Standard Operation Procedures (SOP) for the Callaway Nuclear Plant Unit 2 Siting Study

Natural Resources
Field Sampling and Analysis

Prepared for:

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MACTEC PROJECT Number 3250075219

November 30, 2007

MACTEC

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Table of Contents

Section Page

Table of Contents (cont.)

List of Appendices

Table of Contents (cont.)

List of Figures

List of Abbreviations and Acronyms

BBS	Breeding Bird Survey
C	coefficients of conservatism
CFR	Code of Federal Regulations
COC	Chain of Custody
COLA	Combined Operating License Application
CPE	catch-per-effort
CWA	Clean Water Act
EPT	Ephemeroptera, Plecoptera, and Trichoptera
FEMA	Federal Emergency Management Agency
FIRMS	Flood Insurance Rate Maps
FO	fly-overs
FQI	Floristic Quality Index
FT	fly-throughs
GIS	geographical information system
GPS	global positioning system
ID	identification
MDC	Missouri Department of Conservation
MDNR	Missouri Department of Natural Resources
mm	millimeter
MSDIS	Missouri Spatial Data Information Service
NEPA	National Environmental Policy Act
NRC	U.S Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service
NWI	National Wetland Inventory
OHWM	ordinary high water mark
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
RS	Representative Species
RTE	Rare, Threatened or Endangered
SOP	Standard Operating Procedures
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey

1.0 Introduction

1.1 Purpose

The purpose of this document is to establish a consistent procedure to perform natural resources field and laboratory studies conducted by MACTEC Engineering and Consulting, Inc. (MACTEC) in conjunction with the Combined Operating License Application (COLA) for Unit 2 at the Callaway Nuclear Power Plant (Figure 1-1).

1.2 Scope

These Standard Operating Procedures (SOPs) are applicable to all field and laboratory sampling analysis by MACTEC personnel. It provides procedures that are specific to the Callaway COLA documentation requirements. Natural resources work to be performed is required to satisfy regulatory requirements for documenting and characterizing environmental conditions of the project vicinity and site, and in evaluating potential construction phase and operational phase effects. Specific work elements addressed in this SOP include the following:

- Terrestrial vegetation assessment,
- Herpetofaunal assessment,
- Avifaunal assessment,
- Mammal assessment,
- Waters of the United States delineation,
- Threatened and endangered species assessment,
- Adult/juvenile fish assessment,
- Benthic invertebrate assessment,
- Unionid assessment,
- Lake sturgeon survey,
- Sample custody, and
- Ecology laboratory sample logging, sorting, splitting, identification and quality control.

1.3 Key Project Contacts

Various personnel are involved in the Callaway COLA Program and will be available to discuss relevant issues, clarify applicability of this SOP, and resolve problems. The following table provides a list of key program personnel and their contact information.

Key Client Contacts	Key MACTEC Contacts
Paul C. Rizzo Associates Project Manger	**MACTEC Project Manager**
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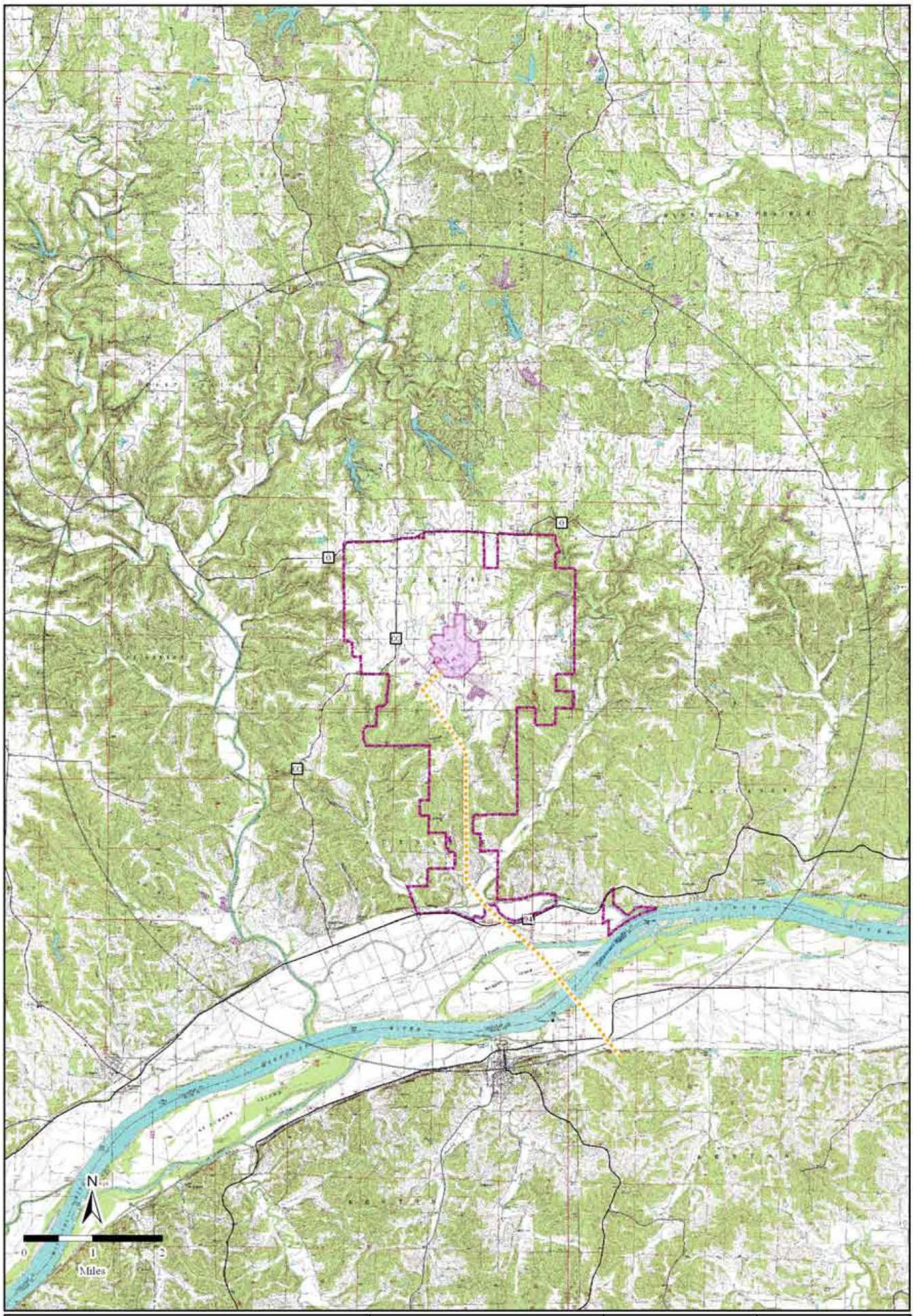


Legend

- Proposed Transmission Corridor
- Missouri Conservation Land
- Callaway Plant Site
- 6 Mile Radius

Drawn By: CGS Approved By: SPS

Checked By: BSM August 13, 2007

MACTEC

Figure 1-1
Callaway Nuclear Plant Vicinity Map

Callaway Nuclear Plant

1.4 Previous Studies

An environmental baseline inventory of the Callaway Plant Site was conducted in mid 1970s. This inventory involved studies of vegetation, mammals, birds, amphibians, reptiles, and invertebrates. Ten permanent terrestrial vegetation study plots measuring 2.5 acres (1 hectare) each were established within the Callaway Plant Site boundary. Four forested and four old field study plots were established in the early 1970s for baseline preconstruction monitoring of vegetation and wildlife. Two additional plots were established in 1982 for additional monitoring.

