 28 Alderwoman is the Honorable Lyda Krewson.

3.4.4 The Revised Code of the City of St. Louis is a compilation of ordinances that are generally enforceable throughout the city. Ordinances that are compiled in the Code are organized according to topic (i.e. Personnel, Administration, Health and Hospitals, etc). Ordinances related to neighborhood redevelopment projects, traffic regulations and street closings do not appear in the Code.

3.4.5 The city Mayor, currently the Honorable Francis G. Slay, appoints the officers of several departments to serve as the Board of Public Service. These include the Director of the Department of Parks, Recreation, and Forestry, and the Director of Public Safety. Samuel Simon is the Director of Public Safety, whose mission is to safeguard the city's state of well being, protect lives and property, and ensure the complete safety of the people who live in the city, and the one million people who work, traverse, and visit the City of St. Louis daily. Daniel W. Skillman is the Commissioner of the Parks Division of the Department of Parks, Recreation, and Forestry and reports to Gary D. Bess, the department director.

3.4.6 In December 1993, the city convened the three-day Forest Park Summit, where hundreds of St. Louis residents expressed their visions of Forest Park. This summit gave birth to a two-phase planning process, including extensive public participation at hundreds of public meetings and the formation of a Forest Park Planning Committee, comprised of park users, special interest groups, institutional representatives, and city officials.

3.4.7 The process was supported by 20 technical experts and consultants directed by the city's urban design director. To insure a plan was accepted, it was essential to listen to public comment and develop a plan that would maintain the balance of existing park uses, repair decaying infrastructure, and improve neglected natural systems. The planning process included 25 public meetings to gather input and ideas from park users and area residents; an additional 100 meetings with various community, park user, and neighborhood groups; citizen involvement in the planning process, led by the 67 member Forest Park Master Plan Committee which met 20 times. A Forest Park Executive Committee met more than 50 times.

3.4.8 The final Forest Park Master Plan was drafted and approved by the Board of Aldermen. Estimating a cost of $86 million, the plan was to be implemented by 2004, the anniversary of the 1904 World's Fair.

3.4.9 The Forest Park Master Plan represents the latest technology and responsible ecology, yet is realistic, attainable and is rooted in community consensus. Costs for implementing the Forest Park Master Plan are shared between City of St. Louis public funds and private funds from corporations and foundations raised by Forest Park Forever, a private, not-for-profit organization. Funding as of 28 February 2003, shows $55.7 million raised by the City of St. Louis and $46.9 million raised by Forest Park Forever for a total of $102.6 million, the largest amount of money ever raised by a public/private partnership for an urban park renovation anywhere in the country.

3.4.10 The Forest Park Advisory Board, appointed by the mayor, monitors and provides community input and oversight of the Master Plan. The board consists of 25 members chaired by Jean L. Cowell and reports to the Director of Parks, Recreation and Forestry of the City of St. Louis. The members of the board represent community groups, park institutions, park users, plus people with expertise in landscape and urban design, and environmental issues.

Table 3-4: St. Louis Department of Parks, Recreation, and Forestry

Institutional Analysis Element	Summary
Origin of Institution	St. Louis Charter of 1914
Basis of Authority	St. Louis Charter of 1914
Authority Limits	St. Louis city limits
Amount of Control	City government actions subject to approval of citizens of St. Louis
Enforcement Authority	St. Louis is responsible for, and capable of, enforcing its own ordinances and policies
Sunset Provisions	None
Geographic Jurisdiction	St. Louis city limits
Public Safety Function	Very limited law enforcement capabilities within managed areas, with volunteer law enforcement officers. Supplemented by St. Louis City Police Department.

Institutional Analysis Element	Summary
Land Use Controls	Ultimate control over land owned by St. Louis administered by the Parks, Recreation, and Forestry Department. Land use control functions include decisions regarding development efforts within dedicated park properties
Financial Capability	Yes, public funds and private donations
Mission	To provide a full range of municipal as well as county services to the residents and businesses located within its borders
Desire to Participate in IC Program	Yes
Ability to Partner With Other Agencies	Yes
Constraints to Institutional Effectiveness	Influence limited to city limits and subject to citizen approval

4. INSTITUTIONAL CONTROL ALTERNATIVES SELECTION

4.1 PURPOSE OF STUDY

4.2 INSTITUTIONAL CONTROL OBJECTIVES

IC objectives defined for the Forest Park site include:

- Notifying persons who plan to disturb the land surface or conduct excavation activities of the potential presence of residual MEC before any disturbance occurs, and of safe response actions if MEC is encountered.
- Discouraging inappropriate subsurface excavation.
- Discouraging any change in land use until the current owner/operator or other person using the land is informed of the potential presence of MEC.
- Ensuring occupational and public safety and environmental integrity by providing an acceptable contingency plan outlining proper MEC clearance procedures in the event that residual ordnance is discovered.
- Developing a mutually acceptable MOA between the federal government and entities with the responsibility, resolve, and authority to ensure that the ICs are implemented, maintained, monitored, and enforced.

4.3 METHODOLOGIES

4.3.1 Institutional Control Strategies

4.3.1.1 When deciding which ICs to implement, a few practices can be implemented to ensure effectiveness. One practice that can greatly enhance the endurance and effectiveness of ICs is layering, or combining different types of ICs, rather than just implementing a single IC. This concept will be integrated into the ICs at Forest Park to the degree that it is feasible.

4.3.1.2 The federal government is responsible for ICs, just as it is responsible for addressing MEC. Therefore, either USACE or the EPA must ensure that the ICs are effective for the time that the risk of MEC exposure remains at Forest Park. If USACE or the EPA does not have the authority, they will enter into MOAs with institutions that do have the authority for establishing, implementing, maintaining, monitoring, and enforcing ICs

4.3.1.3 The Missouri DNR is a state authority implementing, monitoring, and enforcing ICs with regard to any confirmed release of MEC-related Contaminants of Concern. In the event that a release of Contaminants of Concern related to MEC is confirmed, the DNR will provide regulatory oversight and any potential ensuing removal actions. Depending upon the nature of the controls that are actually implemented, the DNR could have a significant role in this process.

4.3.1.4 When deciding whether to use ICs as a component of a response, and if so, which ICs to use, three basic factors are important to consider:

- Type of IC
- Existence of an authority to implement the IC
- Appropriate entity's resolve and ability to implement the IC

4.3.1.5 In addition to these considerations, when responses are performed to be consistent with CERCLA, responses should consider the following nine criteria as part of the remedial alternative selection process:

- Overall protection of human health and the environment
- Compliance with applicable legal requirements
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, and volume
- Short-term effectiveness
- Implementability
- Cost
- Regulatory acceptance
- Stakeholder acceptance

4.3.1.6 Each alternative in the detailed analysis in Chapter 6 of the EE/CA is evaluated against these criteria. The most important criteria for ICs at Forest Park are overall protection of human health and the environment, long-term effectiveness and permanence, short-term effectiveness, and implementability. However, with ICs, state and community acceptance are significant components of the overall feasibility of the alternative. These latter evaluation criteria will be evaluated formally following the public comment and review period.

4.3.1.7 USACE intends to drive cleanups to completion with remedies that have regulator concurrence and public acceptance. Stakeholder involvement is needed to achieve these goals. The *National Policy Dialogue on Military Munitions, Final Report* (Keystone Center, 2000) describes communication and stakeholder involvement in munitions decision-making as "...the right thing to do...the smart thing to do...the fiscally responsible thing to do." The report lists the following six basic steps, referred to as the "6 I's" to assist stakeholder involvement:

- Identify potential stakeholders
- Invite stakeholders to participate
- Inform stakeholders of potential actions and decisions
- Involve stakeholder input in decision-making
- Incorporate stakeholder concerns in decision-making
- Implement decisions that incorporate stakeholder concerns

Forest Park is a FUDS site administered by the Department of the Army. FUDS establishes public participation requirements that must be observed when deciding components of environmental response actions at a site. In addition, it is not possible to implement proprietary controls without current landowner consent, cooperation, and action. Furthermore, other entities with the responsibility, authority, and resolve must ensure that effective ICs are implemented, maintained, monitored, and enforced. For these reasons, public participation is not only required, but is a way of establishing the agreements needed for effective ICs.

4.3.2 Institutional Control Options

IC options include any type of physical, legal, or administrative mechanism that restricts the use of, or limits access to, real property to prevent, or reduce, risks to human health and the environment. The evaluation of IC options begins with a determination of the existence of any current deed restrictions, or other types of ICs placed on Forest Park because of some other activity. If such restrictions exist, it will be easier to modify the existing restrictions to address the MEC risk than to implement an entirely new IC.

The following sections present legal, administrative, and engineering control options, as well as some educational/notification programs that could augment the effectiveness of these controls. The different types of ICs are presented in Figure 4-1 and are described in the following sections.

4.3.2.1 Legal Controls

Several legal mechanisms for limiting or restricting access to property are established generally as proprietary controls and governmental controls. Proprietary controls are those established by a private property owner, and governmental controls are those established by local, state, or federal government.

4.3.2.2 Proprietary Controls

4.3.2.2.1 A proprietary control consists of a right or obligation imposed on a piece of land by the owner of the land. The most common types of proprietary controls are easements, covenants, and reversionary interests. Proprietary controls are usually established in the form of a private contractual mechanism contained in a deed or other document transferring the property.

4.3.2.2.2 The only person who can impose an easement, covenant, or reversionary interest on a piece of land is the owner of that land. In order to implement a proprietary control, a private landowner must be willing to burden his/her land with the control. In addition, proprietary controls must be implemented in accordance with state law. However, a proprietary control can be implemented without federal, state, or local governmental involvement. The types of proprietary controls listed on Figure 4-1 include easements, covenants, reversionary interests, statutory controls, and deed restrictions.

4.3.2.3 Government Controls

4.3.2.3.1 ICs can be established by federal, state, and local governmental authorities, as well as by private individuals and landowners. State and local governments, in particular, have a legitimate interest in IC. Traditionally, governments have carried out this function over lands within their jurisdictions using their police power.

4.3.2.3.2 Benefits of governmental controls are that these controls can be placed on land without going through the parcel-by-parcel negotiation and recording required with proprietary controls. Other legal constraints on proprietary controls, such as whether the control runs with the land or whether the control can be transferred, are not encountered with governmental controls. Government controls remain effective until repealed.

4.3.2.3.3 Usually, local or state governments impose governmental controls, so the state or local government must be willing to implement and enforce the controls. The state or local governments also would bear the costs of implementing and enforcing the controls. Other authorization for governmental controls by the federal or state governments can be found in laws and rules authorizing the government to establish ICs. Methods for federal, state, and local governments to establish ICs are described briefly in the following paragraphs. These methods include zoning and planning, regulatory permit programs, advisories and restrictions, and statutory or rule requirements.

4.3.2.3.3.1 Planning and zoning are the most common forms of local IC. With this type of IC, use restrictions are imposed through the local zoning or land use planning authority. Examples of use restrictions are those that limit access and prohibit disturbance of the remedy. Zoning authority does not exist in every jurisdiction. Zoning is governed by state law but implemented at the local level. There is no federal involvement in zoning. Regulation of building construction is a function of zoning. Building restrictions can be imposed by municipal ordinance or by a program that requires approval or requires acquiring a permit for building.

4.3.2.3.3.2 Often, a state authority or a local authority, such as a municipal health department, will issue an advisory on water and well use. In the case of Forest Park, the St. Louis Building Inspections Office could provide an advisory on the site, in response to all building permit applications within the project area. The advisory would include a brief history of Forest Park with respect to its former use and the presence of MEC at the site and procedures to follow if a suspect item is found.

4.3.2.3.3.3 Sometimes a statute will establish a requirement that amounts to an IC, such as the five-year review requirement of CERCLA or the deed notice requirements of the RCRA closure rules. Congress passed CERCLA in 1980 to guide the EPA cleanup of releases of hazardous substances. Congress further authorized DoD to use the CERCLA process to conduct those cleanups for which it is responsible. FUDS program administration is modeled after CERCLA and has similar five-year review requirements for certain site closeouts.

4.3.2.4 Administrative Controls

Administrative activities include the following elements:

- Placement of MEC educational/awareness materials, advisories, and investigative/remedial information in the information repository established to provide information to the public.
- *Consultation Process Among Local Governments or Between Government Agencies.* An example of this control includes establishing agreements that 911 operators notify USACE,

or one of several alternative local Explosive Ordnance Disposal (EOD) support units, when called upon to address MEC encounters at Forest Park.

- *Records.* This administrative activity refers to maintaining legal records related to the implementation of proprietary controls and other project-related information in centrally accessible repositories, such as a library or Geographic Information System (GIS).
- *Notice.* Notice can take many different forms, such as including a statement describing the nature of the hazards and removals that occurred at the site in the property deed. These notices could include proprietary controls already discussed earlier.

4.3.2.5 Physical Controls

Fences and signs can reduce the potential for contact with MEC by limiting access to the property and by alerting individuals to a site's former use and potential dangers. If signs were placed in the park or around as yet undeveloped areas, maintenance and monitoring would be needed.

4.3.2.6 Education and Notification Programs

Educational and notification programs are designed to be an integral component of engineering, access, and ICs. These programs are intended to inform people about the ICs, how to identify hazards that might remain at the site, and what to do if hazards are discovered. Therefore, educational and notification programs at Forest Park will include ensuring that land users are aware of the steps to take once MEC is encountered, as well as steps to take during routine activities to minimize the chance of having an accident. These could include the following activities:

- *Regular Mailings.* A notification pamphlet can be published and distributed on a regular basis to owners/occupants of affected properties until MEC removals are complete.
- *Response to Inquiries.* The Kansas City District Public Affairs Office will serve as the contact point for direct calls from citizens seeking information on the project. The Kansas City District Public Affairs Office, working in conjunction with the District Project Manager, and with assistance from the Omaha District Public Affairs Office, will be responsible for coordinating and directing responses to community inquiries.
- *Special Briefings.* Special project briefings may be given by USACE to local officials to review the project goals and accomplishments. Such meetings may be held at a local public meeting site at a time mutually acceptable to USACE representatives and local officials. If more practicable, USACE may provide a briefing employing a "town meeting" style gathering. These briefings, which provide an informational pool for elected leaders to answer constituent inquiries, will be coordinated through the Kansas City District Public Affairs Office, with technical support provided by USACE, Omaha District, as needed.
- *Public Information Meetings.* Public information meetings can be held to educate the public about the dangers of the MEC that is potentially present at Forest Park.
- *City/Program Participation.* Broadcast radio public service announcements and published newspaper ads and articles will be used to inform the entire community several times a year about Public Information meetings, or other public events, and about work progress.

- *Fact Sheets and Brochures.* As construction projects are initiated under the Forest Park Master Plan, a Contractor Fact Sheet was developed for distribution by USACE, Omaha District. This fact sheet provides a brief site history and procedures to follow if a suspect item is found. Concurrence must be received from the St. Louis Department of Parks, Recreation, and Forestry prior to distribution of the Fact Sheet.

4.4 SELECTED INSTITUTIONAL CONTROL ALTERNATIVES

4.4.1 IC alternatives for Forest Park will include informational signs augmented by education and notification programs. These ICs are intended to prevent or reduce risk to human health and the environment. Chapter 6 of the Forest Park EE/CA includes a detailed analysis of response alternatives, some of which consisted of, or included, ICs. This section presents recommendations for IC alternatives that were evaluated in Chapter 6 against the evaluation criteria of effectiveness, implementability, and cost.

4.4.2 Certain agencies will have larger roles and responsibilities than others and will have different authorities in implementing, maintaining, monitoring, and enforcing ICs at the Forest Park. Roles define the purpose of the organization, responsibilities are those activities for which the organization is held accountable, and authorities are actions the organization can control (e.g., approve/disapprove, issue, arrest). For example, USACE is responsible for implementing effective and enforceable ICs, but does not have enforcement authority over most controls, such as zoning. In this example, USACE must rely on local government, which is responsible and has the authority to enforce zoning.

4.4.3 Normally, ICs are implemented at the local level because the federal government does not have the authority to enforce many of them. In addition, responsibilities required for ICs, while within the authority of local agencies, are not required of them. Consequently, MOAs will be needed to ensure that effective and enforceable ICs are implemented. If services required by the MOAs are already provided for under state or local funding, then the federal government usually is not obligated to fund these services.

4.4.4 A description of the roles, responsibilities, and authorities that each organization will have in implementing, maintaining, monitoring, and enforcing ICs at Forest Park is provided in Tables 3-1 through 3-4 of this document. Each of these organizations would have a role in IC alternatives that might be implemented. Legal controls will be limited to advisories only, because of the absence of existing mechanisms for proprietary controls, and the difficulty in establishing governmental controls over city property.

4.4.5 A combination of educational materials and public notification will be implemented as the IC option. Chapter 6 of the Forest Park EE/CA, Identification and Analysis of Response Action Alternatives, reflects the most viable IC alternatives for the site, given the site conditions and hazards, institutional framework, and acceptability of potential stakeholder. During the alternative identification process, both components of these ICs and the alternative in its entirety were considered in terms of their relevance and appropriateness to the response action objectives.

4.5 RESIDUAL RISK

4.5.1 The primary type of IC would be a combination of educational programs (Figure 4-1). Common concerns throughout the evaluation were the economic burden of imposing ICs on property, including the effect on property value if the property is sold, the aversion to certain controls by stakeholders, and the continuation of ICs when the property is subdivided and transferred, or otherwise conveyed, to another party.

4.5.2 Any of several combinations of ICs could be used to provide adequate notice to protect human health and the environment while USACE is conducting MEC removals at known and suspected MEC sites.

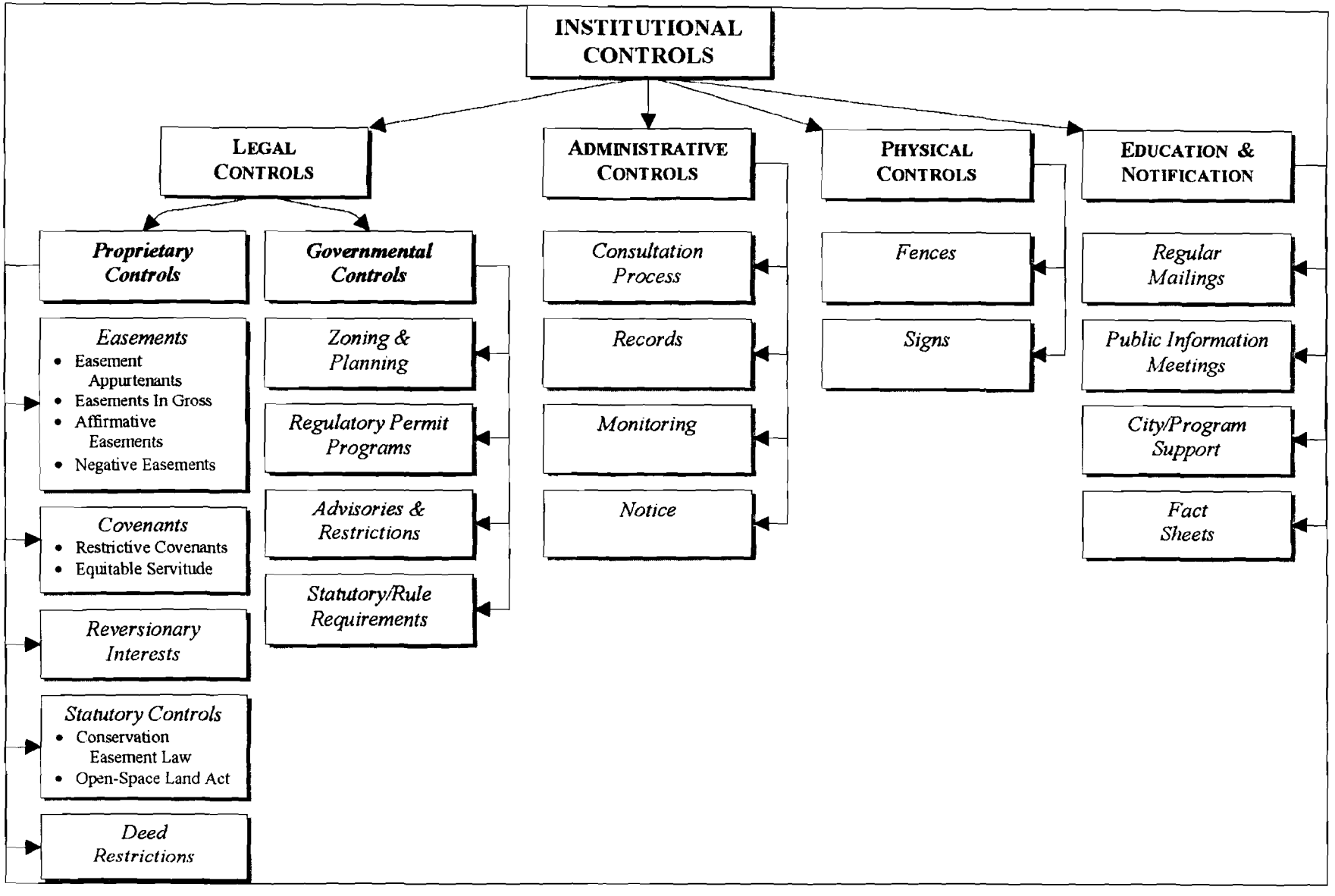

Figure 4-1: Institutional Controls

APPENDIX E

COST BREAKDOWNS AND ASSUMPTIONS

COST BREAKDOWNS AND ASSUMPTIONS, FOREST PARK RECREATION AREA, ST. LOUIS, MISSOURI

1. INTRODUCTION

1.1 The cost breakdowns for response action alternatives evaluated for Forest Park were developed based on costs documented during previous projects of similar scope and magnitude. Additional information was obtained during the Technical Project Planning (TPP) Process. If cost data were not available from a previous project, costs were estimated using best professional judgment and represent rough order of magnitude estimates. Detailed cost breakdowns and assumptions are provided in the subsections that follow. The possible response action alternatives evaluated for Forest Park are:

- No DoD Action Indicated (NDAI)
- Institutional Controls
- Comprehensive Surface Clearance with Institutional Controls
- Comprehensive Subsurface Clearance with Institutional Controls

1.2 Alternative 1, No DoD Action Indicated, did not have any representative costs. As there are no costs associated with this alternative, no cost breakdown is provided.

1.3 Alternative 2, Institutional Controls, assumes a yearly production run of 2,000 MEC warning pamphlets and a site visit to distribute the pamphlets. Costs included below are for one year. The yearly production run and site visit would continue until the Recurring Review Team and stakeholders determine it is no longer required.

1.4 Alternative 3, Comprehensive Surface Clearance with Institutional Controls, assumes 100% accessibility to the entire project area. The project area is approximately 125 acres. Surface clearance costs assume the use of magnetometers to assist the clearance efforts. As the area is currently open park space and a golf course, it is assumed no brush clearance will be required for this effort. Per the land use described above, the assumption was made that limited surface anomalies would exist (1 anomaly per acre). As a result of this assumption, it was estimated that a seven person UXO crew could complete 2.5 acres/day. Temporary relocations of some residents just north of the project area would be required to ensure the safety of residents during clearance and demolition operations. These costs are further detailed in the Alternative 3 cost estimate that follows. Road closures would also be required during demolition operations. No costs for road closures are provided as the assumption was made that the St. Louis Police Department would provide the resources to accomplish such closures. As no MEC detection technology is considered 100% effective, Institutional Controls are included after the clearance action is completed.

1.5 Alternative 4, Comprehensive Subsurface Clearance with Institutional Controls, assumes 100% accessibility to the entire project area. The project area is approximately 125 acres. Subsurface clearance costs assume magnetometers or digital geophysical mapping is employed to detect subsurface anomalies. As the area is currently open space and a golf course, it is assumed no brush clearance will be required for this effort. Additionally, it was assumed that

subsurface anomalies requiring investigation would be ≤ 50 per acre. As a result of this assumption, it was estimated that a seven person UXO crew could complete approximately 0.45 acres/day. Temporary relocations of some residents just north of the project area would be required to ensure the safety of residents during clearance and demolition operations. These costs are further detailed in the Alternative 4 cost estimate that follows. Road closures would also be required during demolition operations. No costs for road closures are provided as the assumption was made that the St. Louis Police Department would provide the resources to accomplish such closures. As no MEC detection technology is considered 100% effective, Institutional Controls are included after the clearance action is completed.

2. ALTERNATIVE 1, NO DoD ACTION INDICATED

There are no actions associated with alternative 1, No DoD Action Indicated (NDAI), and therefore no costs are provided.

3. ALTERNATIVE 2, INSTITUTIONAL CONTROLS

The estimated cost to implement Alternative 2 is $14,924. The implementation costs minus informational pamphlet development costs would continue to be incurred on a yearly basis until the Recurring Review Team and stakeholders determine it is no longer required.

3.1 Assumptions

The cost estimate for Alternative 2 (Table 3-1) includes the following assumptions:

- The development of a bilingual (English and Spanish) informational pamphlet for ground intrusive workers describing MEC hazards at the site would require approximately 80 man-hours to complete.
- Task Management would require approximately 80 man-hours.
- A site visit and pamphlet distribution would require one individual for 8 man-hours.
- One round trip airline ticket from Kansas City, MO to St. Louis, MO and one night at a hotel and one day of per diem would be required.
- Costs for production of 1,000 informational pamphlets would be $2,000.

Table 3-1: Cost Breakdown, Alternative 2, Institutional Controls

Task /Expense	Unit	Rate	Quantity	Cost
Task Management	Man-hours	$80.00	80	$6,400
Informational Pamphlet Development	Man-hours	$70.00	80	$5,600
Site Visit and Distribution	Man-hours	$80.00	8	$640
Airfare – Kansas City, MO to St. Louis, MO	Round trip	$129.00	1	$129
Hotel Stay	Day	$102.00	1	$102
Per Diem	Day	$53.00	1	$53
Produce Informational Pamphlet	Each	$2.00	1000	$2,000
TOTAL				$14,924

4. ALTERNATIVE 3-COMPREHENSIVE SURFACE CLEARANCE WITH INSTITUTIONAL CONTROLS

The estimated cost to implement the clearance component of Alternative 3 is $605,265. The project is estimated to require 50 10-hour workdays. If the UXO team works four 10-hour workdays per week, the duration of the project is expected to be 12.5 weeks. The Institutional Controls component of this alternative is $14,924 as described in Table 3-1.

4.1 Assumptions

The cost estimate for Alternative 3 (Table 4-1) includes the following assumptions:

- No brush clearance is required and the project area is 100% accessible.
- Magnetometers will be used to assist the clearance efforts.
- Limited surface anomalies will exist (1 anomaly per acre).
- No stand-down time (inclement weather, trespassers, city events, etc.) is included in the cost estimate.
- Project documentation development is estimated to take 200 man-hours.
- A Project Manager would require 80 man-hours for oversight of the project.
- Survey of the site and establishment of 100' by 100' grids would require a local 2- person survey team 160 man-hours to complete.
- UXO Safety and Quality Control is a combined position and would require 500 man-hours.
- A Senior UXO Supervisor would oversee a 7-person UXO team conducting the clearance and would require 500 man-hours.
- A 7-person UXO team would require 3500 man-hours to complete the clearance.
- OE Safety Oversight would require 500 man-hours.

- One security guard would be required for 2100 man-hours to provide security for the magazine 24 hours/day for the duration of the project.
- 20 round trip airline tickets from Omaha, NE to St. Louis, MO would be required for the project. These tickets include project mobilization and demobilization and one interim round trip for all project field personnel.
- Rental vehicles would be required for a total of 63 weeks (12.5 weeks x 5 vehicles).
- A total of 875 nights in a hotel would be required to complete the project.
- A total of 875 per diem payments would be required to complete the project.
- A one-time delivery of explosives would be required from a local vendor.
- Rental of an explosive storage magazine and other equipment is provided as a lump sum.
- Residents requested to temporarily relocate from their homes would be offered lodging and food expenses. Total temporary relocation costs are provided as a lump sum estimate. These costs may be higher or lower based on number of temporary relocations required.
- No costs for road closures are provided as it was assumed the St. Louis Police Department would provide the resources for road closures.
- Development of a project report after completion of the project would require 60 man-hours.
- Review of the project report prior to submittal would require 4 man-hours.
- The assumptions associated with the Institutional Controls component of this alternative are detailed in Section 3.1.

Table 4-1: Cost Breakdown, Alternative 3, Comprehensive Surface Clearance with Institutional Controls

Task/Expense	Unit	Rate	Quantity	Cost
Documentation Development (WP, SSHP)	Man-hours	$75.00	200	$15,000
Project Manager	Man-hours	$100.00	80	$8,000
UXO Safety/QC	Man-hours	$80.00	500	$40,000
Senior UXO Supervisor	Man-hours	$85.00	500	$42,500
OE Safety Oversight	Man-hours	$78.00	500	$39,000
UXO Team	Man-hours	$60.00	3500	$210,000
Security Guard (Magazine Security)	Man-hours	$20.00	2100	$42,000
Survey	Man-hours	$65.00	160	$10,400
Airfare – Omaha, NE to St. Louis, MO	Round trip	$200.00	20	$4,000
Rental Vehicles	Week	$300.00	63	$18,900

Task/Expense	Unit	Rate	Quantity	Cost
Hotel Stay	Day	$102.00	875	$89,250
Per Diem	Day	$53.00	875	$46,375
Temporary Relocation of Residents	Lump sum	$20,000.00	1	$20,000
One-time Explosives Delivery	Each	$5,000.00	1	$5,000
Equipment, Supplies and Storage Magazine	Lump sum	$10,000.00	1	$10,000
Project Report	Man-hours	$75.00	60	$4,500
Project Report Review	Man-hours	$85.00	4	$340
Institutional Controls	Lump sum	$14,924.00	1	$14,924
TOTAL				$620,189

5. ALTERNATIVE 4-COMPREHENSIVE SUBSURFACE CLEARANCE WITH INSTITUTIONAL CONTROLS

The estimated cost to implement the clearance component of Alternative 4 is $2,195,930. The project is estimated to require 70 10-hour workdays. If the UXO teams work four 10-hour days per week, the duration of the project is expected to be 17.5 weeks. The Institutional Controls component of this alternative is $14,924 as described in Table 3-1.

5.1 Assumptions

The cost estimates for Alternative 4 (Table 5-1 and 5-2) includes the following assumptions:

Table 5-1: Magnetometer Only

- Four UXO teams will work full time on the project.
- No brush clearance is required and the project area is 100% accessible.
- No digital geophysical work will be conducted. Magnetometers will be used to locate subsurface anomalies.
- Subsurface anomalies will occur at $\leq$50 per acre.
- No stand-down time (inclement weather, trespassers, city events, etc.) is included in the cost estimate.
- Project documentation development is estimated to take 300 man-hours.
- A Project Manager would require 160 man-hours for oversight of the project.
- Survey of the site and establishment of 100' by 100' grids would require a local 2- person survey team 160 man-hours to complete.
- UXO Safety and Quality Control is a combined position and would require 700 man-hours.

- A Senior UXO Supervisor would oversee four 7-person UXO teams conducting the clearance and would require 700 man-hours.
- Four 7-person UXO teams would require 19,600 man-hours to complete the clearance.
- OE Safety Oversight would require 700 man-hours.
- One security guard would be required for 2,940 man-hours to provide security for the magazine 24 hours/day for the duration of the project.
- 93 round trip airline tickets from Omaha, NE to St. Louis, MO would be required for the project. These tickets include project mobilization and demobilization and two interim round trips for all project field personnel.
- Rental vehicles would be required for a total of 140 weeks (17.5 weeks x 8 vehicles).
- A total of 3,798 nights in a hotel would be required to complete the project.
- A total of 3,798 per diem payments would be required to complete the project.
- A one-time delivery of explosives would be required from a local vendor.
- Rental of an explosive storage magazine, two backhoes, and other equipment is provided as a lump sum.
- Residents requested to temporarily relocate from their homes would be offered lodging and food expenses. Total temporary relocation costs are provided as a lump sum estimate. These costs may be higher or lower based on number of temporary relocations required.
- No costs for road closures are provided as it is assumed the St. Louis Police Department would provide the resources for road closures.
- Development of a project report after completion of the project would require 60 man-hours.
- Review of the project report prior to submittal would require 4 man-hours.

Table 5-1: Cost Breakdown, Alternative 4, Comprehensive Subsurface Clearance with Institutional Controls (Magnetometer Only)

Task/Expense	Unit	Rate	Quantity	Cost
Documentation Development (WP, SSHP)	Man-hours	$75.00	300	$22,500
Project Manager	Man-hours	$100.00	160	$16,000
UXO Safety/QC	Man-hours	$80.00	700	$56,000
Senior UXO Supervisor	Man-hours	$85.00	700	$59,500
OE Safety Oversight	Man-hours	$78.00	700	$54,600
UXO Teams	Man-hours	$60.00	19,600	$1,176,000
Security Guard (Magazine Security)	Man-hours	$20.00	2,940	$58,800
Survey	Man-hours	$65.00	160	$10,400

Task/Expense	Unit	Rate	Quantity	Cost
Airfare – Omaha, NE to St. Louis, MO	Round trip	$200.00	93	$18,600
Rental Vehicles	Week	$300.00	140	$42,000
Hotel Stay	Day	$102.00	3,798	$387,396
Per Diem	Day	$53.00	3,798	$201,294
Temporary Relocation of Residents	Lump sum	$40,000	1	$40,000
One-time Explosives Delivery	Each	$5,000.00	1	$5,000
Equipment, Supplies and Storage Magazine	Lump sum	$43,000.00	1	$43,000
Project Report	Man-hours	$75.00	60	$4,500
Project Report Review	Man-hours	$85.00	4	$340
Institutional Controls	Lump sum	$14,924.00	1	$14,924
TOTAL				$2,210,854

Table 5-2: Digital Geophysical Mapping

- No brush clearance is required and the project area is 100% accessible.
- Digital geophysical work will be conducted to detect subsurface anomalies.
- Subsurface anomalies will occur at $\leq$50 per acre.
- No stand-down time (inclement weather, trespassers, city events, etc.) is included in the cost estimate.
- Project documentation development is estimated to take 300 man-hours.
- A Project Manager would require 160 man-hours for oversight of the project.
- Survey of the site and establishment of 100' by 100' grids would require a local 2- person survey team 160 man-hours to complete.
- Costs for Digital Geophysical Mapping are provided on a per acre basis
- One security guard would be required for 1,470 man-hours to provide security for the magazine 24 hours/day for the duration of the project.
- 93 round trip airline tickets from Omaha, NE to St. Louis, MO would be required for the project. These tickets include project mobilization and demobilization and two interim round trips for all project field personnel.
- Rental vehicles would be required for a total of 70 weeks (8.75 weeks x 8 vehicles).
- A total of 1,899 nights in a hotel would be required to complete the project.
- A total of 1,899 per diem payments would be required to complete the project.

- A one-time delivery of explosives would be required from a local vendor.
- Rental of an explosive storage magazine, two backhoes, and other equipment is provided as a lump sum.
- Residents requested to temporarily relocate from their homes would be offered lodging and food expenses. Total temporary relocation costs are provided as a lump sum estimate. These costs may be higher or lower based on number of temporary relocations required.
- No costs for road closures are provided as it is assumed the St. Louis Police Department would provide the resources for road closures.
- Development of a project report after completion of the project would require 60 man-hours.
- Review of the project report prior to submittal would require 4 man-hours.

Table 5-2: Cost Breakdown, Alternative 4, Comprehensive Subsurface Clearance with Institutional Controls (Digital Geophysical Mapping)

Task/Expense	Unit	Rate	Quantity	Cost
Documentation Development (WP, SSHP)	Man-hours	$75.00	300	$22,500
Project Manager	Man-hours	$100.00	160	$16,000
Survey	Man-hours	$65.00	160	$10,400
Geophysical Prove Out and Test Plots	Lump sum	$10,000.00	1	$10,000
Geophysical Investigation	Acres	$3,000.00	125	$375,000
GIS	Lump sum	$10,000.00	1	$10,000
Site Admin and Safety	Man-hours	$75.00	700	$52,500
Security Guard (Magazine Security)	Man-hours	$20.00	1,470	$29,400
Airfare – Omaha, NE to St. Louis, MO	Round trip	$200.00	40	$8,000
Rental Vehicles	Week	$300.00	70	$21,000
Hotel Stay	Day	$102.00	1,899	$193,698
Per Diem	Day	$53.00	1,899	$100,647
Temporary Relocation of Residents	Lump sum	$40,000	1	$40,000
One-time Explosives Delivery	Each	$5,000.00	1	$5,000
Equipment, Supplies and Storage Magazine	Lump sum	$43,000.00	1	$43,000
Project Report	Man-hours	$75.00	60	$4,500

Task/Expense	Unit	Rate	Quantity	Cost
Project Report Review	Man-hours	$85.00	4	$340
Institutional Controls	Lump sum	$14,924.00	1	$14,924
TOTAL				$956,909

APPENDIX F

RESPONSIVENESS SUMMARY

The following comments were received during the Forest Park Draft Final EE/CA public comment period. Responses are also included.

General Comments: The word insure is frequently used in text when ensure seems to be what is meant. Please review definitions and maybe do a "find and replace" if you agree. **Response:** "insure" has been replaced with "ensure" throughout the document.

Specific Comments:

1. Section 5.4.1.4 (Depth Distribution), Page 5-6: Last sentence, "Therefore, ...", is not a justified or logical conclusion based on preceding information in 5.4.1.4. Conclusion must be modified. (See my previous Comment 17, the USACE response, and text noted here.) **Response:** The conclusion has been modified to read: Therefore, MEC that exists at the AOC is not expected on the ground surface. Any MEC that exists at the AOC is expected to be below the ground surface.

2. Section 6.5 (Summary), Page 6-14, Table 6-4: Seems like ranking for Alternative 4 should be a 3 rather than a 2. Please review. **Response:** Ranking for alternative 4 has been changed to 3 instead of 2.

3. Section 4.3.2.4 (Administrative Controls), Page D4-5, First Bullet: Provisions for placing a notice of MEC warning, advisories, and investigative/remedial information the public repository expressly created for this purpose should be included. **Response:** The following bullet has been added: Placement of MEC educational/awareness materials, advisories, and investigative/remedial information in the information repository established to provide information to the public.

4. Section 5 (Stakeholder Identification), Page G-2: It seems stakeholder list should be ordered with respect to awareness of current issues, involvement with, and historic knowledge of the site, perhaps list bomb squad, USACE, MDNR, and then golf course, board of public service, EPA, and art museum(?). This is just a suggestion since there are lots of considerations. **Response:** No change made. Stakeholder list is part of the Recurring Review Plan and all stakeholders will be contacted during Recurring Review.