1.5 Regulatory Basis

The National Environmental Policy Act (NEPA) requires federal agencies to integrate environmental values into their decision making processes by considering the environmental impacts of their proposed actions and reasonable alternatives to those actions. The U.S Nuclear Regulatory Commission (NRC) staff is required by parts of 10 Code of Federal Regulations (CFR) 51 (Environmental Protection Regulations For Domestic Licensing and Related Regulatory Functions) Subpart A (NEPA – Regulations Implementing Section) to assess project environmental impacts. In addition the NRC has created many Regulatory Guides. NRC Regulatory Guides Division 4 was established to provide guidance on Environmental and Siting issues. In accordance with NRC Regulatory Guides 4.2 (Preparation of Environmental Reports for Nuclear Power Stations), 4.7 (General Site Suitability Criteria for Nuclear Power Stations) and 4.11 (Terrestrial Environmental Studies for Nuclear Power Stations), the environmental studies as discussed below will involve the collection and analyzes of data seasonally, as appropriate, at the Callaway Plant Site. Regulatory Guide 4.11 provides technical information for the design and execution of terrestrial environmental studies for nuclear power stations, but where appropriate, this guide will also be used for performing aquatic environmental studies. The baseline data will be used to compare subsequent data to evaluate plant construction and operation impacts. It is anticipated that this environmental report will satisfy the requirements of NEPA, and the NRC Regulatory guides.

The NRC guidance document, NUREG-1555 (Environmental Standard Review Plan), provides guidance to Staff when performing environmental reviews for nuclear power plants pursuant to the provisions of 10 CFR 51 related to new site/plant applications. It is the intent of these environmental studies to satisfy all the terrestrial and aquatic ecosystem data needs to provide sufficient baseline characterization information to allow for a complete and thorough environmental review as required in NUREG-1555. This baseline data will be used at a later date to assess the requirements of NUREG-1555 (Parts 4.0 and 5.0) to evaluate the environmental impacts of construction and operations respectively. Results of this work shall also be considered in the formulation of future monitoring programs in accordance with the requirements of NUREG-1555 Part 6.5.

The responsibility for protection of the environment has also been assigned to many agencies. As a prerequisite to plant licensing and construction it is important to identify and assess the many environmentally related authorizations required by federal, state, regional, local and affected Native American tribal agencies. The baseline data collected in these studies will also be utilized to support potential future construction and operational activities and to address the concerns of the many agencies and insure compliance with these laws and regulations. Major required authorizations, permits or consultations include the following:

- U.S. Army Corps of Engineers (USACE) – Clean Water Act, Section 404 permit is required for fill activities within wetlands and waters of the United States.

- USACE – Rivers and Harbor Act of 1899, Section 10 permit is required for any activities "over, under, or through" navigable waters.
- U.S. Fish and Wildlife Service (USFWS) – Endangered Species Act, Section 7 consultation is required on project impacts to endangered species during construction and operation.
- U.S. Environmental Protection Agency (USEPA) – NEPA, documentation in support of Federal decision-making.
- Missouri Department of Natural Resources (MDNR), State Historic Preservation Office – National Historic Preservation Act, Section 106 consultation regarding impacts of Archaeological sites and Historic sites during construction and operations.
- MDNR – Clean Water Act, Section 401 water quality certification for discharges under the NPDES permit and CWA Section 404 permit.
- MDNR – Clean Water Act, Section 402 NPDES permits for land disturbance, point discharges and stormwater discharges.
- MDNR – Clean Water Act, Section 316(a) and (b) permits for NPDES actions entailing water withdrawal and thermal discharges.

1.6 Site and Vicinity Boundary

The NRC has created NUREG-1555 (Environmental Standard Review Plan) for providing guidance to Staff when performing environmental reviews for nuclear power plants. The format of NUREG–1555 includes 6 sections: area of review, acceptance criteria, review procedures, evaluation findings, implementation, and references. The area of review identifies data and information needs for Water (hydrology-wetlands) Ecology (terrestrial and aquatic) and Socioeconomics (historic properties) in addition to other environmental areas. The data and information requirements frequently mention the need to submit data on a site or vicinity basis. The site and vicinity boundaries defined in this regulation are larger boundaries than just considering the footprint of new construction. NUREG-1555 under 2.2.1 (The Site and Vicinity) defines site and vicinity as follows:

- "Site" – The site is defined as that area of land owned or controlled by the applicant for the principal purpose of constructing and operating a nuclear power station. As a general rule, the applicant's "site boundary" should be accepted as defining the site.
- "Vicinity"- For small sites (on the order of two square kilometers), the vicinity is the area encompassed within a radius of ten kilometers (six miles). For larger irregularly shaped sites, the vicinity is a band or belt ten kilometers (six miles) wide surrounding the plant site. The intent is to investigate land use in an area in which the site makes up no more than 10 percent of the area. If a lake or pond is to be created for use by the station, the entire water-body area should be included in the vicinity. The vicinity considered may follow natural or political boundaries.

In this report, the site boundary definition will be used to limit our field terrestrial and aquatic reconnaissance investigations. The site boundary generally coincides with the Missouri Department of Conservation (MDC) Reform Conservation Area and is 7,528 acres in size. However, some reconnaissance will be required off-site for the Missouri River near the plant intake (existing and proposed) and discharge pipe locations, along the discharge pipe alignment in the floodplain, and for the transmission line corridor routes.

In examining the vicinity definition, this site is a large site approximately 28.5 square kilometers. However, in this case it is prudent to investigate "an area in which the site makes up no more than 10 percent of the area." A radius of six miles defining the vicinity will result in an area of 72,345 acres of which the site area is approximately 10 percent. The six-mile radius will be used to gather environmental data in the vicinity. Data will be gathered by obtaining available

mapping, literature reviews, talking to local experts and consulting with appropriate agencies. The only exception to the six-mile radius is for historic properties where the station can have a visual or noise impact on cultural and historic resources that are located at a greater distance from the station. NUREG-1555 part 2.5.3 requires a description of historic properties within a radius of 10 miles of the site and 1.2 miles of proposed transmission lines.

2.0 Terrestrial Vegetation Assessment

2.1 Project Objectives

The specific objectives of this work plan are as follows:

1. Develop a recent Callaway Plant Site inventory of flora for comparison with the 1970s preconstruction inventory;
2. Prepare a recent photographic record of the vegetation communities;
3. Develop a current land cover map; and
4. Provide a description of the change in plant communities at the site since the 1970s monitoring project;

2.2 Methods

Due to succession of the previously established vegetation study plots (i.e., most old field plots are now immature forests), five new transects 1,500 feet in length have been established for the terrestrial vegetation assessment (Figure 2-1). Two transects (T-2 and T-4) have been established in forested areas, one (T-3) has been established in grassland/pasture, one (T-5) has been established in old field and forest, and one (T-1) has been established in the bottomlands near Logan Creek. To account for seasonal variability of the vegetation within the site, each of the five transects will be assessed in the spring and fall during the 2007 growing season.