APPENDIX G

DRAFT RECURRING REVIEW PLAN

DRAFT

RECURRING REVIEW PLAN

FOREST PARK RECREATION AREA
ST. LOUIS, MISSOURI

Prepared by

U.S. Army Corps of Engineers
Omaha District

April 2004

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1. INTRODUCTION

This draft Recurring Review Plan describes the basis for, and the scope of, recurring reviews for the Forest Park Recreation Area. Forest Park is located in the city of St. Louis, Missouri. This plan is included as an appendix to the Engineering Evaluation/Cost Analysis (EE/CA) that is being conducted for the site. Recurring Reviews are intended to determine if a selected response action continues to minimize explosive safety risks and continues to be protective of human health, safety, and the environment. Recurring Reviews also provide an opportunity to assess the applicability of new technology for addressing previous technical impracticability determinations. Recurring Reviews are conducted under the Long Term Management phase once a Formerly Used Defense Site (FUDS) achieves Response Complete. Recurring Reviews satisfy the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) five-year review requirement.

2. SITE DESCRIPTION

2.1 Forest Park, a St. Louis City Park, was established in 1876 and opened its doors to the public on 2 June 1876. In 1904, the western half of the park served as the site of the 1904 World's Fair. After the completion of the fair, most of the buildings and exhibits were demolished and the debris was buried on site. Documented military use of Forest Park began with World War I. During World War II, 17 acres in the southeastern corner of Forest Park was used as a U.S. Army Recreation Camp. Forest Park Recreation Camp was established in 1942 and was abandoned by 1947.

2.2 In May 1988, construction workers installing a sprinkler system on the 3rd fairway of the 9-hole golf course dug up a live 3" White Phosphorus (WP) Stokes mortar. The 50th Explosive Ordnance Disposal Detachment responded to the incident. The round was recovered and disposed. A second Stokes mortar was uncovered during excavation activities in December 2001. The St. Louis Police Department Bomb and Arson Squad responded to the incident. It was later determined that the round contained WP. Two additional Stokes mortars were discovered in May and June 2002. The St. Louis Police Department Bomb and Arson Squad responded to both incidents. In July 2002, a Livens Projector was uncovered during renovation work at the Grand Basin at the foot of Art Hill. The item was subsequently determined to be empty by the St. Louis Police Department Bomb and Arson Squad.

2.3 An EE/CA is being conducted for the site. No previous response actions have occurred at the site.

3. SCHEDULE FOR RECURRING REVIEW

3.1 Recurring Reviews will occur at a minimum of every five years after the signature of the EE/CA Action Memorandum and implementation of the institutional controls recommended. The first review will take place no more than five years after the signature of the EE/CA Action Memorandum. These reviews will continue for at least twenty years after the completion of the first Recurring Review. Subsequent Recurring Reviews will be completed no later than five years after completion of the previous review.

3.2 A site inspection will be conducted once a year during years when a Recurring Review is not being conducted. A site inspection will not require the extensive review of a Recurring Review, but will at a minimum include a site visit and interviews with stakeholders.

4. REVIEW OF EXISTING DOCUMENTATION

The following documents will be reviewed as part of the Recurring Review for the Forest Park site. Most of these documents are available in the Administrative Record that will be maintained by the Kansas City District of the Corps of Engineers. Documents denoted with a star will need to be requested through various stakeholder agencies. This list is not exhaustive and other documents may be reviewed as appropriate.

- Archive Search Report (ASR)
- Inventory Project Report (INPR)
- Engineering Evaluation/Cost Analysis (EE/CA) Report
- EE/CA Action Memorandum
- Memorandum of Agreement (MOA) between the City of St. Louis and the U.S. Army Corps of Engineers
- Institutional Analysis Report
- Explosive Safety Submission(s)
- Previously conducted Recurring Review, if applicable
- Newspaper Records*
- Incident Reports*

5. STAKEHOLDER NOTIFICATION

The following table lists the primary stakeholders and associated contact information for the Forest Park site. All stakeholders listed were reached by phone and were accessible for interviews.

Stakeholder	Contact Information
Missouri Department of Natural Resources Attn: Mark Ort	Hazardous Waste Program P.O. Box 176 Jefferson City, MO 65102 573-751-1968
U.S. Environmental Protection Agency Attn: Diana Bailey	EPA Region VII 901 North 5th St. Kansas City, MO 66101 913-551-7717
Board of Public Service City of St. Louis Attn: Roger Allison, Chief Design Engineer	City Hall, Room 301 1200 Market Street St. Louis, MO 63103 314-622-3535

Stakeholder	Contact Information
St. Louis Art Museum Attn: Dan Esarey, Building Operations Manager	Forest Park 1 Fine Arts Drive St. Louis, MO 63110 314-655-5240
Forest Park Golf Course Attn: Jeff Raffelson	Norman K. Probstein Community Golf Course 6141 Lagoon Drive St. Louis, MO 63112 314-367-1337
St. Louis Police Department Bomb and Arson Section Attn: Stephen Sorocko	1200 Market Street St. Louis, MO 63103 314-591-4202
U.S. Army Corps of Engineers, Kansas City District Attn: Josephine Newton-Lund	601 E. 12th St. Kansas City, MO 64106-2896 816-983-3912

6. IDENTIFICATION/REVIEW OF NEW INFORMATION AND CURRENT SITE CONDITIONS

The stakeholders listed in Section 5.0 are the primary sources available to provide new information and current site conditions. All are involved in the management of Forest Park on at least a periodic basis, and some are involved on a daily basis. The Recurring Review Team will be responsible for identifying readily available information regarding the site that has become available since implementation of the response action or since the last Recurring Review. The Recurring Review Team is also responsible for identifying the current site conditions.

7. PRELIMINARY SITE ANALYSIS AND WORK PLAN

The Recurring Review Team will prepare a preliminary site analysis based upon the review of existing and new information. This analysis will identify any additional information that is required in order to prepare the final site analysis. The Recurring Review Team will prepare a work plan to identify procedures to be used in collecting the additional information identified during the preliminary site analysis.

8. SITE VISIT

The Site Visit will include at a minimum the following activities:

- Site Inspection of Area of Concern
- Interviews with primary stakeholders
- Reviews of any police incident reports regarding military munitions in Forest Park
- Investigation of archives at Missouri Historical Society

9. RECURRING REVIEW REPORT

The Recurring Review Team will prepare a Recurring Review Report to document the information collected and evaluated, and present the findings of the evaluation of the continued protectiveness of the response action. The report will document whether the response action that was implemented continues to minimize explosive safety risks, is still protective of human health, safety, and the environment, and/or recommend follow-up actions, if required.

10. TERMINATION OF THE RECURRING REVIEW

Recurring Reviews are currently planned to continue for at least twenty years after completion of the initial Recurring Review. The Recurring Review Team, in coordination with the stakeholders and regulators, will ultimately determine the duration for continuing Recurring Reviews at Forest Park. The Recurring Review Team will develop a strategy and rationale to clearly demonstrate when Recurring Reviews would be terminated. U.S. Army Corps of Engineers EP 75-1-4 provides further information on the termination of Recurring Reviews.

APPENDIX H

FINAL EE/CA WORK PLAN

FINAL WORK PLAN
FOR
FOREST PARK EE/CA

25 MAR 2004

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ACRONYMS

ASR	Archive Search Report
CENWK	U.S. Army Corps of Engineers, Kansas City District
CENWO	U.S. Army Corps of Engineers, Omaha District
CERCLA	Comprehensive Emergency Response, Compensation, and Liability Act
DERP	Defense Environmental Restoration Program
DID	Data Item Description
DoD	Department of Defense
DOQQs	Digital Orthographic Quarter Quadrangles
DQOs	Data Quality Objectives
EE/CA	Engineering Evaluation/Cost Analysis
EP	Engineering Pamphlet
EPA	Environmental Protection Agency
EPP	Environmental Protection Plan
FUDS	Formerly Used Defense Site
GIS	Geographic Information System
HTRW	Hazardous, Toxic, and Radioactive Waste
INPR	Inventory Project Report
LTO	Lead Technical Officer
MEC	Munitions and Explosives of Concern
NCP	National Contingency Plan
NDAI	No Department of Defense Action Indicated
OE	Ordnance and Explosives
OERIA	Ordnance and Explosives Risk Impact Assessment
OSWER	Office of Solid Waste and Emergency Response
PAO	Public Affairs Office
PDT	Project Delivery Team
PM	Project Manager
POC	Point of Contact
QC	Quality Control
RCWM	Recovered Chemical Warfare Material
SACM	Superfund Accelerated Cleanup Model

SSHP	Site Safety and Health Plan
SOW	Statement of Work
TCRA	Time Critical Removal Action
TPP	Technical Project Planning
USACE	U.S. Army Corps of Engineers
UTM	Universal Trans Mercator
UXO	Unexploded Ordnance

1.0 INTRODUCTION

1.1 PROJECT AUTHORIZATION

1.1.1 In 1986, Congress established the Defense Environmental Restoration Program (DERP) at 10 U.S.C. 2701 et.seq. This program directed the Secretary of Defense to "carry out a program of environmental restoration at facilities under the jurisdiction of the Secretary."

1.1.2 In March 1990, the EPA issued a revised National Contingency Plan (NCP). Under 40 C.F.R. 300.120, EPA designated DoD to be the removal response authority for incidents involving DoD military weapons and munitions under the jurisdiction, custody and control of DoD.

1.1.3 Since the beginning of DERP, the U.S. Army Corps of Engineers has been the agency responsible for environmental restoration at Formerly-Used Defense Sites (FUDS). In 2003, the U.S. Army Corps of Engineers Omaha District was designated as a Design Center for Ordnance and Explosives.

1.2 PURPOSE AND SCOPE

1.2.1 Scope – A statement of work (SOW) was prepared by the project delivery team (PDT) of the Omaha District. The SOW provides the scope of the work, which includes nine tasks to be accomplished, for this project. The SOW is attached as Appendix A.

1.2.2 Purpose – The purpose of an EE/CA report is to characterize the nature, location, and concentration of munitions and explosives of concern (MEC)*; provide a description of the MEC related problems affecting human use of the site; identify and analyze reasonable risk management alternatives; recommend a proposed alternative for this particular site; seek public comments, and participation; and to provide a convenient record of the process for use in final decision making and judicial review, if necessary.

1.3 WORK PLAN ORGANIZATION

1.3.1 The Work Plan is organized according to Table 9.1 in the Engineering Pamphlet (EP) 1110-1-18; Engineering and Design - Ordnance and Explosives Response. The Type I EE/CA Work Plan Data Item Description (DID) was also consulted to organize the EE/CA work plan. However, the organization of the DID is slightly different from the EP; therefore, the EP is the outline that will be used for this work plan.

* Munitions and Explosives of Concern (MEC) is new terminology to replace ordnance and explosives (OE).

1.3.2 The following are the contents of an EE/CA Work Plan outlined in Table 9.1 of EP 1110-1-18:

Cover Page
Table of Contents
1 Introduction
2 Site Description
3 Project Management
4 Overall Approach to OE EE/CA
5 Scope of Work By Task
6 Site Characterization Planning and Operations
7 OE Planning and Operations
8 Site Safety and Health Plan
9 Environmental Protection Plan
10 Data Management Plan
11 Quality Control Plan
12 References
Appendices

1.4 PROJECT LOCATION

The project location is Forest Park, a St. Louis City park, in St. Louis, Missouri. Further project location particulars will be provided from the information collected during the site visit on February 23 –26, 2004. Washington University and the Missouri Historical Society will be visited to collect data for the EE/CA report. Information from the ASR will also be included in this section of the EE/CA report.

2.0 SITE DESCRIPTION

2.1 SITE LOCATION, TOPOGRAPHY, CLIMATE, VEGETATION, AND SITE GEOLOGY

2.1.1 Forest Park is one of the largest public parks in the United States, located in the west central portion of the City of St. Louis approximately 5-6 miles west of the downtown area.

2.1.2 Forest Park is located in the Dissected Till Plain of the Central Lowland Province west of the Mississippi River. The Dissected Till Plain is characterized by gently rolling hills with elevations ranging from 500 to 700 feet above sea level.

2.1.3 Winter temperatures drop below zero only two or three days a year on average. Snowfall averages about 20 inches a year. Temperatures of 90 degrees or higher are recorded 35-40 days a year on average. Total precipitation averages about 36 inches per year.

2.1.4 The area addressed by this report is primarily used for recreation purposes, and vegetation on the site includes open expanses of grass with small stands of deciduous trees interspersed throughout the area.

2.1.5 Site soils generally fall into three different soil profiles. The profiles are similar and are intermingled with each other throughout the site.

2.1.6 Additional information regarding the site location, topography, climate, vegetation, and site geology will be collected using the ASR, INPR, and during the site visit on February 23 –26, 2004. Washington University and the Missouri Historical Society will be visited to collect data for the EE/CA report.

2.2 SITE HISTORY

2.2.1 Forest Park was established in 1876 as a St. Louis City park. In 1904, the western half of the park was used as the site of the 1904 World's Fair. After the closing of the Fair, most of the buildings and exhibits were demolished and the debris was buried on site. This debris is consistently uncovered whenever subsurface intrusion is performed in the western end of the park.

2.2.2 Documented military use of the park began with World War I. Documented use during this period was limited to public demonstrations and bivouacs. In July 1942, the U.S. Army was granted permission to use 17 acres in the southeastern corner of the park for a recreation camp. The camp was abandoned by 1947 and the area was restored by July 1948.

2.2.3 Additional information regarding the site history will be collected using the ASR, INPR, and during the site visit on February 23 –26, 2004. Washington University and the Missouri Historical Society will be visited to collect data for the EE/CA report.

2.3 CURRENT AND PROJECTED LAND USE

2.3.1 Forest Park is currently used as a recreation area for the city of St. Louis. The park includes a golf course, an art museum, the St. Louis zoo, the Missouri Historical Society, the St. Louis Science Museum, and other buildings. A more detailed current land use will be written into the EE/CA report using the existing ASR and the information collected during the site visit on February 23 –26, 2004, to Washington University and the Missouri Historical Society.

2.3.2 The projected land use is as a park for recreational use by the people of St. Louis. Information gathered during interviews and document searches on a site visit on February 23 – 26, 2004, to Washington University and the Missouri Historical Society will be used for further discussion on the projected land use for Forest Park.

2.4 PREVIOUS INVESTIGATIONS OF SITE

2.4.1 There have been two federal investigations conducted previously regarding Forest Park that will be used to provide information for the EE/CA Report. They are:

1) DERP-FUDS, Inventory Project Report, Prepared by Kansas City District, U.S. Army Corps of Engineers, 5 Jun 1995.

2) Archives Search Report Findings, Forest Park Recreation Camp, St. Louis, MO, Prepared by St. Louis District, U.S. Army Corps of Engineers, Sep 1997.

2.4.2 Information obtained during literature searches at Washington University and the Missouri Historical Society will be included in the EE/CA report. Information available in the ASR will also be used in describing the previous investigations at Forest Park.

2.4.3 Incident Reports and other information pertaining to the presence of MEC at Forest Park will be reviewed and included in the EE/CA Report as appropriate.

2.5 INITIAL SUMMARY OF MEC RISK

The MEC risk at this site is due to 3" and 4" stokes mortars and a Livens Projector found in the subsurface during construction activities. The risk for the EE/CA activity is nominal due to the location (subsurface) of the ordnance and the anticipated land use and field activities. Stokes mortars may be filled with white phosphorus, which will ignite when it comes in contact with the air. A Livens Projector may also be filled with white phosphorus. An ordnance and explosives risk impact assessment (OERIA) will be performed as part of the EE/CA report to evaluate the MEC risk.

3.0 PROJECT MANAGEMENT

3.1 PROJECT OBJECTIVES

The objective of the project is to prepare an EE/CA report for Forest Park in St. Louis, MO. An EE/CA is used to characterize the nature, location, and concentration of MEC; provide a description of the MEC related problems affecting human use of the site; identify and analyze reasonable risk management alternatives; recommend a proposed alternative for this particular site; seek public comments and participation; and provide a convenient record of the process for use in final decision making and judicial review, if necessary.

3.2 PROJECT ORGANIZATION

Figure 3.1 depicts the Forest Park EE/CA project organization. This project is a joint effort between the Omaha District Corps of Engineers and the Kansas City District Corps of Engineers.

3.3 PROJECT PERSONNEL

The primary project personnel are as follows:
CENWK Project Manager: Josephine Newton-lund
CENWO OE Project Manager: Joe Slattery
Lead Technical Organization: Kevin Siemann
OE Safety: Glenn Marks
Industrial Hygiene: Marc Anderson
Chemistry: Mark Meacham
Geophysical Operations: Rick Grabowski
Surveys and Mapping: Ty Sabin
Technical Writer: Jennifer Wolbers

3.4 PROJECT COMMUNICATION AND REPORTING

Effective communications will be maintained throughout the Forest Park EE/CA project by conducting team meetings, one on one meetings with team members, and periodic design team meetings. E-mail and periodic phone calls with the CENWK Project Manager (PM) will ensure effective communication occurs. The CENWK PM will be responsible for maintaining communication with, and providing documents for review to, the Missouri Department of Natural Resources and the Environmental Protection Agency (EPA), through project completion. Specific reporting requirements are outlined below:

3.4.1 Bi-weekly Reports

Bi-weekly reports will be provided to the CENWO PM. These reports will include a summary of work completed during the previous two-week period and a discussion of any problems encountered during that time frame.

3.4.2 Records Management

Hard copies of primary records for the Forest Park EE/CA project will be maintained in the project files at the Omaha District Corps of Engineers offices located at 106 S. 15th St., Omaha, NE 68102-1618. Electronic versions of records or working products will be retained within the Omaha District Corps of Engineers network server. Access to this server is limited and password controlled.

3.5 PROJECT DELIVERABLES

The Project Deliverables are as follows:
Draft EE/CA Report
Draft Final EE/CA Report
Final EE/CA Report

3.6 PROJECT SCHEDULE

The Project Schedule is as follows:
Draft EE/CA Report 30 Apr 2004
Draft Final EE/CA Report 22 Jun 2004
Final EE/CA Report 10 Aug 2004

3.7 PERIODIC REPORTING

Periodic status meetings will occur to provide status updates. These meetings will be scheduled based on client/management needs. In addition, bi-weekly reports will be submitted to the CENWO PM.

3.8 COSTING AND BILLING

The budget for this project will be distributed on a quarterly basis. Estimates of required quarterly funding has been provided previously. Any changes to these previously submitted estimates will be coordinated with the CENWK PM and the CENWO PM.

3.9 PROJECT PUBLIC RELATIONS SUPPORT

3.9.1 Media inquiries or requests for information from members of the public will be referred to the Omaha District PM and Kansas City District Public Affairs Office (PAO). Information will be provided after approval from the PM and PAO.

3.9.2 One public awareness session is planned for the Forest Park EE/CA Report. Two representatives from the Project Delivery Team will attend the public awareness session.

Additionally, the team will provide posters and handouts explaining the results of the EE/CA report. Additional support will be provided as required.

3.9.3 The CENWK PM and the CENWO LTO will coordinate on proposed actions with the Federal Facilities Section Community Relations Coordinator, including possible efforts to increase the public's ordnance awareness, if this becomes part of the selected remedy.

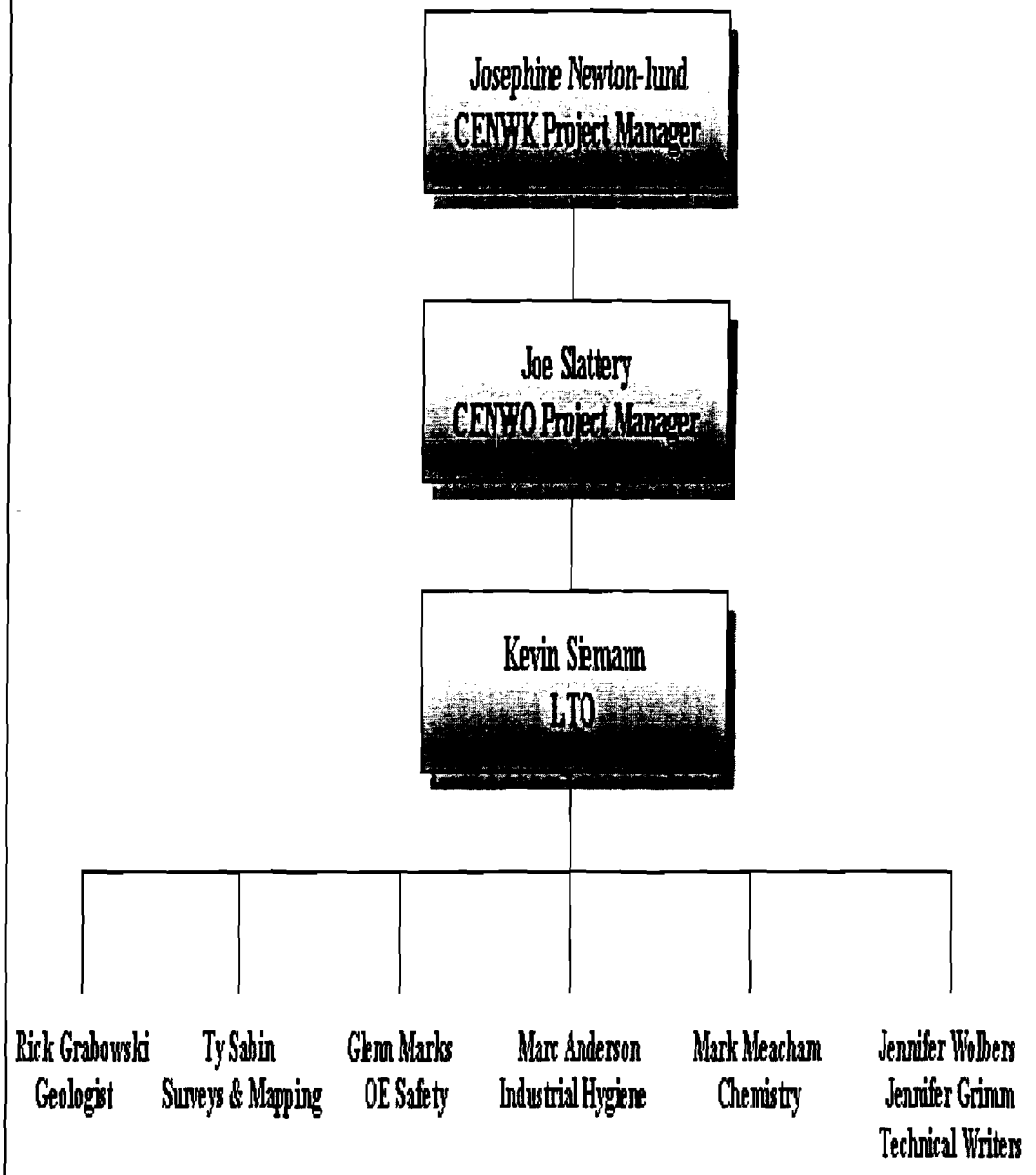
3.10 SUBCONTRACTOR MANAGEMENT

No subcontracts are currently planned for this project.

3.11 MANAGEMENT OF FIELD OPERATIONS

No field operations are currently planned for this project.

Figure 3.1
Project Organization
Forest Park EE/CA



4.0 OVERALL APPROACH TO OE EE/CA

4.1 PRELIMINARY REMOVAL ACTION GOAL

4.1.1 The preliminary removal action goal is to reduce and/or mitigate the potential risk of MEC exposures to the public.

4.1.2 To meet the NCP statutory goal of "the correction of other environmental damage (such as detection and disposal of Munitions and Explosives of Concern (MEC)) which creates an imminent and substantial endangerment to the public health or welfare or to the environment," the following objectives for preliminary risk reduction are defined:

- minimize the potential public exposure to MEC, considering current and potential future land and water use and technical and administrative feasibility; and

- remove and dispose of, or destroy, MEC, as necessary, in a safe and effective manner.

4.2 IDENTIFICATION OF DATA QUALITY OBJECTIVES

4.2.1 Data quality objectives (DQOs) will be defined in accordance with the USACE's guidance for the Technical Project Planning (TPP) process, EM 200-1-2; Implementation of TPP for OE Formerly Used Defense Sites (FUDS) (USACE); and Engineer Pamphlet (EP) 1110-3-8, "Public Participation in Defense Environmental Restoration Program (DERP)–FUDS" (USACE 1999).

4.2.2 DQOs will be used to demonstrate that the objectives of this EE/CA have been achieved. Specifically, DQOs will be used to ensure that data of sufficient type, quantity, and quality are collected to document and select appropriate response actions that address safety, public health, and the environment. DQOs will be developed during project planning and will serve as standards against which project objectives are measured at the completion of the characterization.

4.2.3 DQOs are dependent on site conditions and will be consistent with the current and future land use. DQOs are used to determine the most technically feasible and fiscally responsible characterization approach.

4.2.4 A key factor in the initial planning is to understand the types of MEC that might be present and where they might be found. Forest Park was used from 1917 to about 1947 as a recreational camp and a maneuver and mock battle area. The property where the ordnance was found was the location where the U.S. military conducted maneuvers and demonstrations using live ammunition during World Wars I and II. This property is known to contain MEC and therefore may present an explosive hazard.

4.2.5 As a result of the information already in place concerning Forest Park and the customers and stakeholders requirements, field work to include geophysical activities

will not be performed for this EE/CA. The majority of the area is currently used as a golf course for the City of St. Louis, and any field work would unacceptably disrupt this use. Additionally, the presence of metallic debris underground could potentially render geophysical investigation technically infeasible. A presentation of the information available and reviewed, with critical evaluation and conclusions, will be presented in the EE/CA Report. Additionally, a detailed discussion of the decision not to perform field work as part of this EE/CA will be presented in the report.

4.3 REQUIRED DATA

4.3.1 Data needs will be defined in accordance with the USACE's guidance for the TPP process, EM 200-1-2, "TPP Process" (USACE 1998); "Implementation of TPP for OE FUDS Sites (USACE); EP 1110-3-8, "Public Participation in DERP–FUDS (USACE 1999); and EM 1110-1-4009, "OE Response" (USACE 2000a).

4.3.2 Preliminary data needs, subject to review and approval, are listed in Table 4.1.

Table 4.1

Risk	OE Safety Specialists	Cost Analysis	Institutional Analysis
OE Factors: • Type • Sensitivity • Quantity/Density • Depth **Site Characteristics:** • Accessibility • Stability **Human Factors:** • Activities • Population	• Blast Effects • Ordnance and Explosives Risk Impact Assessment (OERIA) information	• Nature and Extent of OE • Existing Land-Use Controls • Current and Future Land Use	• Population Trends • Community Plans • Local Infrastructure

4.4 DATA REDUCTION AND EVALUATION

The data reduction and evaluation approach will be defined in accordance with USACE's guidance for the TPP Process, EM 200-1-2, "TPP Process" (USACE 1998); "Implementation of TPP for OE FUDS Sites" (USACE); EP 1110-3-8, "Public Participation in DERP–FUDS (USACE 1999); and EM 1110-1-4009, "OE Response" (USACE 2000a).

4.5 DATA INCORPORATION INTO EE/CA REPORTS

All previous and current data related to the EE/CA will be incorporated into the report.

4.6 OE EXPOSURE ANALYSIS

An OERIA will be performed in accordance with *Interim Guidance for OERIA* (USACE 2001c). The assessment will be conducted in two phases. First, baseline risk (i.e., no action) will be assessed, and then the results will be compared to risks under the different response alternatives. Risk will be assessed assuming some of the following scenarios: hunting, camping, child playing, hiking, picnicking, trespassing, and construction.

4.7 ALTERNATIVES IDENTIFICATION AND ANALYSIS

4.7.1 Introduction

4.7.1.1 Preliminary MEC response action alternatives have been identified for the Former Forest Park Recreational Camp that may potentially achieve the MEC response action objectives discussed in Subsection 4.1. The alternatives and response actions were grouped into the following categories:

- No MEC removal action;
- Institutional controls;
- MEC surface clearance; and
- MEC subsurface clearance

4.7.1.2 Four categories of MEC response actions will be used as a basis for determining the MEC response action alternatives to be considered in the EE/CA. The potential response alternatives are developed in the following subsections.

4.7.1.3 Based on the MEC response action categories described above, preliminary MEC response action alternatives were identified as candidates for potential implementation at Forest Park. The four alternatives identified for potential implementation are:

- No DoD Action Indicated (NDAI);
- Institutional Controls;
- Surface Removal of MEC items; and
- Clearance to Depth Removal of MEC items

No MEC response action, even using the best available technology, can completely remove all MEC risk for Forest Park. Yet, all of the MEC response actions considered (with the exception of NDAI) reduce the potential risks posed to the public by inadvertent ordnance detonation, resulting in a reduction of the MEC risk.

4.7.1.4 Implementation of a recurring review program will not be evaluated as a separate alternative, but as an integral part of any alternative. The recurring review program will be used in conjunction with the NDAI alternative, the Institutional Control alternative, and the OE clearance alternatives. As part of this program, visual surveys will be performed on a proposed schedule. These visual surveys will consist of the inspection of area within Forest Park to determine the effectiveness of the MEC response action alternative implemented. These visual surveys will be concentrated in areas most susceptible to erosion and other disturbances. Any incident reports will be reviewed and any Institutional Control in effect will be checked to ensure viability and proper maintenance. During the periodic inspections changes in the land-uses will be assessed. The first visual inspection would occur approximately one year after MEC response

action alternatives have been completed. After this initial inspection, the inspections will continue at a five-year frequency beginning at the end of the first five-year duration and continuing every five years up to 25 years from the completion of OE response actions. If the results of these inspections indicate that the conditions of Forest Park have changed significantly, the recommendations of the EE/CA will be revisited and revised as warranted.

4.7.2 Alternative 1: No DoD Action Indicated

Alternative 1 is for the government to take no action in regards to locating, removing, and disposing of any potential MEC present within Forest Park. In addition, no public awareness or education training would be initiated with regards to the risk of OE. The NDAI alternative assumes continued use of Forest Park in its present state. If the potential exposure and hazards associated with the area are compatible with current and future development in the area as well as the OE response action objectives, then NDAI may be warranted. The NDAI alternative is a potential candidate alternative for this site.

4.7.3 Alternative 2: Institutional Controls

4.7.3.1 Description and Objective

4.7.3.1.1 The implementation of an Institutional Controls alternative would provide a means for the DoD and their representatives to coordinate with the state and private landowners in an effort to affect behavior modification to reduce MEC exposure risk. The Institutional Controls alternative can be used in combination with other MEC response actions or in cases where it may not be possible or practical to physically clear MEC from the site. Successful implementation of Institutional Controls is contingent on the cooperation and active participation of the existing powers and authorities of other government agencies to protect the public from MEC risks. Instead of direct removal of the MEC from the site, the Institutional Controls response action relies on behavior modification and access control strategies to reduce or eliminate MEC risk. For example, an educational program may be required to warn the public of the location of the MEC found at Forest Park. The educational program would provide guidance on public safety and prudent actions should a person discover MEC material.

4.7.3.1.2 Aside from conventional MEC response actions, risks related to potential MEC contamination may be managed through land use restrictions, access control, public awareness programs, deed notices, or a combination of strategies. It is important to understand that the risk associated with ordnance contamination is associated with three causative factors that, if completely avoided, would prevent an MEC-related accident. These three factors are: presence, access, and behavior. If there is no presence of ordnance at the site, then there is no possibility of an MEC-related accident. If ordnance exists within the site, but people do not have access, then there will be no accident. Even if ordnance exists within the site and people have access to the ordnance, if their behavior is appropriate, then there will be no accident. An accident requires all three events or circumstances to be present. No accident will happen if any one causative factor is missing. Each factor provides the basis for a separate implementation strategy.

4.7.3.1.3 Behavior modification is an Institutional Control that relies on the personal responsibility of the property user. Even if the MEC exists and there is open access to it, there is no risk if the behavior is appropriate. For behavior to be appropriate, one must understand the situation and voluntarily react in a responsible manner. The power of the federal government is limited in any situation where local enforcement is available. Therefore, the local authorities must be convinced that the risks are sufficient to warrant their participation. The concept of behavior modification through public awareness extends to agencies that have jurisdiction over the property within Forest Park. Some behaviors that must be modified may belong to the local government.

4.7.3.2 Land Use Restrictions and Regulatory Control

Land Use Restrictions and Regulatory Controls provide the primary Institutional Controls that can be exercised over areas where ordnance is present. Through these controls, local government can dictate the type of development that will occur within Forest Park, and the methods by which that development occurs. The primary intent would be to disclose to property owners and the public at large that MEC may be present within certain areas and an increased level of awareness and caution should be taken in the use of the land. These restrictions and controls include deed notices and ordinances prohibiting ground disturbance.

4.7.3.3 MEC Trained Escorts for Construction Support

The role of the MEC trained escort would primarily be for avoidance of MEC and not to perform clearance operations. Since it is anticipated that periodic maintenance will be performed at the golf course; the MEC trained escorts could be placed under contract and used as needed.

4.7.3.4 Printed Media

Ordnance awareness, respect for the risk involved, and reinforcement of the message are key ingredients in minimizing the public risk associated with ordnance contamination. One of the major avenues available to facilitate this awareness and understanding is through printed media, in the form of brochures, fact sheets, newspaper articles, and other information packages. The opportunity to disseminate information through the printed media is readily available and can be easily facilitated. Although there are few obvious reminders of past DoD activities, many of the current residents and property owners within Forest Park are aware of the potential ordnance risk associated with the former use of the property. However, area residents should still be reminded of the potential presence of ordnance items on a regular basis. Also, providing information to new residents and visitors is of primary importance. The addition, reinforcement, and augmentation of current knowledge is desirable in order to keep the realization of ordnance contamination and the potential hazards in the minds of people at all times.

4.7.3.5 Brochures

Brochures can be very effective educational tools and could be prepared and distributed through the individual County government or other local agencies. Brochures could

describe the history of the Forest Park, how to identify ordnance, safety procedures associated with the proper handling/avoidance of ordnance items, instructions for dealing with ordnance if encountered, and telephone numbers to contact if ordnance is encountered or if questions need to be answered.

4.7.3.6 Newspaper Articles/Interviews

Newspaper articles and interviews with local residents, the USACE, and other institutions can be printed to further educate the public concerning the ordnance contamination at the site. These articles can be very informative and can effectively reduce the risk of improper handling of ordnance.

4.7.3.7 Visual Media

Ordnance awareness, respect for the risk involved, and reinforcement of the message are key ingredients in minimizing the risk associated with ordnance contamination. Visual media in the form of videotape programs for use during presentations and for broadcast on local television stations is a major avenue available to facilitate this awareness and understanding. The opportunity to disseminate information through the visual media is readily available and can be easily facilitated. Two visual media programs, one as a 30-minute television special and one as a 5 to 7 minute professional videotape for classroom and other use, would be highly effective tools in educating the public about ordnance safety. These videos should describe the history of Forest Park, how to identify ordnance, safety procedures associated with avoidance of ordnance items, instructions for dealing with ordnance if encountered, and telephone numbers to contact if ordnance is encountered or if questions need to be answered. Videotapes can be shown in classrooms throughout the region. Copies could also be provided to local libraries, any association, and government agencies. These institutions could make the videotapes a part of permanent exhibits/displays.

4.7.3.8 Signage

Signs can be posted along the perimeter of specific areas to warn the public about the risk of exposure to ordnance items. Signage can also include information regarding site access restrictions, how to respond to discoveries of ordnance items, telephone numbers and addresses to contact with questions or concerns, and any other applicable site-specific information.

4.7.3.9 Fencing

Fencing would provide a physical barrier to prevent the public from entering specific areas and inadvertently coming in contact with ordnance. However, construction of fencing is generally considered only as a last resort Institutional Controls strategy due to generally negative public acceptance.

4.7.3.10 Other Institutional Controls

Exhibits/displays could be prepared and placed in the local public library and other areas where the public will be exposed to educational information. In addition, the creation of a Web Page on the Internet and creation of an ad hoc committee could also be effective method of raising and preserving general awareness and educating the public about the former Forest Park Recreational Camp.

4.7.4 Alternative 3: Surface Removal of MEC Items

4.7.4.1 The surface clearance of MEC alternative may be a viable MEC response alternative if the risk assessment indicates that there is a high number of anticipated exposures to MEC by the public on the ground surface and a low risk of exposure to subsurface MEC.

4.7.4.2 Surface MEC clearance would be completed by experienced UXO-qualified personnel who visually search the ground surface for any MEC. In addition, UXO-qualified personnel would use metal-detection devices to ensure that any MEC items that may exist on the surface of the ground or protruding from the ground are located during the sweep. The UXO-qualified personnel would perform their sweep in lanes five feet wide, or some other comparable width depending on the sweep reach of the type of metal detection equipment used, to ensure complete surface coverage. All potential MEC contacts on the ground surface or protruding from the ground surface would then be identified and removed. A land surveyor would establish control points for a grid system that would cover the areas where surface clearance was required. Where necessary, brush-clearing crews would clear enough undergrowth so that the surface clearance crews could adequately perform their work. Brush clearing should be limited to only those areas where the vegetation prevents the effective use of the geophysical equipment. In areas where the geophysical equipment can be used effectively in the natural state, no brush clearance would be necessary. In areas where the future land use is anticipated to be nonresidential, brush clearing would only be used as necessary so that the surrounding ecosystem would not be disturbed. It is assumed that brush clearance will create minimal short-term disturbances to the ecosystem due to the rapid vegetation growth rates in this climate.

4.7.5 Alternative 4: Clearance to Depth Removal of MEC Items

4.7.5.1 The clearance to depth of MEC alternative may be a viable MEC response alternative if the risk assessment indicates that there is a high number of anticipated exposures to MEC by the public below the ground surface.

4.7.5.2 The clearance would extend to depths consistent with the EE/CA findings within a given area. Land surveying and brush clearing operations would be necessary as described in Alternative 3. Under this alternative, one hundred percent of an area would be cleared of surface and subsurface MEC items (to the specified depth). This alternative is the most ambitious of the three alternatives identified for consideration in the EE/CA. Experienced, UXO-qualified personnel would perform removal activities associated with this alternative. Institutional controls could be implemented in conjunction with this alternative to further decrease the estimated number of annual exposures in the area.

4.7.5.3 During the investigation phase, a geophysical instrument would be used to perform surveys over established grids. This geophysical survey would identify subsurface anomalies and any surface anomalies not identified during the brush clearing activities. In this way, both the surface and subsurface surveys could be performed simultaneously saving time and money. The primary difference in performing this kind of survey over that described in Alternative 3 is that instead of relying primarily on visual identification and near surface detection, a marking/locating system is used to relocate the subsurface anomalies for subsequent intrusive investigate and removal. All surface anomalies uncovered during the performance of the survey would be immediately identified and removed/disposed from the area to ensure that only subsurface anomalies remain to be investigated.

4.7.5.4 The second phase to this approach includes the intrusive investigation of all subsurface metallic anomalies identified during the metal detection survey is to determine their exact nature. During this intrusive investigation, phased engineering controls may have to be used to reduce the evacuation distance that would be required during the conduct of these investigations. Once the intrusive investigations begin, each anomaly will be excavated in 6-inch depth increments utilizing hand tools. If the item causing the magnetic reading has not been identified within the first foot below the ground surface, then the hand-dug excavation will continue in 12-inch depth increments until the item is identified. Following removal of the item identified, the excavation will be restored to as close to its original state as possible.

4.8 EE/CA REPORT

4.8.1 The EE/CA will be prepared in accordance with DID OE-010.01. The goals of the EE/CA are to identify the objectives of the removal action and to analyze the various alternatives that may be used to satisfy these objectives for cost, effectiveness, and implementability. A removal action can include institutional controls such as fencing and public awareness campaigns.