The project will consist of the following components:

- Photographic documentation;
- Qualitative inventory of flora; and
- Report presenting the study results.

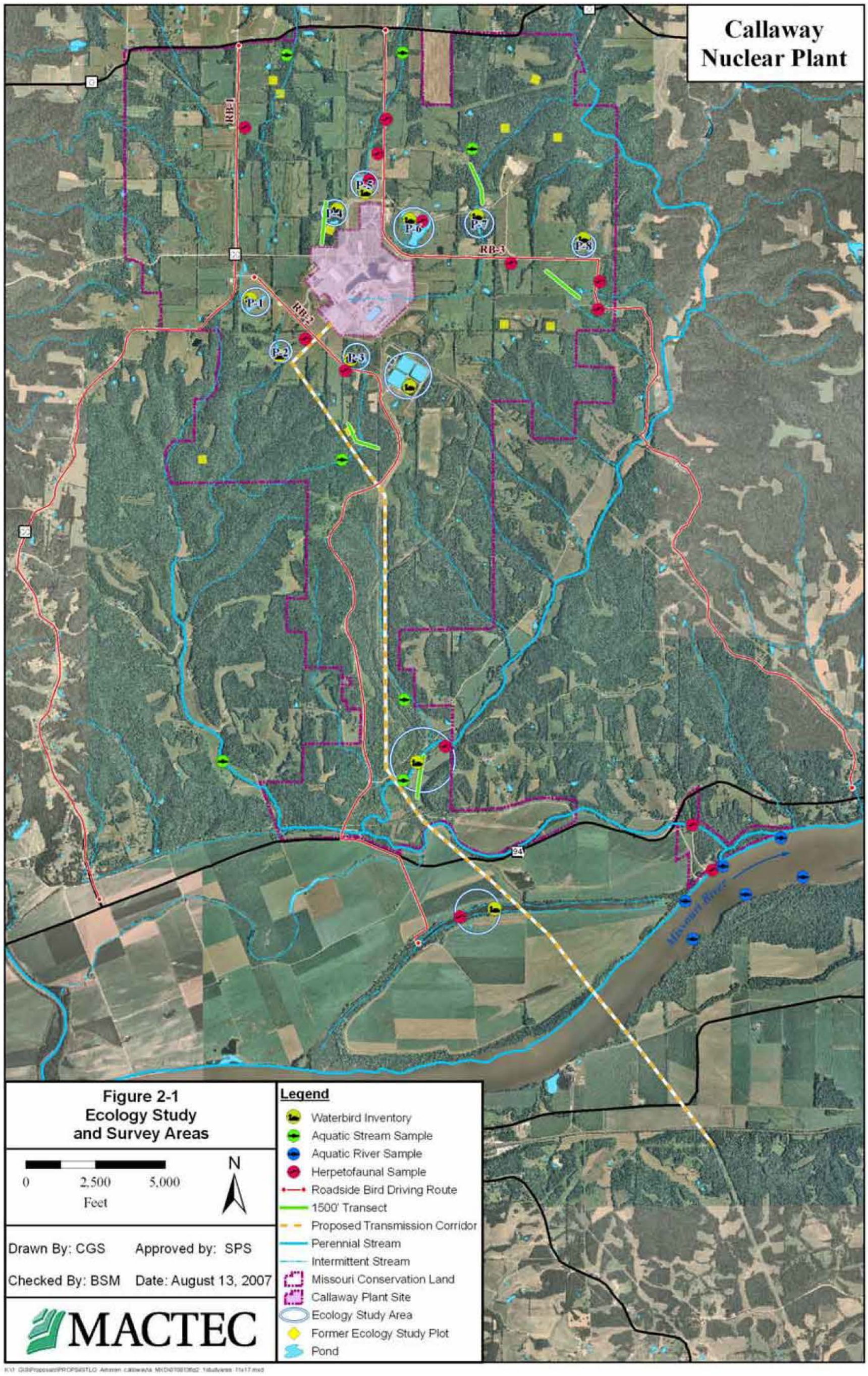
MACTEC will prepare geographical information system (GIS) (aerial and topographic) base maps and locate transects with global positioning system (GPS) for inclusion in the base maps. MACTEC field crews will be responsible for conducting field surveys and plant species identifications and will preserve voucher specimens for the project.

2.2.1 Land Cover Mapping

Missouri Spatial Data Information Service (MSDIS) mapping for the site was examined to evaluate its use for the project in establishing baseline conditions and in assessing project impacts. The data from MSDIS was noted to be coarse (30-meter grid) and was observed to contain known errors in cover type. For the project vicinity, this level of detail is assumed to be acceptable. Incorporation of MSDIS regional land cover data will be performed to quantify and tabulate land cover types within the project vicinity (six-mile radius). This work will be done using a GIS query of established data. No ground truthing will be performed within the project vicinity.

For the project site, MSDIS land cover information is considered to be inadequate, due to its inaccuracies and its coarse level of detail, and is considered to be insufficient for properly assessing project effects. Photo interpretation of current land cover on the project site will be performed to provide a more accurate tabulation of land cover characteristics. “Heads-up” digitizing will be used to delineate land cover types based on recent aerial photography.

A single field trip will be conducted to ground truth land cover types mapped by photo interpretation.


Callaway Nuclear Plant
RB-1
RB-2
RB-3
P-1
P-2
P-3
P-4
P-6
P-7
P-8
Missouri River
Figure 2-1
Ecology Study and Survey Areas
0
2,500
5,000
Feet
N
Drawn By: CGS
Approved by: SPS
Checked By: BSM
Date: August 13, 2007
MACTEC
Legend
Waterbird Inventory
Aquatic Stream Sample
Aquatic River Sample
Herpetofaunal Sample
Roadside Bird Driving Route
1500' Transect
Proposed Transmission Corridor
Perennial Stream
Intermittent Stream
Missouri Conservation Land
Callaway Plant Site
Ecology Study Area
Former Ecology Study Plot
Pond

2.2.2 Qualitative Inventory of Flora

A qualitative inventory of the site flora will be documented during the 2007 growing season. The qualitative inventory will, to the extent practical, record the presence of each plant species growing on the Callaway Plant Site (Appendix A). Observations of plant species will be recorded during other terrestrial monitoring efforts and additional site reconnaissance visits will be used to record observations of plant species occurring outside the established transect locations to provide a more complete inventory of the site.

Due to the varying phenology (life cycles) of plant species and the need to observe plants in proper reproductive condition necessary to permit species identification, spring and fall on-site inventories will be performed to identify plant species occurring on the site. This approach will require pedestrian surveys during the growing season to observe and record plants occurring in various habitats on the site. Particular emphasis will be given to those areas potentially affected by future disturbance (construction sites, drift zones, etc.).