4.8.2 The EE/CA for the site will be based on available data. Field investigations will not be performed for this site.

4.8.3 A public notice and public comment period will be provided for the EE/CA. The EE/CA will become a part of the administrative record.

4.9 EE/CA ACTION MEMORANDUM

4.9.1 The Action Memorandum substantiates the need for a removal action, identifies the proposed action, and explains the rationale for the removal action selection. An EE/CA summary, EE/CA Action Memorandum, and a summary of written comments on the EE/CA for alternative actions considered will be included. In addition, a copy of the EE/CA and the response to significant public comments on the EE/CA will be included as attachments to the Action Memorandum.

4.9.2 The EE/CA Action Memorandum will be prepared in accordance with EP 1110-1-18 and EPA's "Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA," EPA-540-R-93-057 (EPA 1993).

4.10 EE/CA COMPLETION AND CLOSEOUT

It is estimated that the Forest Park EE/CA activities will be a site visit and a draft EE/CA repot completed by April 2004. The Action Memorandum and final EE/CA report are scheduled to be completed in August 2004.

4.11 USE OF TIME-CRITICAL REMOVAL ACTIONS DURING EE/CA PROCESS

4.11.1 Time-critical removal actions require action within 6 months.

4.11.2 Criteria for defining time-critical removal actions and associated requirements include, but are not limited to, the NCP (Section 300.415) and Office of Solid Waste and Emergency Response (OSWER) Publication 9203.1-03, "Guidance on Implementation of Superfund Accelerated Cleanup Model (SACM) under CERCLA and NCP," PB93-963252 (EPA 1992).

4.11.3 The USACE has determined that this project is not subject to a time-critical removal action (TCRA). The determination was made that the public was not at risk from MEC without construction activity in progress. Forest Park is being used as a city park and golf course. Due to the high traffic of the area in question the assumption for this report is that there is no MEC on the surface, thereby reducing the risk to an acceptable level. Therefore, the USACE is conducting the EE/CA investigation as a non-TCRA.

4.12 FOLLOW-ON ACTIVITIES

4.12.1 Follow-on activities will be defined in accordance with the results and recommendations of the EE/CA. Activities may include no action, additional investigation, OE removal, and/or institutional controls.

4.12.2 Activities will be implemented in accordance with federal, state, and local guidance and requirements.

5.0 SCOPE OF WORK BY TASK

5.1 TASKS FOR FOREST PARK PROJECT

The following are the tasks associated with the Forest Park Project:

Task 1: Site Visit and Records Review
Task 2: Project Work Plan
Task 3: Location Surveying
Task 4: Prepare an EE/CA Report
Task 5: Prepare a Record of Decision/Action Memorandum
Task 6: Community Relations Support
Task 7: Project Management
Task 8: Prepare a Memorandum of Agreement
Task 9: Prepare and Submit an Explosive Safety Submission

5.2 TASKS THAT MAY NOT BE COMPLETED/REQUIRED

Task 3: Location Surveying may not be required if adequate information can be obtained during the site visit.

6.0 SITE CHARACTERIZATION PLANNING AND OPERATIONS

6.1 SITE CHARACTERIZATION GOALS

6.1.1 The objective of this MEC site characterization is to obtain enough data to characterize the site and to generate recommendations for the proposed MEC response action. The Former Forest Park Recreational Camp area shown in Appendix B is the subject of this investigation.

6.1.2 The site characterization goal will be verified during the project planning and implementation.

6.2 SITE CHARACTERIZATION PROCEDURAL OVERVIEW

6.2.1 The site characterization process will be implemented in accordance with the SOW requirements described in Chapter 5.0.

6.2.2 The site characterization procedure will be based on the existing site information. The results of the information will be compiled into the EE/CA Report.

6.2.3 Recovered Chemical warfare material (RCWM) is not suspected to be present at the Former Forest Park Recreational Camp. However, if RCWM is encountered during the site visit, the on-site crew will withdraw from the area and follow the procedures outlined in EP 1110-1-18 and the abbreviated site safety plan.

6.3 MEC SAMPLING LOCATIONS AND PROCEDURES

6.3.1 An MEC field investigation is not planned for Forest Park; therefore, field-sampling activities will not be addressed.

6.4 SITE PREPARATIONS

6.4.1 An MEC field investigation is not planned for Forest Park; therefore, site preparation activities will not be addressed.

6.5 SURVEYING AND SITE LAYOUT AND CONTROL

6.5.1 General

6.5.1.1 Location surveying and mapping, if required, will be completed in accordance with requirements and procedures defined in Chapter 5.0 of this EE/CA Work Plan.

6.5.1.2 A high-precision/accuracy survey of the study area is not technically nor financially justifiable. The ambiguous spatial nature of buried MEC dictates that polygons of Areas of Concern be drawn on large-scale air photographs, allowing an ample "buffer-zone" to ensure safety by erring on the safe side.

6.5.1.3 The Areas of Concern will be "heads-up" digitized onto the air photography DOQQs to create a base map that will support the addition of further information layers.

6.5.2 UXO Safety Provisions

6.5.2.1 If surveyed boundaries are required then the survey crew will be given an MEC Recognition Class before surveying begins.

6.5.2.2 An MEC field investigation is not planned for the Former Forest Park Recreational Camp; therefore, specific MEC avoidance procedures will not be addressed.

6.5.3 Control Points and Monuments

The specification requires horizontal control of "Class I, Third Order" or better shall be established for network of Monuments. Digital orthophotographic quarter-quadrangles (DOQQs) are being used as base maps for the Forest Park project. Accuracy requirements for DOQQs meet that of the required Class I, Third Order requirement. Horizontal control also meets the requirement that the North American Datum of 1983 (NAD83) and the Universal Transverse Mercator (UTM) Grid system in meters be used

6.5.4 Mapping

6.5.4.1 A boundary land survey, if required, of the FUDS portion of Forest Park will be performed by a state-certified surveyor in accordance with DID OE-005-07.01.

6.5.4.2 Maps will be produced in accordance with DID OE-005-07.01 for submission with the EE/CA Report.

6.5.4.3 Subsurface Survey Area

An MEC field investigation is not planned for Forest Park; therefore, subsurface survey areas will not be addressed.

6.5.5 Digital Data

USACE Omaha District will supply digital data in the format required in DID OE-005-007.01.

6.5.6 Digital Format for Intergraph Survey/Mapping Data

6.5.6.1 All data will conform to the Tri-Service Spatial Data Standards (TSSDS).

6.5.6.2 All data will be submitted electronically on PC CD-ROM.

6.5.7 Items and Data

6.5.7.1 Drawings and Digital Data

6.5.7.1.1 Drawings and digital data will be submitted, in accordance with DID OE-005-07.01 and the SOW, with the EE/CA Report.

6.5.7.1.2 All maps will be drawn at a scale no smaller than 1:600 on reproducible (Mylar) drawings. One original copy and one blue-line print of each final drawing will be delivered to USACE Kansas City.

6.6 GEOPHYSICAL INVESTIGATIONS

An MEC field investigation is not planned for Forest Park; therefore, geophysical investigations will not be addressed.

6.7 RISK CHARACTERIZATION AND ANALYSIS

6.7.1 A risk assessment will be performed for Forest Park according to USAESCH's OERIA guidance. Although no formal risk assessment has been completed for Forest Park previously, the determination to conduct the EE/CA Report as a non-TCRA was based on professional knowledge and experience with other similar sites.

6.7.2 The OERIA will be completed in accordance with Interim Guidance Ordnance and Explosive Risk Impact Assessment dated 27 March 2001.

6.8 GEOGRAPHICAL INFORMATION SYSTEM

6.8.1 The ESRI suite of GIS products will be used for all project spatial information manipulation and output requirements. Vector coverages will be attributed and maps produced to meet applicable standards.

6.8.2 Project GIS products in the appropriate file structure will be copied onto CDs for customer use and archiving.

7.0 MEC PLANNING AND OPERATIONS

It is not anticipated that any MEC investigations will be performed during this EE/CA, the only field work performed will be a site visit and document research. All work performed during the site visit will be in accordance with the Abbreviated Site Safety and Health Plan and section 8 of this document.

8.0 SITE SAFETY AND HEALTH PLAN

8.1 PURPOSE

The purpose of an SSHP is to describe protocols necessary for the anticipation, recognition, evaluation, and control of hazards associated with each task performed at this site. The SSHP addresses site-specific safety and health requirements and procedures based upon-site-specific conditions. The level of detail in the SSHP is tailored to the type of work, complexity of operations to be performed, and hazards anticipated.

8.2 ABBREVIATED SITE SAFETY AND HEALTH PLAN

There will be no intrusive field work during the Forest Park EE/CA. Therefore the SSHP will be an Abbreviated Site Safety and Health Plan authorized in EP 1110-1-18. This will be used for the site visit and for any other actives during this EE/CA unless current anticipated requirements change. If the need for a detailed SSHP arises then it will be written in to the work plan as an appendix and the work plan amended.

9.0 ENVIRONMENTAL PROTECTION PLAN

As no field investigation is anticipated at this time, no Environmental Protection Plan (EPP) is required. If the need for an EPP arises then it will be written in to the work plan as an appendix and the work plan amended.

10.0 DATA MANAGEMENT PLAN

10.1 DATA MANAGEMENT

10.1.1 Electronic data and records will be managed to prevent accidental loss of information. All data will be backed up periodically, and data will not be stored only on one single media. Floppy disks, zip disks, CDs, or other means of storage will be used in addition to standard computer hard drives to ensure that data are not lost by the failure of any one device. Since conventional document control practices do not always lend themselves to electronic records, the following additional guidelines will be followed for all electronic QC records:

10.1.2 Once an electronic record is completed and saved to disk, the file name will be used as the registration number for that document and will appear on each page of the electronic record such that it also appears on printed copies. This file name will be entered in the Field Document Control Log as that document's registration number.

10.1.3 Changes, additions, late entries, and corrections to completed electronic records will be accomplished by creating a revision to the previously completed record. Included in the file name of the completed record will be the sequential revision number of that record. The first such revision of any record will be designated as R1 at the end of the file name. Subsequent revisions will be designated R2, R3, etc.

10.1.4 The original record will not be deleted electronically, and each revised record will include a description of the changes made on that particular revision as well as retaining the description of any previous revisions.

10.1.5 Any document that is revised after any required distribution, either off-site or to any electronic or hard-copy file, will be likewise distributed to all recipients as the original document. The revision will be filed along with the original and any previous revisions.

10.1.6 Electronic forms, which require signatures, will be printed, and the printed original signed and dated in black ink as required. The words "signature on file" will be entered on the electronic copy, in the signature space, of all documents requiring signatures. The signed original will be filed in the proper location. Subsequent revisions to forms requiring signatures will also be printed, signed, and filed.

11.0 QUALITY CONTROL PLAN

11.1 QC OBJECTIVES

This section presents the project QC Plan as required by the SOW. The QC procedures described in this section will be used for all work performed during the EE/CA. This QC Plan is designed to manage, control, and document performance of work efforts in accordance with the SOW to assure quality throughout the execution of the tasks described therein. This QC Plan will achieve the following objectives:

• identify QC procedures and responsibilities for EE/CA investigations,

• ensure CENWO's notifications as required by the SOW,

• document the quality of work efforts via audits and independent staff reviews of deliverables,

• assure data integrity through implementation of data management QC procedures.

11.2 QC Responsibility

The Corps of Engineers, Omaha District is solely responsible for the control of product quality. Only those products/services that conform to contractual requirements will be offered to the customer for acceptance.

11.3 Quality Management

11.3.1 The Omaha PM has the responsibility of ensuring that QC procedures are implemented in accordance with the SOW.

11.3.2 The Lead Technical Officer (LTO) will provide the quality management oversight for the project. The Quality Manager is a part of the project team, but is authorized to elevate any quality problems that cannot be resolved by the project team. The LTO interacts with the PM, PDT, and the customer to prevent and/or correct problem situations, as necessary. He also has authority to:

• initiate action to prevent the occurrence of nonconformance relating to the provided services;

• identify and record any problems relating to the services;

• initiate, recommend, or provide solutions through the management channel;

• verify the implementation of solutions;

• control further actions of any nonconforming services until the unsatisfactory conditions have been corrected; and

• elevate quality concerns, which cannot be resolved by the team to the Omaha PM.

11.3.3 All project team members are responsible for and will be held accountable for the quality of their work. All project team members are encouraged to identify potential quality problems and are encouraged to suggest solutions or corrective actions to ensure all work conforms to the approved Work Plan.

11.4 QC PLAN PROCESSES

11.4.1 This section documents the processes affecting quality. These are essential steps to assure a quality product is delivered to the customer.

11.5 SPECIFIC PROCEDURES

11.5.1 Described below are the specific procedures that will be used to assure quality in this SOW regarding Audits, Corrective/Preventive Action, Data Management.

11.5.1.1 **Customer Complaints:** Customer complaints will be addressed immediately. The complaint may come in the form of a verbal comment, written correspondence, or a email. Whatever the vehicle, the Omaha PM will conduct an investigation to analyze the complaint and ensure that corrective action has been initiated. The corrective action will address not only the root cause but also the application of controls to ensure its effectiveness.

11.5.1.2 **Data Management:** Electronic data and records will be managed to prevent accidental loss of information. All data will be backed up periodically, and data will not be stored only on one single media. Floppy disks, zip disks, CDs, or other means of storage will be used in addition to standard computer hard drives to ensure that data are not lost by the failure of any one device. Since conventional document control practices do not always lend themselves to electronic records, the following additional guidelines will be followed for all electronic QC records:

11.5.1.3 Once an electronic record is completed and saved to disk, the file name will be used as the registration number for that document and will appear on each page of the electronic record such that it also appears on printed copies. This file name will be entered in the Field Document Control Log as that document's registration number.

11.5.1.4 Changes, additions, late entries, and corrections to completed electronic records will be accomplished by creating a revision to the previously completed record. Included in the file name of the completed record will be the sequential revision number of that record. The first such revision of any record will be designated as R1 at the end of the file name. Subsequent revisions will be designated R2, R3, etc.

11.5.1.5 The original record will not be deleted electronically, and each revised record will include a description of the changes made on that particular revision as well as retaining the description of any previous revisions.

11.5.1.6 Any document that is revised after any required distribution, either off-site or to any electronic or hard-copy file, will be likewise distributed to all recipients as the original document. The revision will be filed along with the original and any previous revisions.

11.5.1.7 Electronic forms, which require signatures, will be printed, and the printed original signed and dated in black ink as required. The words "signature on file" will be entered on the electronic copy, in the signature space, of all documents requiring signatures. The
signed original will be filed in the proper location. Subsequent revisions to forms requiring signatures will also be printed, signed, and filed.

11.5.2 "Lessons Learned" from day-to-day activities are an important part of the continuous improvement process. They can prove vital to prevent similar problems from occurring at other sites. "Lessons Learned" from daily activities and from the occurrence of nonconforming conditions will be documented by the LTO. The objectives of Lessons Learned are:

- Prevent the recurrence of repetitive design/execution deficiency;
- Clarify interpretations of regulations or standards;
- Reduce the potential of mistakes in high risk/probability areas of concern;
- Promote a good work practice that should be ingrained for repeat application; and
- Promote efficient and cost effective business practices.

11.6 Reviews and Approvals

All contract submittals (reports, work plans, etc.) shall undergo review by various personnel to ensure that they meet contract requirements prior to being submitted to the customer for acceptance. This review will include, but is not limited to, the PM, the Quality Control Review Team, and the PDT. Work plans and reports are checked against the SOW and applicable DIDs to ensure that they are in conformance. Changes to approved documents will undergo the same review process as the original document and will be communicated to all personnel affected by the revision.

11.7 Chemical Quality Data Management

No HTRW or RCWM are expected at this site per the SOW. If suspected HTRW is encountered, the PDT will immediately notify the Omaha PM. If RCWM is encountered or suspected, the PDT will immediately withdraw upwind of the work area, secure the area, and contact the local POC. Due to the area, past activities, and the current use of

Forest Park the event of finding RCWM is improbable for the activities described in this work plan.

12.0 REFERENCES

10 USC 2701, *Defense Environmental Restoration Program*

16 USC 1531-1544; 50 CFR 17, 401-424, 450-453 *Endangered Species Act*

16 USC 470; 36, CFR 60, 63, 68, 800; Executive Order 11593. *National Historic Preservation Act.*

29 CFR 1910. *Occupational Safety and Health Administration (OSHA) General Industry Standards*

29 CFR 1926. *Construction Industry Standards*

40 CFR 300. *National Oil and Hazardous Substance Contingency Plan*

EPA (U.S. Environmental Protection Agency) 1992. *Guidance on Implementation of Superfund Accelerated Cleanup Model (SACM) under CERLA and NCP*, OSWER Publication 9203-1-03, PB93-963252.

EPA *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA*, EPA/540-R-93-057

DOD (U.S. Department of Defense). *DoD Ammunition and Explosive Safety Standards*, DOD 6055.9 Std.

DOD Directive 1000.3. *Safety and Occupational Health Policy for the Department of Defense*

USACE (U.S. Army Corps of Engineers) 2003. *Safety and Health Requirements Manual*, EM 385-1-1

USACE. *Technical Project Planning (TPP) Process*, Engineer Manual, EM 200-1-2

USACE. *Public Participation in the Defense Environmental Restoration Program (DERP) for Formerly Used Defense Sites (FUDS)*, Engineer Pamphlet, EP 1110-3-8

USACE. *Ordnance and Explosives Response*, EP 1110-1-4009

USACE. *Ordnance and Explosives Response*, EP 1110-1-18

USACE. *Establishing and Maintaining Institutional Controls for OE Projects,* EP 1110-1-24

USACE. *Unexploded Ordnance Support During Toxic and Radioactive Waste and Construction Activities,* EP 75-1-2

USACE. *Basic Safety Concepts and Considerations for Ordnance and Explosive Operations,* EP 385-1-95a

USACE. *Explosive Safety Submissions,* EP 385-1-95b

USACE. *OE Risk Impact Assessment for OE EE/CA Evaluations,* IGD 01-01

USACE. *Implementation of Technical Project Planning (TPP) for Ordnance and Explosives (OE) Formerly Used Defense Sites (FUDS) Projects*, IGD 01-02

Applicable Data Item Descriptions:
DID OE-001.01 Type I Work Plan
DID OE-005-02.01 Technical Management Plan
DID OE-005-03.01 Explosives Management Plan
DID OE-005-06.01 Site Safety and Health Plan
DID OE-005-07.01 Location Surveys and Mapping Plan
DID OE-005-08.01 Work, Data, and Cost Management Plan
DID OE-005-09.01 Property Management Plan
DID OE-005-10.01 Sampling and Analysis Plan
DID OE-005-11.01 Quality Control Plan
DID OE-005-12.01 Environmental Protection Plan
DID OE-010.01 Engineering Evaluation/Cost Analysis (EE/CA) Report
DID OE-015.01 Accident/Incident Reports
DID OE-025.01 Personnel and Work Standards
DID OE-030.01 Site Specific Final Report
DID OE-040.01 Disposal Feasibility Report
DID OE-045.01 Report/Minutes, Record of Meetings
DID OE-055.01 Telephone Conversations/ Correspondence Records
DID OE-060.01 Conventional Explosives Safety Submissions (ESS)
DID OE-080.01 Monthly Status Report
DID OE-085.01 Weekly Status Report
DID OE-100 Analysis of Institutional Controls
DID OE-110.01 Recurring Review Plan

APPENDIX A

SCOPE OF WORK

Engineering Evaluation/Cost Analysis
AT
FOREST PARK RECREATION AREA, ST. LOUIS, MISSOURI

December 15, 2003

1.0 OBJECTIVE/GOALS

1.1 The purpose of an Engineering Evaluation/Cost Analysis (EE/CA) report is to characterize the nature, location, and concentration of ordnance and explosives (OE) provide a description of the OE related problems affecting human use of the site; identify and analyze reasonable risk management alternatives; recommend a proposed alternative for this particular site; seek public comments and participation; and provide a convenient record of the process for use in final decision making and judicial review, if necessary. The work required under this Scope of Work (SOW) falls under the Defense Environmental Restoration Program (DERP) – Formerly Used Defense Sites (FUDS) Program. OE exists on property formerly owned by the Department of Defense (DOD). This tract of land falls under the control of the City of St. Louis, Missouri.