In order to effectively characterize plant communities of the site, the relative abundance of each species occurring along five terrestrial transects (same as those used for faunal inventories) will be assessed. Plant species shall be visually scored as follows: A-abundant, C-common, O-occasional, U-uncommon, or R-rare.

Particular attention will be given to identifying any listed (rare, threatened or endangered) species. Data recorded will be maintained by date and location and will be compiled into the final Callaway Plant Site flora inventory.

2.3 Report and Data Analysis

A separate individual report will not be written. Rather, reporting for the terrestrial vegetation assessment will be included in the Callaway Nuclear Power Plant COLA (Unit 2) Environmental Report, Section 2.4, Ecology.

3.0 Herpetofauna Assessment

3.1 Project Objectives

Because the previous studies are more than 25 years old, this chapter will be used to establish current baseline information regarding the reptiles and amphibians that inhabit the Callaway Plant Site. The specific objectives of this work plan are as follows:

1. Characterize reptile and amphibian communities in the project vicinity and within the project site; and
2. Provide a basis for evaluating project effects due to construction, transmission line operation, and cooling system operation.

3.2 Methods

Herpetofauna occurrence will be evaluated by multiple methods to facilitate an inventory of reptile and amphibian species that utilize the site and that occur in the project vicinity.

3.2.1 Project Vicinity

Recorded range and distributional records shall be used to compile a list of species historically known to occur in the project vicinity. Coordination shall be conducted with regional MDC staff to validate the species included on the project vicinity lists.

Records shall be obtained from MDC for game species to tabulate relative harvest rates from the region to establish general context information for each species. Additionally, recorded occurrences of rare, threatened and endangered species shall also be obtained through consultation with MDC.

3.2.2 Project Site

Characterization of herpetofauna use of the Callaway Site will be performed seasonally (spring, fall and summer) by direct and indirect observational methods. Indirect methods shall include recording species presence based on signs including nests, skin sheds, shells or other evidence such as roadkills (see Appendix A). Such observations shall also be recorded during other field floral and faunal inventories.

In addition, since many reptiles and amphibians are not readily observed using these indirect methods, seasonal pedestrian surveys will be conducted along the five established transects (see Figure 2-1) and at other selected habitat types not represented by the transects (ponds, brush piles, within decaying logs, under flat rocks, etc.) to document species presence and relative abundance.

Audible listening surveys will be conducted at site ponds in the spring. Listening surveys will be conducted at night and will coincide with the breeding season of frogs and toads. Survey results will document weather conditions, species and relative abundance wherein the number of anurans calling will be estimated in a range of individuals calling through a full chorus. Listening surveys will be conducted only in the spring (see Appendix A).

Hoop net traps will be used to identify aquatic turtles within site ponds and streams. Hoop nets will be baited with fresh fish. Traps will be run every 24 hours for two consecutive days. Turtles captured will be marked by filing a small wedge on the marginal scutes in order to identify recaptured animals. Individuals captured will be identified to species. Turtles will be trapped

alive and released unharmed at the point of capture. Results of turtle trapping shall be expressed as the number of animals per trap night during each season (recaptured specimens will not be included).

When conducting a survey, general climatic conditions will be recorded including wind intensity (estimate its strength: no wind, slight, gusty, strong wind), temperature (Fahrenheit), and estimate percent of cloud cover (e.g., 50 percent cloud cover).

3.3 Report and Data Analysis

A separate individual report will not be written. Rather, reporting for the herpetofauna assessment will be included in the Callaway Nuclear Power Plant COLA (Unit 2) Environmental Report, Section 2.4, Ecology.

4.0 Avifauna Assessment

4.1 Objective

The objectives the avifaunal (bird) survey is to:

1. Characterize bird communities in the project vicinity and within the project site; and
2. Provide a basis for evaluating project effects due to construction, transmission line operation, and cooling system operation.

4.2 Methodology

Avifaunal occurrence will be evaluated by multiple methods to facilitate an inventory of bird species that utilize the site and that occur in the project vicinity.

4.2.1 Project Vicinity

For the project vicinity the North American Breeding Bird Survey (BBS) will be a primary source of bird population trends and distribution. The typical survey unit is a roadside route, which is 39.4 kilometers (24.5 miles) long. With respect to the Callaway Site, the nearest established BBS route is the Danville Route (Route No. 52019), which will be used as a basis to report long term trends within the region. Historical data will be used to report relative abundances of birds along the route. The Danville Route however, is distant from the Callaway Site and reflects a different land cover mosaic from that which exists at the site. Consequently, it is not appropriate for use in characterizing avifauna of the immediate project vicinity or project site.

To document seasonal avifaunal use within the immediate project vicinity, three roadside survey routes have been established and will be sampled seasonally using a modified BBS methodology (see Figure 2-1). Accordingly, two observers will stop at 0.8 kilometers (0.5 mile) intervals along an established route, and record all birds seen or heard at each stop during a three-minute sampling period. Data recorded at each stop will include habitat type, weather, wind speed, bird species observed, sex, and behavior (see Appendix A). Each route will be driven on two separate dates during each season (two different days) with observations initiated approximately 15 minutes before sunrise on each day.

4.2.2 Project Site

Characterization of avifaunal use of the Callaway Site will be performed using a transect approach. This method will be focused on deriving relative abundance information on avifauna within the site boundary. Specific methodologies will be used to obtain relative bird inventory information along established transects within the site

- River/stream location (1) at Logan Creek floodplain;
- Forested Habitat at two locations near the plant; and
- Old field/Prairie Habitat at two locations near the plant.

No density determinations will be made.

Five transects within the site boundary will be established for use in characterizing bird use of the project site. Transects will be surveyed on two separate days during each season. A team of two observers shall inventory all birds seen or heard within 20 meters (65 feet) of the transect centerline. Transects will be established in generally uniform habitat types and shall be approximately 1,500 feet in length. After arriving at the transect starting point, observers shall wait for approximately two minutes to allow birds to acclimate to their presence prior to initiating

the transect. Transects shall be walked by the observers at an approximate rate of 0.7 kilometer per hour. For each bird species detected, the number of each species detected along with the species name shall be recorded.

Additionally in order to document waterfowl use of the site, spot counts will be made at selected waterbodies on site to document seasonal waterfowl use.

Weather: When conducting a transect, record general climatic conditions. Record wind intensity (estimate its strength: no wind, slight, gusty, strong wind), temperature (Fahrenheit), and estimate percent of cloud cover (e.g., 50% cloud cover). This is important because climatic variables are known to affect bird activity. Avoid counting birds if it is raining or if it is extremely windy.

4.3 Report and Data Analysis

A separate individual report will not be written. Rather, reporting for the avifauna assessment will be included in the Callaway Nuclear Power Plant COLA (Unit 2) Environmental Report, Section 2.4, Ecology.

5.0 Mammal Assessment

5.1 Project Objectives

The specific objectives the mammal surveys are as follows:

1. Characterize mammal communities in the project vicinity and within the project site; and
2. Provide a basis for evaluating project effects due to construction, transmission line operation, and cooling system operation.

5.2 Methods

Mammal occurrence will be evaluated by multiple methods to facilitate an inventory of mammal species that utilize the site and that occur in the project vicinity.

5.2.1 Project Vicinity

Recorded range and distributional records shall be used to compile a list of species historically known to occur in the project vicinity. Coordination shall be conducted with regional MDC staff to validate the species included on the project vicinity lists.

Records shall be obtained from MDC for game and furbearing species to tabulate relative harvest rates from the region to establish general context information for each species. Recorded occurrences of uncommon species (e.g., bobcat, etc.) shall also be obtained through consultation with MDC.

In addition, roadside survey routes used for characterizing avifauna within the project site and vicinity shall also be used to record mammal presence in the project area. Specifically, any roadkills observed along the roadside while conducting bird surveys shall be recorded and tabulated.

5.2.2 Project Site

Characterization of mammal use of the Callaway Site will be performed by direct and indirect observational methods (see Appendix A). Indirect methods shall include recording species presence based on signs including tracks, scat, nests, or other indicated evidence (e.g., roadkills). Indirect evidence shall be recorded during all field faunal inventories (e.g., roadside bird surveys, bird transect surveys, etc.).

In addition, since many small mammals are not readily observed using these indirect methods, seasonal trapping surveys will be conducted along five transects established within the project boundary (Figure 2-1). The five transects are located within varying habitat types as follows:

- River/stream location (1) at Logan Creek floodplain
- Forested Habitat at two locations near the plant; and
- Old field/Prairie Habitat at two locations near the plant.

Surveys shall be conducted during spring and fall only. Along each transect 20 Sherman live traps will be set for two consecutive nights. Traps will be set at approximate 20-meter intervals with specific trap locations depending on microhabitat types available. All traps will be baited with a mixture of peanut butter and oatmeal. Traps will be run every 24 hours for two consecutive days. All animals captured will be marked by clipping the left front toe in order to identify recaptured animals. Each individual captured will be identified to species. In addition its sex, age, left hind foot length, tail length, weight, and specific habitat will be recorded.

Results of mammal trapping shall be expressed as the number of animals per trap night during each season (recaptured specimens will not be included).

When conducting a survey, record general climatic conditions. Record wind intensity (estimate its strength: no wind, slight, gusty, strong wind), temperature (Fahrenheit), and estimate percent of cloud cover (e.g., 50 percent cloud cover).

5.3 Report and Data Analysis

A separate individual report will not be written. Rather, reporting for the mammal assessment will be included in the Callaway Nuclear Power Plant COLA (Unit 2) Environmental Report, Section 2.4, Ecology.

6.0 Waters of the United States Delineation and Mapping

The objective of the Clean Water Act (CWA) is to maintain and restore the chemical, physical, and biological integrity of the waters of the United States. Section 404 of the CWA authorizes the Secretary of the Army, acting through the Chief of Engineers, to issue permits for the discharge of dredged or fill material into the waters of the United States, including wetlands. As such, the USACE issued the *Corps of Engineers Wetlands Delineation Manual* in January of 1987 (hereafter referred to as the 1987 Manual) to provide the methodology to determine whether a given area is a wetland for purposes of CWA Section 404 compliance. The 1987 Manual is the currently accepted guidance document for making wetland determinations and is the guiding document used on all MACTEC wetland projects.

Wetlands are defined as those areas that are "inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." Wetlands have general diagnostic characteristics with regard to each of three parameters: hydrophytic vegetation, hydric soil and wetland hydrology. According to the 1987 Manual, characteristics of all three wetland parameters must be present in order for the site to be considered a wetland.

The following represents MACTEC's typical approach for the identification and delineation of project area wetlands using the Routine On-Site Investigation Approach of 1987 Wetland Delineation Manual.

6.1 Pre-Field Activities

Initial activities required in support of a defensible wetland determination and delineation consist of the acquisition and review of all available mapping, hydrologic, and soils data. Typical information MACTEC considers during this initial review process include the following:

- National Wetland Inventory (NWI) maps;
- U.S. Geological Survey (USGS) topographic maps;
- Natural Resources Conservation Service (NRCS) soil survey mapping;
- NRCS lists of hydric soils;
- NRCS Food Security Act wetland mapping;
- Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMS);
- Detailed topographic mapping (1-2' contour intervals); and
- Current aerial photography (1"=400', prefer digital).

6.2 Field Investigation

6.2.1 Stream Identification

The field determination of streams as jurisdictional resources will be based upon the presence of an ordinary high water mark, bed and bank, and the presence of documented surface water connections to navigable waters of the United States. Streams will be delineated within the construction footprint of Unit 2 and the new transmission line corridor.

According to 33 CFR 328.3, "the term ordinary high water mark (OHWM)" means "the line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the character of soil,

destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas." In general, the OHWM for a stream will be determined through an examination of the recent physical evidence of surface flow in the stream channel. Watercourses that contain bed and bank and exhibit an OHWM will be classified as jurisdictional waters of the United States. Coordination with the USACE is typically necessary for all identified waters of the United States as the USACE will make final determinations on jurisdictional waters.

Potential wetlands associated with the creeks and streams will be distinguished by field observations to determine the extent of adjacent wetlands (see Wetland Data Sheet, Appendix A). Vegetated areas located within stream channel boundaries will be considered part of the stream channel, and therefore, not adjacent wetlands.

Streams and stream crossings will be photographed and documented to characterize the composition of the stream channel, stream width, and adjacent vegetation. GPS and aerial photographic interpretation will be used to determine impacted stream lengths. This information will be subsequently quantified using a geographical information system. A final quality control check will be performed to insure that the impacted stream estimated lengths are accurate.

6.2.2 Wetlands

Wetlands will be delineated in accordance with the Routine On-Site Investigation Approach of the 1987 Manual within the construction footprint of Unit 2 and the new transmission line corridor. Potential wetland areas will be considered jurisdictional wetlands if they meet all three wetland criteria (USACE, 1987):

- **Vegetation** – The prevalent vegetation in wetlands consists of species that are typically adapted to inundated or saturated soil conditions. (Note: In some circumstances in which the area has been significantly disturbed, this criterion does not need to be met.) If greater than 50 percent of the dominant plant species are OBL, FACW, or FAC (excluding FAC-), hydrophytic vegetation is documented for that plot. The indicator status of each species at a given plot is determined by consulting the *National List of Plant Species That Occur in Wetlands*.
- **Soil** – Soils are present and have been classified as hydric if they possess characteristics that are associated with reduced soil conditions. Current hydric soils criteria and lists are available from the U.S, Department of Agriculture NRCS. As such, a hydric soil is a soil that has formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part. NRCS hydric soil criteria includes those soils that are frequently ponded for long or very long duration during the growing season in accordance with it's *Field Indicators of Hydric Soils in the United States*, Version 4.0.
- **Hydrology** – Wetland hydrology is present if the area is inundated either permanently or periodically or the soil is saturated to the surface at some time during the growing season (i.e., 15-day inundations or greater). Indicators of wetland hydrology may include drainage patterns, drift lines, sediment deposits, watermarks, stream gage data and flood predictions, historic records, visual observations of saturated soils, and visual observations of inundation. Any of these indicators may be evidence of wetland hydrologic characteristics. Methods for determining hydrologic indicators can be categorized according to the type of indicator. Recorded data includes stream gage data, lake gage data, tidal gage data, flood predictions, and historical records. Use of these data is typically limited to areas adjacent to streams or other similar areas. Recorded data usually provide both short- and long-term information about frequency and duration of inundation, but contain little or no information about frequency and

duration of soil saturation. Information regarding the frequency and duration of soil saturation is gathered from NRCS soil surveys and other similar information.