1.2 The contractor will fully utilize to the maximum extent possible, existing Documentation in order to eliminate redundant investigation and maximize resource utilization. The contractor shall review all available documentation including, but not limited to, the Inventory Project Report (INPR), the Archives Search Report (ASR), Police Department Reports, and other data as available.

1.3 The contractor shall evaluate the information and provide reasonable alternatives for a Record of Decision/Action Memorandum and future OE responses.

1.4 The contractor will be responsible for coordinating any on-site activities with the city authorities to include the St. Louis Department of Parks, Recreation, and Forestry.

1.5 OE is a safety hazard and may constitute an imminent and substantial endangerment to site personnel and the local population. This action will be performed in substantial compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Sections 104 and 121: Executive Order 12580; and the National Contingency Plan (NCP), Section 300.400. All activities involving work in areas potentially containing unexploded ordnance (UXO) hazards shall be conducted in full compliance with CEHNC, USACE, DA and

DoD requirements regarding personnel, equipment and procedures. 29 CFR 1910.120 shall apply to all actions taken at this site. Due to the inherent risk in this type of operation, the contractor shall provide an UXO-qualified person during the project to ensure safety during the site visit, and to provide technical expertise during the review of documentation and report preparation.

1.6 No intrusive UXO-related activities are anticipated.

1.7 Recovered Chemical Warfare Materiel (RCWM)
During a comprehensive review of archival records, there was no evidence of the potential existence of RCWM or RCWM by-products on Forest Park. In the event that suspect RCWM is encountered, all work will immediately cease and project personnel will be evacuated. A team consisting of two personnel will secure the area to prevent unauthorized access, and CENWK (Josephine Newton-Lund) and CENWO (Joe Slattery) will be notified.

1.8 The contractor shall furnish the necessary personnel and equipment to administer a Quality Control (QC) Plan IAW DID OE-005-11.01 to manage, control, and document contractor and subcontractor activities. The detailed methodology to accomplish this Quality Control Plan shall be included in the Work Plan. The QC activities shall be documented and included in the EE/CA Report.

1.9 The contractor will use Section 3 tasks as a basis to ensure all deliverables are completed.

2.0 BACKGROUND

Forest Park, a St. Louis City park, was established in 1876 and opened its doors to the public on 2 June 1876. In 1904, the western half of the Park was used as the site of the 1904 World's Fair. After the closing of the Fair, most of the buildings and exhibits were razed and their debris buried on site. This debris is constantly being re-discovered when ever subsurface intrusion is performed in the western end of the Park. Documented military use of Forest Park begins with World War I. Known use is limited to public demonstrations and bivouacs. Known activities include the following:

- A 6 April 1917 photograph, shows members of 'A' Battery firing a cannon salute in Forest Park (St. Louis Post Dispatch, 1917)

- During 1917, the Army tank 'Britannia' gave a demonstration in the Park. Thousands of patriotic citizens followed the tank around the Park. (St. Louis, 1918)

- On 26 August 1918, the British Aviation Mission landed six aircraft in Forest Park as part of a demonstration. (St. Louis, 1919)

- A 16 September 1917 photograph shows the 3rd Battalion, 5th Infantry marching through Forest Park

- On 7 April 1918, a Liberty Parade and Mass Meeting was held at Art Hill in Forest Park.

- Fourth of July celebrations were held on Art Hill during World War I. These were of a patriotic nature and included the presence of the Armed Forces.

- In September of 1926, the City of St. Louis held the St. Louis Exposition. As part of the Exposition, Army troops from Jefferson Barracks, would present a mock World War I battle daily. On opening day, 4 September 1926, there was to be a parade and exploding of 13 bombs to start the afternoon festivities. On 12 September 1926 an Army Dirigible was to land at the Exposition. During the Exposition, complaints were made concerning the loud retort of the "French" 75mm cannons. The Officer in Charge of the Battery agreed to reduce the charges for the remainder of the Exposition. After the Exposition, the area was cleared of buildings and debris. The entire field was then plowed and re-seeded for use the following spring for baseball games.

- In 1940, after the start of World War II, Fourth of July celebrations were held on Art Hill to demonstrate their patriotism. These were similar to the celebrations held during World War I. The parade included veterans of both Union and Confederate armies.

- On 4 July 1942, more than 5,000 troops came to Forest Park from Fort Leonard Wood to participate in a Fourth of July parade and a rally held in Forest Park. Many of the men camped in or near the Park.

- On 8 August 1943, a mock battle took place around the Art Hill area of Forest Park, with soldiers from Jefferson Barracks. This mock battle included 350 soldiers, amphibious jeeps, a smoke screen, and a final assault up Art Hill. Prior to the public demonstration, the soldiers were encamped in a 15-acre bivouac area.

- In July 1942, the Army was granted permission to use 17 acres in the southeastern corner of Forest Park for a recreation camp. The camp accommodated approximately 1,500 men and was to operate for the duration of the war. By 1947, the Camp was abandoned and contracts were made by the government to restore the southeast corner of the park. By 1 July 1948, restoration was completed and formal acceptance of the property was given to the government.

- On May of 1988, workers installing a sprinkler system on the 3rd fairway of
  the 9th hole course, dug up a live 3" phosphorus Stokes Mortar round. The workers thought the mortar round was a remnant from the 1904 Worlds

Fair. The round was given to a Mr. Raymond Sloan, who thought it was a type of time capsule. The next week Mr. Sloan tried opening the round and caused the phosphorus to ignite. The Maplewood Fire Department responded and was able to contain the phosphorous by burying the round. Army Captain Hank Counts of the Granite City, Illinois Support Center, 50th Explosive Ordnance Disposal Detachment responded to the incident. He recovered the round and disposed of it. He examined the site of the digging and visually noticed what appeared to be fragments of other rounds.

- In April 1994, the OE Risk Assessment was done.
- July 1995, the INPR was done with a Risk Assessment Code (RAC) score of 2.
- September 1997, the ASR was done. Changing the RAC score to a 1.
- September 2001, Army Corps of Engineers (ACOE) performed construction support for the golf course renovation.
- December 2001, a 3" or 4" stokes mortar was found by a bulldozer worker who was moving dirt. The police removed the round and it was later found to contain (WP).
- May 2002, a 3" or 4" stokes mortar was excavated by an irrigation trenching machine from 18" deep. The round was empty, but was presumed by the police department to contain WP.
- June 2002, a 4" stokes mortar was found, police took off site.
- July 2002, a construction worker excavated a Livens Projector during renovation work at the Grand Basin. The item was determined to be empty by the St. Louis Police Department Bomb and arson Squad.

3.0 SPECIFIC REQUIREMENTS

3.1 (Task 1) Site Visit & Records Review

The contractor will perform a review of pertinent documents to include the INPR, the ASR, interview personnel knowledgeable with site conditions and perform a site visit. The contractor shall coordinate with the Kansas City Corps of Engineers Project Manager (Josephine Newton-Lund, 816-983-3912) at least seven (7) days in advance of the site visit. The site visit team shall include at the minimum the contractor's Project Manager (PM) and an UXO-qualified person. The objective of the site visit is for the contractor team to gain familiarization with the site in general and to gather information required to put together an acceptable and executable proposal and work plan. The contractor is responsible for communicating with the regulators to receive Applicable or Relevant, and

Appropriate Requirements (ARAR's). The contractor shall prepare an Abbreviated Site Safety and Health Plan (ASSHP) and submit the plan to the Contracting Officer for review and approval prior to the visit. The ASSHP is a brief, fill-in-the-blank format, and may be obtained from Engineering Pamphlet 1110-1-18 (dated 24 April 2000) Appendix H. The contractor shall ensure that the site visit is fully coordinated and that all members of the site visit team maintain compliance with the ASSHP. The contractor shall also coordinate with the local points of contact (POC) prior to the site visit. The primary POC for Forest Park for this work is Josephine Newton-Lund.

3.2 (Task 2) Project Work Plan

The Contractor shall prepare a site specific Work Plan describing how all subsequent work required under this contract is to be performed. The Work Plan shall be prepared in accordance with DID OE-001.01 (Type II Work Plan). The Work Plan shall describe the specific work proposed in order to meet the objectives and requirements of this SOW. The Work Plan shall also describe (in specific terms) the policies, organization, objectives, functional activities, Site Specific Health and Safety Plan, Data Management and specific Contractor quality control (QC) activities required to achieve the objectives for this project. The Contractor shall propose and justify methods and procedures that are well suited to the anticipated site conditions. The Contractor shall consider technical requirements for site characterizations as well as safety, security, and environmental regulations applicable to this site. The Work Plan shall describe the goals as stated in Section 1, methods, procedures, and personnel used for data gathering activities. A resource-loaded schedule in Microsoft Project format shall be included in digital form with the Project Work Plan submittal. The work plan shall not include a Sampling and Analysis Plan (Chapter 10) nor and Investigative Derived Waste Plan.

3.3 (Task 3) Location Surveying.

The Contractor shall perform all location surveys and mapping required to establish boundaries of areas. All location surveying and mapping shall be performed in the Missouri Plane Coordinate System, NAD 83 Datum, in US Survey feet. All surveying and mapping data and final drawings shall be submitted to CENWK on PC CD-Rom media, and be compatible with the current Tri-Service Spatial Data Standard and the OE-GIS for OE-Applications, the specifications for which are listed in DID OE-005-07.01.

3.4 (Task 4) Prepare an EE/CA Report

A Pre Draft, Draft Final, and Final EE/CA Report will be prepared in accordance with DID OE-010.01. The OERIA will be used for risk assessment on this site. This methodology is detailed in the USAESCH OE-CX Interim Guidance document, 01-01, dated 27 March 2001,"Ordnance and Explosives Risk Impact Assessment." The Draft EE/CA Report version will be for USACE review only. This report will use data already gathered. The Draft, Draft Final, and Final

EE/CA Report will be prepared in accordance with DID OE-010.01. The EE/CA Report will also include a summary of the recommendations and costs for response actions. Part of the report will include the Technical Project Planning (TPP) requirements to include a Conceptual Site Model (CSM). The contractor will perform an intuitional analysis in accordance with (IAW) DID OE-100.01, DID OE-001.01, and EP 111-1-24.

3.5 (Task 5) Prepare a Record of Decision/Action Memorandum
A Draft and Final Record of Decision (ROD)/Action Memorandum will be prepared IAW EP 1110-1-18, Ordnance and Explosive Response.

3.6 (Task 6) Community Relations Support
The contractor will attend and participate in an EE/CA public meeting as directed by the Contracting Officer (CO). The support will include preparation and delivery of briefings, graphics and presentations, and participation in site visits. The contractor will develop an educational class on OE found at the site for release to all stakeholders and the city. This will be a PowerPoint presentation and a fact sheet explaining what the OE looks like, what to do and who to call in the event OE is found.

3.7 (Task 7) Project Management
The contractor shall perform project management functions as necessary to maintain project control and to meet required reporting requirements.

3.8 (TASK 8) Prepare a Memorandum of Agreement
Prepare a memorandum of agreement between the city of St Louis outlining the roles and responsibilities of both the City of St Louis and the Corps of Engineers to include the liability of the site, the deed restrictions, and any other pertinent information. This shall be prepared as a stand-alone document to be submitted in both paper and electronic form.

3.9 (Task 9) Prepare and Submit and Explosive Safety Submission (ESS)
If the Action Memorandum decision is for no further action (NOFA) or Institutional Controls, the contractor shall, prepare an ESS for coordination and approval by the Department of Defense Explosive Safety Board. Due to the approval process the contractor will expedite the completion of the ESS to the maximum extent possible. The contractor shall use the format specified in EP 385-1-95b.

3.10 Contractor Qualifications
The Contractor shall furnish a staff that is qualified through education, training, and pertinent experience that shall accomplish the objectives and tasks of this SOW IAW DID: OE-025.01 of the Contract. The resumes shall be included in the Work Plan for approval by the contracting Officer. If UXO personnel are substituted at the project site, then their resumes will be provided to the OE Safety Specialist 1 week prior to mobilization and be approved by the Contracting Officer.

4.0 Submittals and Correspondence

4.1 Format and Content of EE/CA Reports

An EE/CA Report presenting all data, analyses, and recommendations shall be prepared and submitted by the contractor. All drawings shall be of engineering quality in drafted form with sufficient detail to show interrelations of major features. When drawings are required, data may be combined to reduce the number of drawings. Data such as scanned photos, or annotated Computer aided design and drafting (CADD) and geophysical data shall be provided to accurately document field activities. Work areas shall be represented either by outlining the limits on a coincident CADD file representing the area or by a scanned hard copy map. Reports shall consist of 8-1/2 inch by 11-inch pages with drawings folded, if necessary, to this size. A decimal paragraphing system shall be used, with each section and paragraph of the reports having a unique decimal designation. The report covers for each submittal shall consist of durable 3-ring binders and shall hold pages firmly while allowing easy removal, addition, or replacement of pages. A report title page shall identify, the contractor, Preliminary Survey, Site Inspection, Surveying and Geophysical Mapping at Forest Park, St. Louis, and the date. The contractor identification shall not dominate the title page. All data, including raw analytical and electronic data, generated under this task order are the property of the DoD and CENWK has unlimited rights regarding their use. A complete electronic copy of reports shall be provided in Adobe Acrobat (PDF) format and shall be furnished on CD-Rom disk. Text files shall be in Microsoft WORD, data files in Microsoft EXCEL and/or ASCII format, schedules in Microsoft PROJECT, and drawings and photos in JPEG or TIFF format. These base files shall be used and referenced in the development of detailed grid files for draft and final submittals.

4.2 Review Comments

Various reviewers will have the opportunity to review submittals made by the contractor under this Contract. The contractor shall review all comments received through the CENWK PM and evaluate their appropriateness based upon their merit and the requirements of the SOW.

4.3 Draft Reports

Each page of draft reports shall be stamped "DRAFT". Submittals shall include incorporation and notation of all previous review comments accepted by the contractor.

4.4 Identification of Responsible Personnel

Each report shall identify the specific members and title of the contractor's staff and contractors that had significant, specific input into the reports' preparation or review.

4.5 Presentations

It is anticipated that one meeting to present the project recommendations will occur.

4.6 Correspondence

The contractor shall keep a record of each phone conversation and written correspondence affecting decisions relating to the performance of this Task Order (TO). A summary of the phone conversations and written correspondence shall be submitted with the monthly progress report to the Contracting Officer.

4.7 On-Site Coordination

The contractor shall keep the Contracting Officer's on-site representative informed of day-to-day field activities occurring on site. Where contractor activities are likely to require coordination with other various activities at the site, the contractor shall notify Kansas City Corps of Engineers PM ahead of time to allow for coordination activities to take place.

4.8 Public Affairs

The contractor shall not publicly disclose any data generated or reviewed under this TO. The Contractor shall refer all requests for information concerning site conditions to the CENWO Public Affairs Office (PAO). Reports and data (including all digital data) generated under this Contract are the property of DoD and distribution to any other source by the contractor, unless authorized by the Contracting Officer, is prohibited. All press releases and media appearances shall be coordinated with, and approved by the U.S. Army corps of Engineers, Kansas City District (CENWK) Public Affairs Office (PAO).

4.10 Addresses

The following addresses shall be used in mailing submittals to include 1 electronic copy on compact disk:

ADDRESSEE	Pre/Draft Reports	Final Reports
Commander US Army Corps of Engineers, Kansas City District ATTN: CENWK-EC-EB (Josephine Newton-Lund) 601 East 12th St, Room 610 Kansas City, MO 64106-2896	4	4
Commander US Army Corps of Engineers, Omaha District ATTN: CENWO-PM-HC (Mr. Joe Slattery) 106 S. 15th Street Omaha, NE 68102	6	6
Commander US Army Corps of Engineers, Huntsville ATTN: CENHC-OE-CX (Patricia Berry) P.O. Box 1600	1	1

Huntsville, AL 35807-4301

(The following reports will be furnished to the above address; EE/CA report, Action Memorandum, and the Explosive Safety Submission 4 copies)

4.11 Schedule and Submittals

4.11.1 The contractor shall submit a schedule based on the following proposed requirements. All submittals shall be delivered to all addressees no later than the close of business (COB) on the day indicated in this paragraph.

	DOCUMENT	DATE DUE
1.	ASSHP	At least 3 days prior to site visit
2.	Draft Work Plan	15 days after Notice to Proceed (NTP)
3.	Completed Work Plan	7 days after receipt of comments
4.	Weekly Report	First day of each week
5.	Pre Draft Final Report	15 days after data collection activities
6.	Pre Draft Explosive Safety Submission	15 days after data collection activities
	Pre Draft Memorandum of Agreement	15 days after data collection activities
7.	Draft Final Report	7 days after comment period
8.	Draft Explosive Safety Submission	7 days after comment period
9.	Draft Memorandum of Agreement	7 days after comment period
10.	Completed Final Report	15 days after public comment period
11.	Completed Explosive Safety Submission	15 days after public comment period
	Completed Memorandum of Agreement	15 days after public comment period
12.	Monthly Report	No later than (NLT) the 10th of the following month
13.	Minutes of Meeting	NLT 10 days after each meeting
14.	*Overall completion date*	*30 SEP 2004*

4.11.2 **Quantity of Submittals**

The submittals (with quantity noted) will be delivered to addressees listed in Section 4.10 and according to the schedule shown in Section 4.11.

5.0 References

10 U.S.C. 2701, Defense Environmental Restoration Program

29CFR 1910, Occupational Safety and Health Administration (OSHA) General Industry Standards, and 29CFR 1926, Construction Industry Standards; especially:

29CFR 1926.120/29CFR 1926.65 - Hazardous Waste Site Operations and Emergency Response

40CFR 300, National Contingency Plan

NIOSH/OSHA/USCG/EPA (DHHS (NIOSH) Publication #85-115) (OCT 85), Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities

ER 385-1-92, Appendix B (18 Mar 94), US Army Corps of Engineers Safety and Occupational Health Document Requirements for Hazardous Toxic and Radioactive Waste (HTRW) and Ordnance and Explosive Waste (OE) Activities

Federal Acquisition Regulation (FAR) Clause 52.236.13, Accident Prevention

EP 1110-1-18 (24 Apr 00) Ordnance and Explosive Response

EP 1110-1-18, Ordnance and Explosives Response, 24 April 2000

EM 385-1-1 (3 NOV 03), US Army Corps of Engineers Safety and Health Requirements Manual

EP 1110-3-8, Public Participation in DERP FUDS, 1 December 1999

EM 200-1-2, Technical Project Planning (TPP) Process, 31 August 1998

EM 1110-1-4009, Engineering and Design, Ordnance and Explosives Response, 23 June 2000

CEHND 1105-3-14 (Jun 94), Standing Operating Procedures for Developing Ordnance and Explosive (OE) Waste-Related Contracts

USAESCH OE-CX Interim Guidance document, 01-01, dated 27 March 2001

USACESCH OE-CX Implementation of Technical Project Planning (TPP)
For Ordnance and Explosives (OE) Formerly Used Defense Sites (FUDS) Projects

Applicable Data Item descriptions
DID OE-001.01 Type I Work Plan
DID OE-005-02.01 Technical Management Plan
DID OE-005-03.01 Explosives Management Plan
DID OE-005-06.01 Site Safety and Health Plan
DID OE-005-07.01 Location Surveys and Mapping Plan
DID OE-005-08.01 Work, Data, and Cost Management Plan

DID OE-005-09.01 Property Management Plan
DID OE-005-10.01 Sampling and Analysis Plan
DID OE-005-11.01 Quality Control Plan
DID OE-005-12.01 Environmental Protection Plan
DID OE-010.01 Engineering Evaluation/Cost Analysis (EE/CA) Report
DID OE-015.01 Accident/Incident Reports
DID OE-025.01 Personnel and Work Standards
DID OE-030.01 Site Specific Final Report
DID OE-040.01 Disposal Feasibility Report
DID OE-045.01 Report/Minutes, Record of Meetings
DID OE-055.01 Telephone Conversations/ Correspondence Records
DID OE-060.01 Conventional Explosives Safety Submissions (ESS)
DID OE-080.01 Monthly Status Report
DID OE-085.01 Weekly Status Report
DID OE-100 Analysis of Institutional Controls
DID OE-110.01 Recurring Review Plan

APPENDIX B

SITE MAP

Site Map will be provided after Site Visit is completed.