In addition, wetlands must be hydraulically connected or adjacent to jurisdictional waters of the United States in order to be classified as jurisdictional wetlands (U.S. Supreme Court ruling, Solid Waste Agency of Northern Cook County). Typically, this includes wetlands located within the floodplain of a jurisdictional water.

Wetlands will be photographed, documented (vegetation, hydrology and soils) and classified according to the system of Cowardin et al. (1979). The boundary of the wetlands will be mapped with GPS and impacts quantified by GIS.

The wetlands within a given study area will be identified and illustrated using appropriate mapping and graphics. Cultivated palustrine emergent wetlands (i.e., farmed wetlands) will also be shown on NRCS wetland inventory.

Palustrine Wetlands

Palustrine wetlands cover less than 20 acres (8.1 hectares), lack active wave-formed or bedrock shoreline features, and have water depths at low water of less than 6 feet (1.8 meters). Palustrine wetlands are subsequently classified according to dominant vegetation:

- Palustrine unconsolidated bottom (PUB) wetlands are characterized by small-grained sediment particles and a vegetative cover less than 30 percent. This classification is typically applied to small "pond-like" wetlands. The PUB designation is used for the Open Water (OW) section of jurisdictional pond-like wetlands. If the pond contains vegetated areas large enough to map, these areas are classified separately as PFO, PSS or PEM wetlands.
- Palustrine emergent (PEM) wetlands are characterized by herbaceous (non-woody) plants. Emergent wetlands are also known as marshes, meadows, fens, etc.
- Palustrine scrub-shrub (PSS) wetlands are characterized by woody vegetation that is less than 19.6 feet (6 meters) tall.
- Palustrine forested (PFO) wetlands are characterized by woody vegetation that is 19.6 feet (6 meters) tall or taller.

Farmed Wetlands

The January 1994 MOA between the USACE and NRCS gives NRCS mapping authority over farmed wetlands. Farmed wetlands (FW) consist of active row crop or pasture that meet the hydric soils and wetland hydrology criteria, but are currently used for agriculture. Farmed wetlands typically are not used every year due to excess moisture. Farmed wetlands typically have lower plant diversity and other functional values compared to other wetland types. In addition to farmed wetlands, the NRCS has several classifications within this group (prior converted cropland, wetland pasture, wetland emergent, etc.). Prior converted wetlands occur on agricultural land that was manipulated and drained before December 1985 and are no longer considered jurisdictional wetland areas.

To obtain NRCS wetland inventory data, coordination would be necessary with the local NRCS office. Wetlands identified as a result of this coordination would be digitized into a GIS data layer and shown on field maps. NRCS should also be contacted regarding any Wetlands Reserve Program and Conservation Reserve Program lands as these are protected from development.

6.3 Preliminary Jurisdictional Determination Report

A separate individual report will not be written. Rather, reporting for the waters of the United States assessment will be included in the Callaway Nuclear Power Plant COLA (Unit 2) Environmental Report, Section 2.4, Ecology.

7.0 RTE Survey and Natural Areas Assessment

Rare, Threatened or Endangered species (RTE) and natural areas potentially occurring within the site boundary and its vicinity shall also be evaluated.

Consultation shall be conducted with the MDC (Natural Heritage Program) to identify natural areas and species of concern. Furthermore, field assessments for RTE species will be performed in conjunction with other planned field inventories for mammals, birds, herpetofauna, terrestrial vegetation and aquatic biota. Any observed RTE species shall be photographed, their locations recorded, and the number of individuals will be recorded.

A separate individual report will not be written. Rather, reporting for the RTE species and natural areas assessment will be included in the Callaway Nuclear Power Plant COLA (Unit 2) Environmental Report, Section 2.4, Ecology.

8.0 Adult/Juvenile Fish Community Characterization

8.1 Objectives

The objectives the adult and juvenile fish community characterization are to:

1. Characterize communities upstream and downstream of the new discharge into the Missouri River; and
2. Characterize communities in the Missouri River, and in streams in or adjacent to the project area to establish baseline conditions and evaluate project effects.

8.2 Field

Adult and juvenile fish samples will be collected quarterly at six locations in the Missouri River and seven stream reaches within the study area (see Figure 2-1).

- Missouri River at six locations in differing microhabitats focused in proximity to intake structure/discharge vicinity;
- Logan Creek watershed upstream of Katy Trail at three locations (one perennial, two intermittent);
- Mud Creek watershed at two locations (one perennial, one intermittent); and
- Auxvasse Creek watershed at two intermittent stream locations north of plant.

While several of these are locations where sampling was performed in 1980-81, five additional locations are needed to characterize baseline conditions in streams within or adjacent to the study area.

At Missouri River stations, fish will be collected by four methods: boat electrofishing, hoop nets, gill nets, and shoreline seining. Fish at stream stations will be collected by seining and/or backpack electrofishing.

Samples from the Missouri River will be collected at three locations near the north bank and three locations near the south bank. Boat electrofishing will be performed along shoreline areas of each location using a Smith-Root electrofisher powered by a 5,000 watt Honda generator. Electrofishing samples will represent timed runs (approximately 20 minutes). Sampling will begin at the upstream end of each zone and continue in a downstream direction. The sampling crew will consist of one driver and two dip netters using long-handled dip nets with 3/16-inch mesh. All fish stunned during the sampling run will be placed in holding tanks prior to processing. Hoop nets and gill nets will be set for 48-hour periods at each location during each sampling event and cleared of fish after 24 hours. Nets will be set parallel to shore and anchored with grappling anchors and cinder blocks. Shoreline seining, using a 6-foot by 30-foot 1/8-inch mesh seine with a 6-foot by 6-foot bag, will be performed on an opportunistic basis at six locations within the general study area. The goal will be to obtain samples at all stations, but suitable seining areas will be dependent on bank substrate characteristics and river levels.

At Logan Creek, Mud Creek, and intermittent streams in the Aux Vases creek watershed, a variety of seines will be used to collect fish specimens. Seining at stream locations will utilize a 6-foot by 6-foot kick seine and a 6-foot by 20-foot seine, both with 1/8 inch mesh. A minimum of two seine hauls will be made at each location. Backpack electrofishing may be used as a supplementary collection method.