APPENDIX C

LOCAL POINTS OF CONTACT

Name	Phone	Address	E-Mail
Josephine M. Newton-Lund	816-983-3912 Fax 5550	US Army Corps of Engineers, Kansas City District 601 East 12th Street, Kansas City, MO 64106-2896	Josephine.M.Newton-Lund@usace.army,mil
Joseph M. Slattery	402-221-7674 Fax 7796	* CENWO-PM-HC	Joseph.M.Slattery@usace.army.mil
Glenn Marks	402-221-7683 Fax 7769	*CENWO-ED-GI	Glenn.Marks@usace.army.mil
Mark R. Meacham	402-221-7695	*CENWO-ED-GC	Mark.R.Meacham@usace.army.mil
Mark Anderson	402-221-7692	*CENWO-ED-GI	Mark.D.Anderson@usace.army.mil
Thomas Tracey	402-221-3746	*CENWO-OC	Thomas.J.Tracey@usace.army.mil
Anabeth Calkins	314-289-5330	Dept of Parks and Recreation, City of St. Louis,MO 63110	
Jeff Raffelson		Forest Park Golf Course	
Dan Esarey	314-655-5240	Building Operations Manager, St. Louis Art Museum, Forest Park 1 Fine Arts Drive St. Louis, MO 63110	
Stephen Sorocko	314-591-4202	St. Louis Police Department Bomb and Arson Section, 1200 Market Street St. Louis, MO 63103	
Roger Allison	314-622-3535	Chief Design Engineer Board of Public Service City of St. Louis, City Hall, Room 301, 1200 Market Street St. Louis, MO 63103	
Will Bonneau	402-221-7830	CENWO-PM-A	William.F.Bonneau@usace.army.mil
Judith Meier	816-983-3363	CENWK-PM-ED	Judith.a.Meier@usace.army.mil
Mark Ort	573-751-1968	Missouri DNR Hazardous Waste Program PO Box 176, Jefferson City, MO 65102	
Forest Park Golf Course	314-367-1337	Forest Park St. Louis, MO	

APPENDIX D

Technical Project Planning Sheets

US Army Corps of Engineers ®
Omaha District

Phase I MFR Worksheet

Forest Park Recreation Camp
St. Louis, MO
EE/CA

Author: Marc Anderson
Latest revision date: 3 Feb 04
Reviewer:
Review date:

TPP Team		
Customer	Kansas City District (CENWK)	Josephine Newton-Lund
Project Manager	Omaha District (CENWO)	Joe Slattery
Regulators	Missouri Department of Natural Resources	Mark Ort
	U.S. EPA Region 7	Diana Bailey
Stakeholders	St. Louis City Department of Parks Recreation & Forestry	Dan Skillman 5600 Clayton Road St. Louis, MO 63110
	St. Louis City Police Department Bomb Squad*	
	St. Louis District (CEMVS)	Mike Dace
	Forest Park Golf Course	5591 Grand Drive St. Louis, MO 63112 314-367-1337
	The Muny	Municipal Theatre Association Forest Park St. Louis, Missouri 63112 (314)361-1900
	St. Louis Science Center	5050 Oakland Avenue St. Louis, MO 63110
	St. Louis Art Museum*	Forest Park 1 Fine Arts Drive St. Louis, Missouri 63110 (314) 721-0072
	Missouri Historical Society	Lindell and DeBaliviere P.O. Box 11940 St. Louis, MO 63112-0040 (314) 454-3150 info@mohistory.org
	St. Louis Zoo	One Government Drive St. Louis, MO 63110 In St. Louis: (314) 781-0900 Toll-free: (800) 966-8877

TPP Team		
	Cabanne House	The Saint Louis Ambassadors
	Kennedy Woods Prairie/Savanna Project	
	Forest Park Forever	Dennis & Judith Jones Visitor and Education Center 5595 Grand Drive in Forest Park St. Louis, MO 63112 314-367-7275 lagood@forestparkforever.org
	Board of Public Service City of St. Louis*	Roger Allison, PE Chief Design Engineer City Hall Rm 301 1200 Market Street St. Louis, MO 63103 314-622-3535
Data Types	Data User	Data Gatherer
Compliance/Regulatory (CR)	CENWO, CENWK, CEMVS, Regulators	CENWO
Demographics/Land Use (LU)	CENWO, CEMVS	CENWO
Site Conditions (SC)	CENWO, CEMVS	CENWO
OE/UXO (UXO)	CENWO	CENWO

Customer's Goals		
Land Use(s)	Issues and Regulatory Compliance Status	Site-specific Closeout Goal (if applicable)
Understand the effect of OE present at the site		
Identify appropriate response actions to discovered OE		
Reduce OE hazard and allow public access to the site		
		Achieve Project Close Out.
		Identify long term monitoring procedures as outlined in a MOA with the City of St. Louis

Customer's Goals		

Site Closeout Statement

Customer's Schedule Requirements
Complete Engineering Estimate/Cost Analysis (EE/CA), Action Memorandum, and Explosives Safety Submission (ESS) by EOFY 04

Customer's Site Budget
$203,184.95

Identify Site Approach		
Existing Site Information & Data		
Attachment(s) to Phase I MFR	Located at Repository	Preliminary Conceptual Site Model
Inventory Project Report (INPR)	Not yet	No
Archives Search Report (ASR)	Not yet	No
Project Delivery Team Charter	Not yet	No

Potential Points of Compliance
Subsurface Soil located at the lower nine holes of the newly renovated golf course

Media of Potential Concern
Surface soil
Subsurface soil

Site Objectives
• to characterize the nature, location, and concentration of Munitions and Explosives of Concern (MEC) provide a description of the MEC related problems affecting human use of the site • identify and analyze reasonable risk management alternatives • recommend a proposed alternative for this particular site • seek public comments, and participation • Establish information repository near project site • provide a convenient record of the process for use in final decision making and judicial

Identify Site Approach
review, if necessary.
•
•
•

Regulator and Stakeholder Perspectives		
Regulators	Community Interests	Others
	Land is safe for intended use	
	City entities don't suffer because of uncertainty about OE risk and EE/CA process	
	Recurring reviews interrupt city entities' operations	

Probable Remedies
MOA between USACE and St. Louis City
Training for groundskeepers and construction workers
Literature handout for public visitors
Yearly Site Inspections
Five year review

Executable Stages to Site Closeout
Engineering Estimate/Cost Analysis (EE/CA)
Action Memorandum
Explosives Safety Submission (ESS)
Residual Risk Management Plan

Identify Current Project
Administrative Constraints and Dependencies
Funding
Public involvement
Quick schedule
Technical Constraints and Dependencies

Identify Current Project		
All property publicly accessible and developed for current land use		
Legal and Regulatory Milestones and Regulations		
Compliance with NCP, DERP, Munitions Rule		
Current Executable Stage		
EE/CA		
Basic (for current projects)	Optimum (for future projects)	Excessive (objectives that do not lead to site closeout)

US Army Corps of Engineers®
Omaha District

Phase II-III TPP Worksheets

Forest Park Recreation Camp
St. Louis, MO
EE/CA

Author: Marc Anderson
Latest revision date: 9 Feb 04

Reviewer:
Review Date:

Data Quality Object Worksheet	
DQO Statement Number	1 Survey the site
Intended Data Use (Which project objective(s) will be satisfied?)	Spatially identify the Forest Park Golf Course, Art Hill, and the borrow area
Data need requirement (What data do you need to collect?)	Class I, Third Order or better based on the North American Datum of 1983 and the Universal Transverse Mercator Grid System, IAW with DID OE-005-07.01
Data Classification (basic, optimal, excessive)	Basic: walk about with hand-held GPS and historical maps/aerial photography Optimal: obtaining digital Park maps from St. Louis City Optimal: Trimble GPS survey Excessive: technical survey
Data Quantity (How much data is enough)	Boundaries of the Golf Course, Art Hill, borrow/fill area, and the former Recreation Camp
Data Collection Method (How will this data be collected?)	Obtaining digital Park maps from St. Louis City
Was DQO attained?	
Where is supporting data maintained?	

Data Quality Object Worksheet	
DQO Statement Number	2 Collect historical information
Intended Data Use (Which project objective(s) will be satisfied?)	Write EE/CA report, Memorandum of Agreement between USACE and St. Louis City, and Explosives Safety Submission
Data need requirement (What data do you need to collect?)	Historical information concerning past DoD activities and other activities that may have resulted in OE left in the Park Coordinate with Stakeholders to establish memorandum of agreement and to closeout site

Data Classification (basic, optimal, excessive)	Basic: review ASR, INPR, historical photographs, and newspaper and government documents Optimal: interviews with experts, stakeholders, and historians Excessive: interviews with members of the public with no connection to Forest Park Excessive: traveling to National Archives to conduct research
Data Quantity (How much data is enough)	TBD
Data Collection Method (How will this data be collected?)	Onsite interviews • Golf course supervisor • St. Louis Police bomb squad • St. Louis City Department of Parks Recreation & Forestry • Missouri Historical Society • St. Louis District USACE Records searches • St. Louis City maps • Forest Park Master Plan • Washington University archives • Missouri Historical Society archives • As-built construction diagrams for land improvements on Park • USGS aerial photographs • Washington DC National Archives
Was DQO attained?	
Where is supporting data maintained?	

Data Quality Object Worksheet	
DQO Statement Number	3 Public participation
Intended Data Use (Which project objective(s) will be satisfied?)	Approve EE/CA and write an Action Memorandum
Data need requirement (What data do you need to collect?)	Information about Park history involving military forces not available in information repositories we research Public approval of government actions and decisions regarding former DoD activities at the Park
Data Classification (basic, optimal, excessive)	Basic: newspaper advertisement for a public meeting Optimal: individual contact with known experts and facility operators Excessive: hotlines, webpages, and television advertisement
Data Quantity (How much data is enough)	TBD

Data Collection Method (How will this data be collected?)	individual inquiry with known experts and facility operators; newspaper advertisement for a public meeting
Was DQO attained?	
Where is supporting data maintained?	

APPENDIX F

OERIA DISCUSSION FOR FOREST PARK

Ordnance and Explosives Risk Impact Assessment

OERIA provides a method of risk assessment that is more easily understood by, and communicated to, stakeholders. The use of statistically based risk assessment techniques has often caused difficulty in stakeholder communications concerning risk and the role risk plays in comparing response alternatives and selecting a response action. The three steps in the OERIA process are 1, review base factors and identify additional factors to assess; 2, develop baseline risk assessment; and 3, assess the response alternatives. Steps one and two are presented here, and step three will be presented in the EE/CA report.

Base Factors

OE base factors include the type, sensitivity, quantity or density, and depth. The ASR and other sources document the discovery and subsequent initiation of a 3" Phosphorus Stokes Round unearthed during the placement of a new water sprinkler system in 1988. The round was found on the #3 fairway of the nine hole golf course and may have come from one of the many public demonstrations held in and around the Art Bill area. There is also evidence that 75mm Cannon Salute or Blank rounds were used in the various salutes and public demonstrations at Forest Park. Both are considered type category 2 for the OERIA, OE that will cause major injury if detonated. White phosphorus is very sensitive and reacts violently when exposed to air and is sensitivity category 3; cannon blank rounds have little residual risk even if they malfunctioned and are sensitivity category 1. The paucity of OE discovered at the park suggests few pieces, if any, remain on the site. Other OE base factors include site accessibility and stability characteristics. Forest Park was established by the City of St. Louis in 1876 as a public park. The long term future use will continue to be that of a large public park. Access to the park is generally unrestricted. The entire park is improved for human use. All areas are maintained and it is unlikely that any undiscovered surface OE exists or that subsurface OE will be unearthed by anything less than catastrophic natural events. Future human activities such as road or building construction may expose subsurface OE.

Human factors that contribute to the risk impact assessment are site activities and population. Forest Park attracts more than 12 million visitors a year. Attractions at the park include the region's major cultural institutions—the Zoo, Art Museum, History Museum, Science Center, and the Muny Opera. Forest Park also serves as a sports center for golf, tennis, baseball, bicycling, boating, fishing, handball, ice skating, roller blading, jogging, cricket, rugby and more. Monuments, historic buildings, wildlife, waterways, and landscapes combine to form a cultural institution that is important to the entire St. Louis region. General public activities are classified recreational and include the Art Museum and Grand Basin waterway in the area of Art Hill, and golfing and biking in the area of the former Army Recreation Camp. Hundreds of people work at the park maintaining and operating the park facilities and are classified occupational activities. People working at the park temporarily constructing also engage in occupational exposure to OE hazard.

Baseline Risk Assessment

No additional factors are considered for this assessment. The table below summarizes the base factors used to assess the OE risk as Forest Park. Alternatives identified during technical project planning are included but not assessed. They will be evaluated, along with other alternatives identified, if any, and included in the EE/CA report.

	Ordnance				Site		Human	
Alternative	Type	Sensitivity	Density	Depth	Access	Stability	Activity	Population
Baseline	2	3 – white phosphorus mortar 1 – 75 mm cannon blank	.001	12"	Few restrictions	Stable	Significant recreational and occupational	> 1 million per year
MOA between USACE and St. Louis City								
Training for groundskeepers and construction workers								
Literature handout for public visitors								
Five year review								

The baseline and the alternatives will be ranked alphabetically A through E in order of ability to achieve the most reduction in OE risk posed by the site. If additional alternative or combinations of alternatives are identified, they too will be ranked giving an overall qualitative order of effectiveness of each alternative. The ranking will be published in the EE/CA report and provided for all stakeholders to evaluate.

APPENDIX I

PERSONAL INTERVIEW QUESTIONAIRES

Questions for Forest Park interviews

1. Do you know of any past military activity/uses of Forest Park?
   No

2. Do you have records of construction activities that have occurred in Forest Park (as builts, cut and fill diagrams, etc.)?
   No

3. Have you seen any military ordnance or munitions (frag, souvenirs) in Forest Park and if so where (approximate location on a map, how deep, etc.)?
   No
   a. Can you describe the munition and draw a picture?
      N/A
4. Do you know of any other environmental concerns that can be attributed to the military?
   No
5. Do you know of anyone who has been impacted by the past military use of Forest Park?
   No
6. Additional Information

Provided by Dan Esarey, Building Operations Manager, St. Louis Art Museum, Feb 24, 2004

Questions for Forest Park interviews

7. Do you know of any past military activity/uses of Forest Park?
   Yes, see incident reports

8. Do you have records of construction activities that have occurred in Forest Park (as builts, cut and fill diagrams, etc.)?
   No

9. Have you seen any military ordnance or munitions (frag, souvenirs) in Forest Park and if so where (approximate location on a map, how deep, etc.)?
   Yes, see incident reports
   a. Can you describe the munition and draw a picture?
      N/A
10. Do you know of any other environmental concerns that can be attributed to the military?
    No
11. Do you know of anyone who has been impacted by the past military use of Forest Park?
    No
12. Additional Information

Provided by Michael P. Wuellner, St. Louis City Police Department Bomb and Arson Squad, Feb 23, 2004

Questions for Forest Park interviews

13. Do you know of any past military activity/uses of Forest Park?
    No

14. Do you have records of construction activities that have occurred in Forest Park (as builts, cut and fill diagrams, etc.)?
    Yes, Jeff showed us the Golf course cut and fill diagrams. USACE was directed to contact David Mason Engineering for the Forest Park Master Plan Implementation maps if so desired.

15. Have you seen any military ordnance or munitions (frag, souvenirs) in Forest Park and if so where (approximate location on a map, how deep, etc.)?
    No
    a. Can you describe the munition and draw a picture?
       N/A
16. Do you know of any other environmental concerns that can be attributed to the military?
    No
17. Do you know of anyone who has been impacted by the past military use of Forest Park?
    No
18. Additional Information
    Jeff was very interested in educating his workers on identifying ordnance and explaining the dangers associated with the ordnance previously found at the golf course. The workers at the golf course have been given some instruction on the possible presence of ordnance at this site.

Provided by Jeff Raffelson, Senior Manager, American Golf Corporation, Feb 24, 2004

Questions for Forest Park interviews

19. Do you know of any past military activity/uses of Forest Park?
    Everything I know about past military use of Forest Park I learned from previous Corps of Engineers reports!

20. Do you have records of construction activities that have occurred in Forest Park (as builts, cut and fill diagrams, etc.)?
    Yes, contact Mr. Mike Seemiller of my office (314) 589-6628

21. Have you seen any military ordnance or munitions (frag, souvenirs) in Forest Park and if so where (approximate location on a map, how deep, etc.)?
    Not personally
    a. Can you describe the munition and draw a picture?

22. Do you know of any other environmental concerns that can be attributed to the military?
    No
23. Do you know of anyone who has been impacted by the past military use of Forest Park?
    No
24. Additional Information

Provided by Roger B. Allison P.E., Chief Engineer, Design Division, Board of Public Service, City of St. Louis
Feb 13, 2004

APPENDIX J

INCIDENT REPORTS

RPIR1000 ST.LOUIS METROPOLITAN POLICE DEPARTMENT CMPLT # 02087667
07/16/02 POLICE INCIDENT REPORTING SYSTEM
INCIDENT REPORT

I N C I D E N T

Incident Type: 995200 RECOVERED ARTICLE
Complaint # Status: NOT APPLICABLE
Orig./Supplement: ORIGINAL
Dist/Precinct/Beat: 99 999 9999
Day of Week: THU
Date of Occurrence: 07/11/2002 to 07/11/2002
Time of Occurrence: 09:30 to 09:30
Location Name: FOREST PARK
Street: 6400 LAGOON DR
City/State: ST. LOUIS MO
Invst Followup(Y/N):N
Assignment:
Date: 07/11/2002
Time: 09:45
Asgmt. Code: 432 Car No: 4377
DSN/Officer: 3395 MICHAEL WUELLNER
Assisted by: 5353 ANTHONY WEIDLER

ANY WEAPONS DISCHARGED BY AN OFFICER(Y/N)? N

Summary: A "LIVENS" SMOKE PROJECTILE WAS UNCOVERED JUST WEST OF THE GRAND BASIN IN FOREST PARK BY CONSTRUCTION WORKERS. THE PROJECTILE HAD BEEN PREVIOUSLY FUNCTIONED AND THE INTERIOR CONTENTS APPEARED TO BE DIRT. THE PROJECTILE WAS REMOVED BY MEMBERS OF THIS UNIT AND WILL BE DESTROYED AT A LATER DATE. THE PROJECTILE HAD BEEN LEFT THERE FROM MILITARY TRAINING IN THE EARLY 1900'S.