Adult and juvenile fish, except reference specimens, will be processed immediately after sampling in an effort to return as many to the system alive as possible. Fish will be identified to the lowest taxonomic level possible using Pflieger (1997) as a reference. Certain specimens

(small individuals or those of questionable identity) will be returned to the laboratory for processing. A reference collection of each species encountered in the study will be prepared and maintained. The exceptions will be species listed as threatened or endangered in Missouri or in the United States. Field data will be kept separate by gear type, sampling date, and station. Specimens will be measured for total length (millimeter) and weight (grams), and will be examined for external abnormalities.

8.3 Report and Data Analysis

A separate individual report will not be written. Rather, reporting for the adult/juvenile fish assessment will be included in the Callaway Nuclear Power Plant COLA (Unit 2) Environmental Report, Section 2.4, Ecology.

8.4 Additional

A literature search of the results of other surveys conducted in the sampling area will be performed.

9.0 Benthic Invertebrate Characterization

9.1 Objectives

The objectives the benthic macroinvertebrate survey are to:

1. Characterize communities upstream and downstream of the new discharge into the Missouri River; and
2. Characterize communities in the Missouri River and in streams in or adjacent to the project area, to establish baseline conditions and evaluate project effects.

9.2 Field Procedures

Macroinvertebrate samples will be collected on two occasions (spring and fall/winter) at two locations in the Missouri River and seven stream reaches within the study area (see Figure 2-1):

- Missouri River at locations upstream and downstream of discharge;
- Logan Creek watershed upstream of Katy Trail at three (one perennial, two intermittent);
- Mud Creek watershed at two locations (one perennial, one intermittent); and
- Auxvasse Creek watershed at two intermittent stream locations north of plant.

While several of these are locations where sampling was performed in 1980, additional locations are needed to characterize baseline conditions in the study area.

Benthic macroinvertebrates will be collected by three methods: ponar dredge, towed plankton nets, and rectangular kick nets. Samples from the Missouri River will be performed using a standard 9-inch by 9-inch ponar grab sampler. Three replicate grabs will be collected and sieved through a No. 30 (approximately 600 µ mesh) wash frame at each station. Samples will be washed into labeled 1-L containers and preserved with 10 percent formalin. Macroinvertebrate drift in the Missouri River will be sampled using towed plankton nets upstream and downstream of the plant discharge. Three replicate near-surface tows will be collected using a one-meter conical net of approximately 500 µ mesh. The volume of water sampled will be measured by a General Oceanics Model 2030 flow meter. Material collected in the nets will be washed into labeled one-liter containers and preserved with 10 percent formalin.

Stream samples will be collected with a rectangular 9-inch by 18-inch kick net with 500 µ mesh in accordance with MDNR procedures for wadeable streams (MDNR 2002). No replication will be performed for these samples, but multiple habitats will be surveyed to provide a comprehensive taxonomic characterization; a 30 minute effort will be made at each stream station. Potential habitats may include: (a) flow over coarse substrate, or riffle, habitat; (b) non-flow over fine substrate, or pool, habitat; and (c) root mat habitat; (d) accumulations of leafy or woody debris; and (e) rooted macrophytes.

Habitat data will also be collected at each sample location. Water depth and temperature, velocity, and substrate characteristics will be recorded. If sample location is nearshore, a description of the riparian area will also be recorded. A waypoint designation with a hand-held GPS instrument in latitude/longitude coordinates will be collected for all sample locations.

9.3 Laboratory Processing

Samples will be returned to MACTEC's St. Louis laboratory for analysis. Upon arrival, samples will be assigned a project-specific code and a sample number. Each step in the processing sequence from collection through identification will be recorded. In the laboratory, samples will be thoroughly rinsed through a 500 µ mesh sieve to remove preservative and fine sediments. Large organic material not removed in the field will be rinsed and visually inspected. Samples

will be sorted under a 10x magnifier lamp. Organisms will be separated from debris and placed in vials containing 80 percent ethanol. One of the vials will contain slide-mountable organisms (oligochaetes and Chironomidae), and the other will contain all other organisms. If the number of organisms is excessive (greater than (>)500 organisms for ponar and towed net samples; >1,000 organisms for kick net samples), subsampling may be conducted to obtain a more manageable number of specimens. However, if subsampling is used, samples will be "pre-picked" so that large and/or rare taxa are not eliminated from consideration. Sorting efficiency will be monitored throughout the project. After samples are sorted, the debris will be placed back in the sample jar and retained until the sorter passes a quality control check.

Organisms will be identified to the lowest practical taxon, typically genus, using keys recommended by MDNR (MDNR, 2005). A reference collection for the project will be prepared and maintained, and will be available for examination by agency personnel, or interested parties designated by UniStar.

9.4 Data Summarization

Macroinvertebrate data will be summarized by calculating the following characteristics for each sample:

- Density (ponar and towed net samples only)
- Total richness;
- Ephemeroptera, Plecoptera, and Trichoptera (EPT) richness;
- Shannon diversity; and
- Hilsenhoff biotic index.

The latter four metrics are used by MDNR scientists in their assessment of biological conditions. Taxa richness will be calculated by counting all taxa, including those only encountered in the large and rare search. Likewise, EPT richness will be calculated by counting each taxon in these three orders, including those only encountered in the large and rare search. Biotic index values will be calculated using the formula:

$$BI = \Sigma (X_i T_i / n)$$

where X_i = number of individuals in taxon i, T_i = tolerance value of taxon i, and n = number of organisms in the sample. Tolerance values used for this calculation will be based on the information sources recommended by MDNR. These include Hilsenhoff (1987), Huggins and Moffett (1988), Lenat (1993) and Bode et al. (1996). Tolerance values, and thus the biotic index, range from 0 to 10, with higher values indicating more pollution tolerance by the taxon or community. Finally, Shannon diversity index will be calculated using the formula:

$$SDI = - \Sigma (p_i)(ln\ p_i)$$

where p = the proportion of the sample belonging to taxon i. Sample characteristics will be compared between stations and between seasons. For stream samples, the data will be used to establish baseline conditions in and near the study area.

9.5 Quality Assurance/Quality Control Procedures

In accordance with MACTEC's Ecology Quality Assurance (QA) Procedures, ten percent of each sorter's completed samples will be checked for thoroughness. If less than 90 percent of the organisms were found by the sorter, the samples will be resorted and rechecked until at least 90 percent efficiency is achieved. Additionally, a project voucher collection shall be made containing specimens of all identified taxa. Voucher specimens shall be verified by a second taxonomist to ensure accuracy.

9.6 Non-indigenous and Invasive Species

Two aquatic benthic invertebrate species that are designated as non-indigenous or invasive are the Asiatic clam (*Corbicula fluminea*) and the zebra mussel (*Dreissena polymorpha*) (USGS, http://nas.er.usgs.gov/). Both of these species have the potential to affect cooling water supply systems and may therefore, be a management concern. The collection of either of these species will be properly noted as to their location, their relative abundance, and will be reported.

9.7 Additional Considerations

Vulnerable (pollution-intolerant) species that are encountered in samples will be noted. Additionally, a literature search of the results of other surveys conducted in the sampling area will be performed. State listed (threatened or endangered) species will likewise be noted.