Prepared by:

Detective Michael Wuellner, DSN 3395/432
Bomb and Arson Section

Sergeant Stephen Sorocko, DSN 6155
Supervisor
Bomb and Arson Section

ch/2115

INCIDENT REPORT

I N C I D E N T

Incident Type: 995200 RECOVERED ARTICLE
Complaint # Status: INACTIVE
Orig./Supplement: ORIGINAL
Dist/Precinct/Beat: 09 911 9232
Day of Week: THU
Date of Occurrence: 06/20/2002 to 06/20/2002
Time of Occurrence: 14:00 to 14:00
Location Name:
Street: 41 FOREST PARK
City/State: ST. LOUIS MO
Type of Premises: PARK
Invst Followup(Y/N):N
Assignment:
Date: 06/20/2002
Time: 14:00
Asgmt. Code: 432 Car No: 4377
DSN/Officer: 3395 MICHAEL WUELLNER
Assisted by: 2578 RICHIE WILLIAMS

ANY WEAPONS DISCHARGED BY AN OFFICER(Y/N)? N

Summary: A 4 INCH STOKES MORTAR ROUND WAS UNCOVERED IN FOREST PARK, JUST NORTH OF THE GRAND BASIN. THE ROUND WAS REMOVED AND DETONATED REMOTELY. UPON DETONATION, A CLOUD OF WHITE PHOSPHORUS WAS EXPELLED. THE ROUND WAS APPARENTLY LEFT THERE DURING MILITARY EXERCISES FROM THE 1920'S. NO INJURIES WERE REPORTED.

V I C T I M

NAME: LAST CITY OF ST. LOUIS

DOMESTIC INCIDENT: NO
BIAS INCIDENT: NO

RPIR1000
05/25/02

ST.LOUIS METROPOLITAN POLICE DEPARTMENT CMPLT # 02063743
POLICE INCIDENT REPORTING SYSTEM
INCIDENT REPORT

I N C I D E N T

Incident Type: 995200 RECOVERED ARTICLE
Complaint # Status: NOT APPLICABLE
Orig./Supplement: ORIGINAL
Dist/Precinct/Beat: 02 211 2211
Day of Week: WED
Date of Occurrence: 05/15/2002 to 05/15/2002
Time of Occurrence: 08:00 to 09:00
Location Name: FOREST PARK Ngh: FOREST PARK
Street: 41 FOREST PK
City/State: ST. LOUIS MO 63112
Type of Premises: PARK
Invst Followup(Y/N): N
Assignment:
Date: 05/15/2002
Time: 09:00
Asgmt. Code: 432 Car No: 4377
DSN/Officer: 3395 MICHAEL WUELLNER
Assisted by: 2578 RICHIE WILLIAMS

ANY WEAPONS DISCHARGED BY AN OFFICER(Y/N)? N

Summary: A 4 INCH "STOKES" MORTAR ROUND WAS UNCOVERED IN FOREST PARK DURING TRENCHING ACTIVITIES BY CONSTRUCTION WORKERS. THE MORTAR'S INITIATORS/FIRING MECHANISM HAD BEEN MISSING. THE MORTAR ROUND WAS REMOVED FROM FOREST PARK BY THE MEMBERS OF THE BOMB AND ARSON UNIT AND DISPOSED OF PROPERLY.

V I C T I M

NAME: LAST CITY OF ST. LOUIS

DOMESTIC INCIDENT: NO
BIAS INCIDENT: NO

Respectfully,

Detective Michael Wuellner, DSN 3395
Bomb and Arson Unit

Detective Sergeant Stephen Sorocko, DSN 6155
Supervisor
Bomb and Arson Unit
Bureau of Criminal Investigations

vdh/2109

RPIR1000
02/15/02

ST.LOUIS METROPOLITAN POLICE DEPARTMENT
POLICE INCIDENT REPORTING SYSTEM
INCIDENT REPORT

CMPLT # 02020192

~~02-065113~~

I N C I D E N T

Incident Type: 995200 RECOVERED ARTICLE
Complaint # Status: INACTIVE
Orig./Supplement: ORIGINAL
Dist/Precinct/Beat: 02 211 2212
Day of Week: WED
Date of Occurrence: 12/05/2001 to 12/05/2001
Time of Occurrence: 14:00 to 14:00
Location Name: FOREST PARK Ngh: FOREST PARK
Street: 41 FOREST PK
City/State: ST. LOUIS MO 63112
Type of Premises: PARK
Invst Followup(Y/N): N
Assignment:
Date: 12/05/2001
Time: 14:00
Asgmt. Code: 432 Car No: 4377
DSN/Officer: 3395 MICHAEL WUELLNER
Assisted by: 2578 RICHIE WILLIAMS

ANY WEAPONS DISCHARGED BY AN OFFICER(Y/N)? N

Summary: A "STOKES" MORTAR MILITARY SHELL WAS UNCOVERED INSIDE FOREST PARK BY CONSTRUCTION WORKERS WHILE GRADING. THE SHELL APPEARED TO BE WORLD WAR I VINTAGE. THE SHELL WAS SAFELY DISPOSED OF AT A REMOTE LOCATION. UPON DISPOSAL IT WAS DETERMINED THAT THE SHELL HAD CONTAINED WHITE PHOSPHORUS.

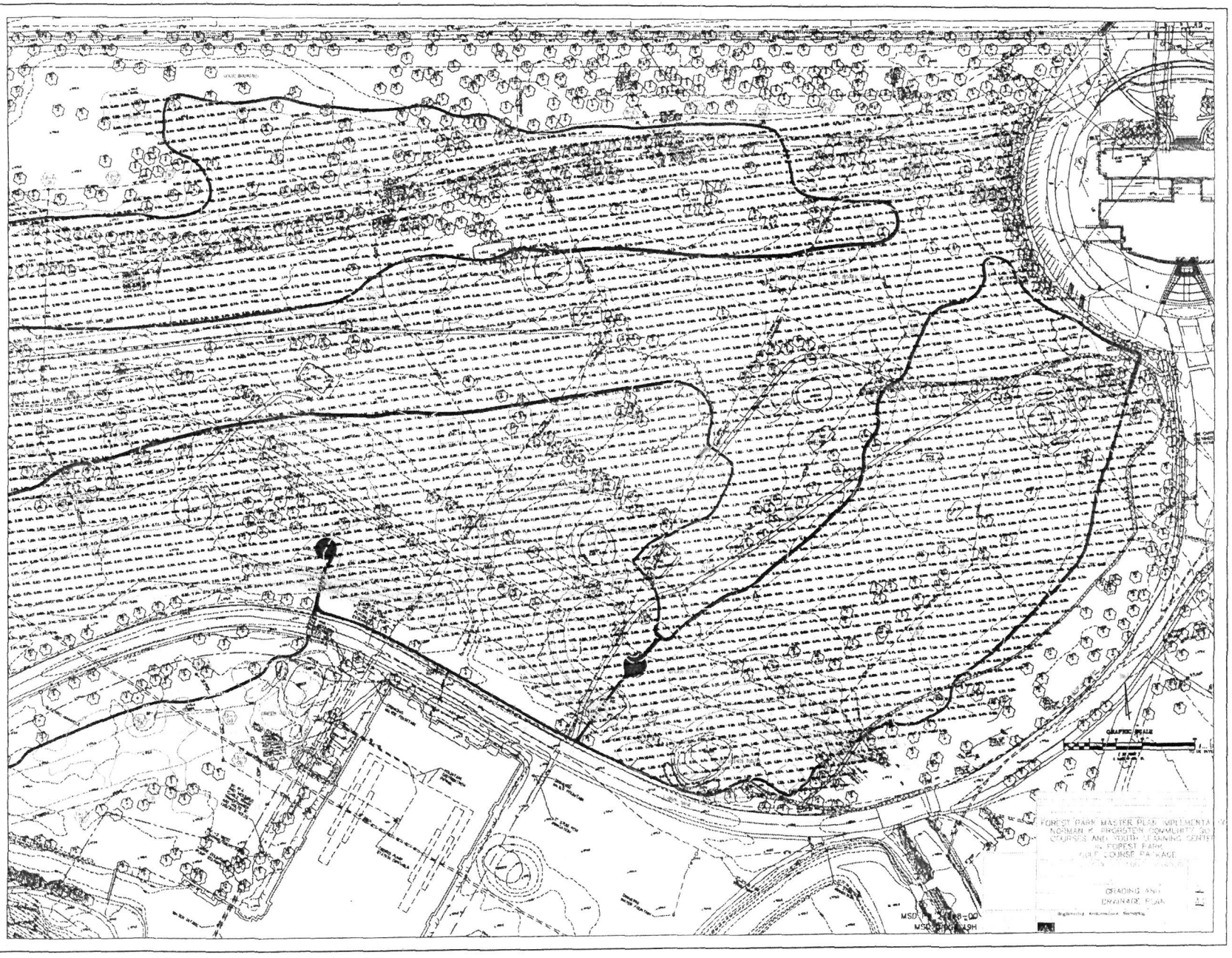
V I C T I M

NAME: LAST UNKNOWN

DOMESTIC INCIDENT: NO
BIAS INCIDENT: NO

APPENDIX K

CUT AND FILL DIAGRAMS



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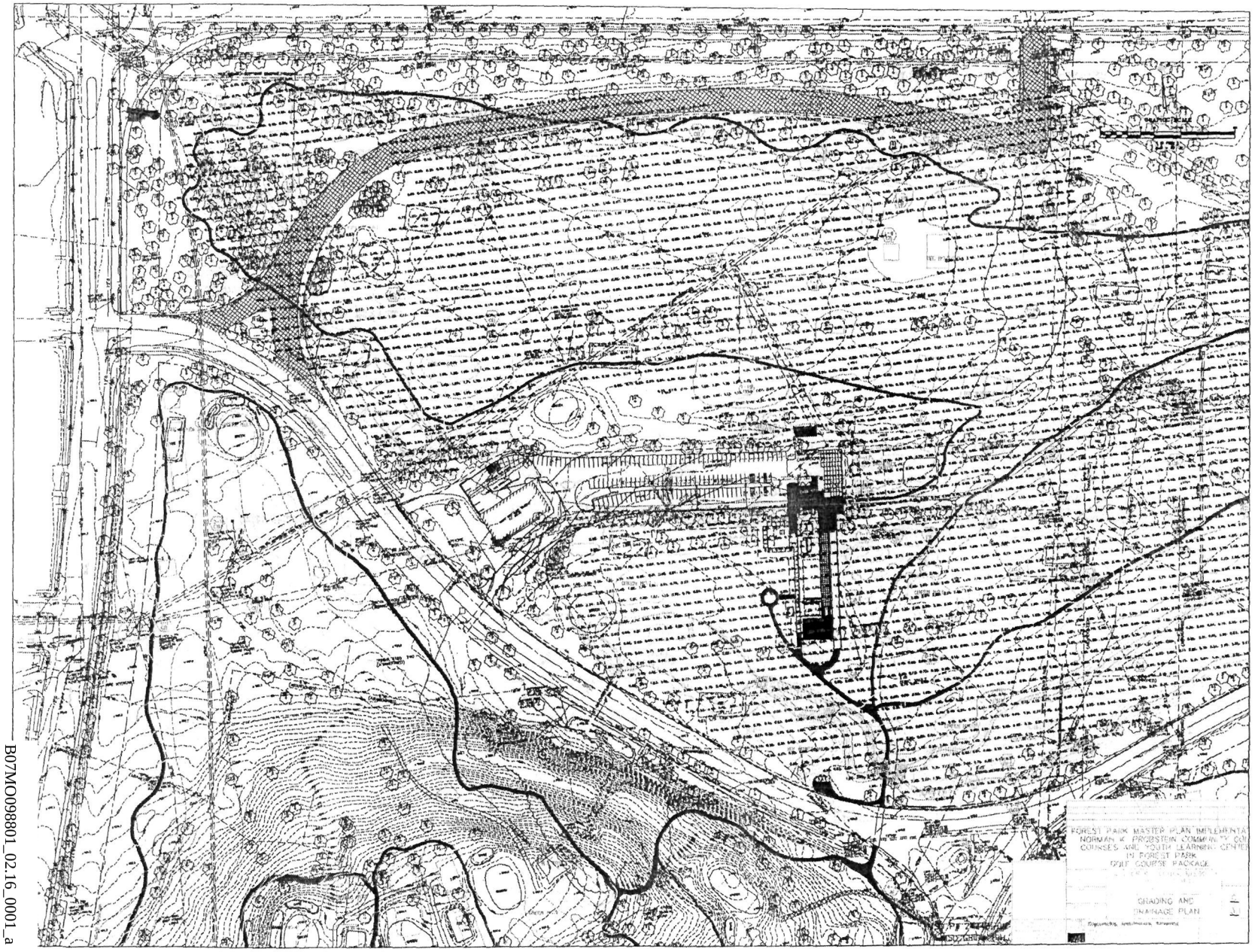


B07MO098801_02.16_0001_a

APPENDIX L

DRAFT MEC AWARENESS PAMPHLET

US Army Corps of Engineers®
Kansas City District

En un esfuerzo cooperativo entre el Cuerpo de Ingenieros del Ejército de los EE.UU., el *Departamento de Recursos Naturales de la ciudad de* St. Louis, Missouri, y el Departamento de la Policía de la ciudad de St. Louis para proteger la salud y seguridad de los ciudadanos de St. Louis.

¿Qué es el UXO?

El UXO (unexploded ordnance/munición que no detonó) es un tipo de munición que falló en explotar. La mayoría de estos UXO están asociados con actividades de entrenamientos o pruebas militares en el pasado. Si el UXO es detonado, este podría causar serios daños o hasta la muerte.

¿Cómo es la aparencia del UXO?

El UXO vienen en diversos tamaños y formas desde balas pequeñas hasta bombas grandes. Este folleto ilustra los tipos más comunes de UXO que pueden ser encontrados en el Parque Forestal.

Soldados de la Primera Guerra Mundial listos para disparar un mortero de fuego. Esta era la forma en que los morteros de fuegos eran disparados en el Parque Forestal.

¿Qué debería hacer Usted de encontrar un UXO?

Recuerde las tres "R"
Reconocer
Retirarse
Reportar

Reconocer que usted ha encontrado un UXO basado en *las características generales presentadas en las fotos* contenidas en este folleto.

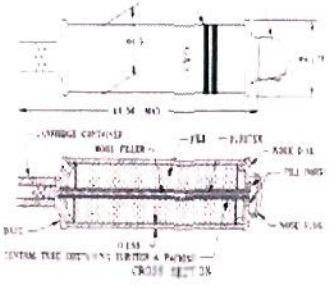
Retírese del área.

Reportar el UXO encontrado llamando al 911.

Identificación de Municiones

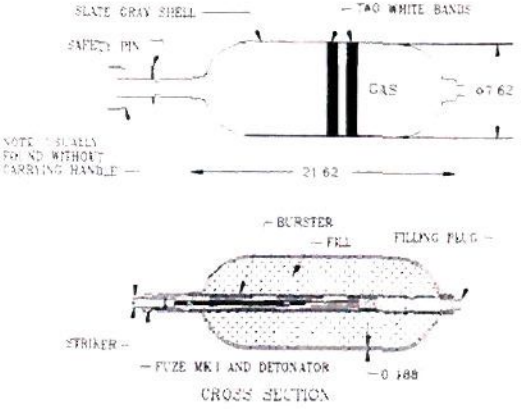
Morteros de Fuego

Los Morteros de fuego eran municiones que fueron usados durante la época de la Primera Guerra Mundial, el cual fueron encontrados en el Parque Forestal durante la construcción del parque de golf Norman K. Probstein. Los morteros de fuego fueron usados en batallas simuladas por las tropas militares en el Parque Forestal durante el principio de la década del 1900. Los morteros de fuego creaban una pared gruesa de humo que ayudaban a ocultar el movimiento de las tropas. Estos materiales de artillería no se asemejan a las municiones convencionales, pero muy parecidos a un pequeño silenciador de carro.



Projectíles Vivos

Projectíles vivos han sido encontrados en el Parque Forestal durante la renovación de la gran cuenca Emerson. Projectíles vivos fueron usados en batallas simuladas por tropas militares en el Parque Forestal durante el principio de la década del 1900. Estos morteros de fuego creaban una pared gruesa de humo que ayudaban a ocultar el movimiento de tropas.



Sus preguntas pueden ser dirigidas a:

El Cuerpo de Ingenieros del Ejército de los EE.UU.
Distrito de Kansas City, Oficina de Relaciones Públicas
en la ciudad de Kansas City, Missouri al (816) 983-3486
o
El Departamento de Recursos Naturales de Missouri -
Las Facilidades de la Sección Federal al (573) 751-3907

US Army Corps of Engineers®
Kansas City District

A cooperative effort between the U.S. Army Corps of Engineers, Missouri Department of Natural Resources, and the City of St. Louis Police Department to protect the health and safety of the citizens of St. Louis.

What is UXO?

Unexploded ordnance (UXO) is an explosive device that failed to explode. Most UXO is from past activities associated with military training or testing. If UXO detonates, it could cause serious injury or death.

What Does UXO look Like?

UXO comes in all shapes and sizes-from small bullets to large bombs. Illustrated throughout this handout are common types of UXO found at Forest Park.

World War I soldiers preparing to fire the Stokes Mortar. This was how the Stokes Mortar was fired at Forest Park.

What Should You Do If You Find UXO?

Remember the three R's
RECOGNIZE
RETREAT
REPORT

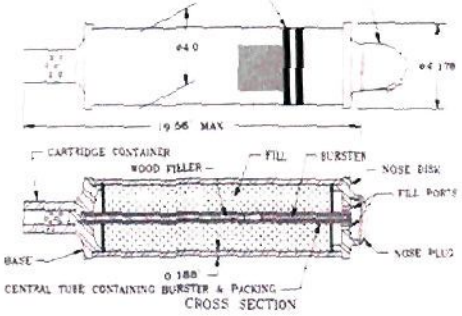
Recognize that a UXO has been found by using the general characteristics of the pictures contained in this handout.

Retreat from the area.

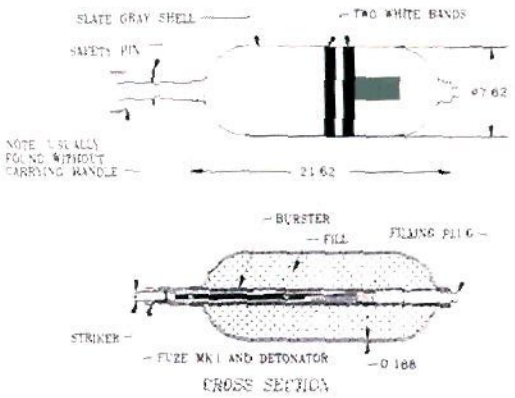
Report *the find by calling 911.*

Ordnance Identification

Stokes Mortars
Stokes Mortars are World War I era ordnance that have been found in Forest Park during construction of the Norman K. Probstein Golf Course. The mortar shells were used in mock battles performed by Army troops in Forest Park during the early 1900's. The mortars shells were used for hiding troop movements by producing a thick wall of smoke. These ordnance items do not look like conventional ordnance, but closely resemble a small car muffler.



Livens Projectors
Livens Projectors have been found in Forest Park during the renovation of the Emerson Grand Basin. Livens Projectors were used in mock battles performed by Army troops in Forest Park during the early 1900's. These ordnance items were used for hiding troop movements by producing a thick wall of smoke.



Questions may be referred to:

Army Corps of Engineers, Kansas City, Public Affairs Office at (816) 983-3486

or

Missouri Department of Natural Resources-Federal Facilities Section at (573) 751-3907