9.8 Reporting

A separate individual report will not be written. Rather, reporting for the benthic invertebrate assessment will be included in the Callaway Nuclear Power Plant COLA (Unit 2) Environmental Report, Section 2.4, Ecology.

10.0 Unionid Assessment

The potential presence and need for field investigation of unionid mussel communities shall be evaluated through the agency consultation process. Agency consultation shall be conducted to identify particular natural resource issues of concern and will include a discussion of unionid mussels. Recorded mussel beds shall be identified in the vicinity of the project area through this consultation process.

In the event that a recorded mussel bed is identified in the vicinity of the project, and subject to potential project effects, further consultation shall be conducted to develop an appropriate level of field investigation to adequately characterize the unionid resource and evaluate project effects.

As needed, unionid results will be reported in the Callaway Nuclear Power Plant's Environmental Report Section 2.4, Ecology.

11.0 Lake Sturgeon Survey

11.1 Objectives

The objective the lake sturgeon survey is to:

3. Determine whether lake sturgeon stocked by the Missouri Department of Conservation (MDC) in the mid-1980s are still present in settling ponds near the Callaway Nuclear Plant.

11.2 Field

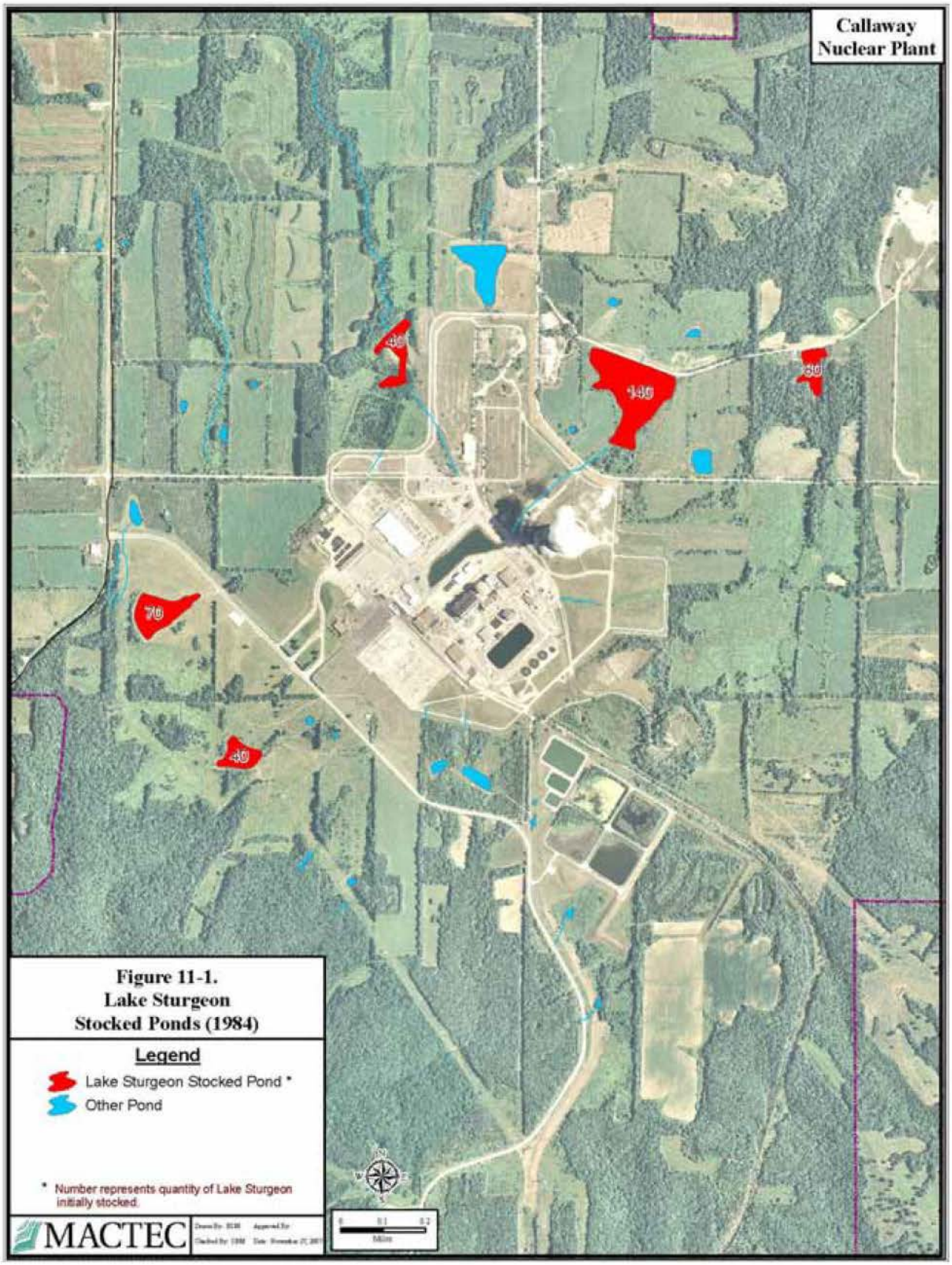
Samples will be collected in early November 2007 at five locations within the study area (see Figure 11-1).

At each location, fish will be collected by gill netting. Each pond will be sampled with two nets for a minimum of two net days each. Gill nets will be 100' in length by 6' in height, and will consist of either 3" or 4" bar mesh. Nets of both sizes will be used in each pond.

Nets will be checked in the morning and afternoon, at approximate 12 hour intervals. Fish collected (all species) will be measured for total length and immediately released back into the pond. If lake sturgeon are encountered, MACTEC biologists will contact an MDC fisheries biologist, so that the specimens can be tagged and transported to the Missouri River.

11.3 Report and Data Analysis

A separate individual report will not be written. Rather, reporting for the lake sturgeon assessment will be included in the Callaway Nuclear Power Plant COLA (Unit 2) Environmental Report, Section 2.4, Ecology.


Callaway
Nuclear Plant
40
140
30
70
40
Figure 11-1.
Lake Sturgeon
Stocked Ponds (1984)
Legend
Lake Sturgeon Stocked Pond *
Other Pond
* Number represents quantity of Lake Sturgeon initially stocked.
MACTEC

12.0 Sample Custody

12.1 Scope and Applicability

The Chain of Custody procedures shall be followed whenever samples are not directly transported and logged into the Ecology Laboratory by the field crew collecting the sample.

12.2 Chain of Custody Form

The Chain of Custody (COC) Form (Figure 12-1) documents the custody transfer of samples from the sampler to another person, to the courier, or to/from MACTEC's Ecology laboratory. The chain of custody form shall be filled out in ink, signed or initialed, and dated. No erasures should be made. If an incorrect entry is made, the information will be crossed out with a single strike mark that is signed or initialed and dated by the sampler. The chain of custody form shall be completed to include date and time of sample, number of containers submitted, collector's initials, and any comments regarding sample condition. The chain of custody form requires appropriate signatures for the sample cooler preparer and the individual relinquishing sample custody to the courier. Information required on the custody form includes the following:

1. Project information (reference name and number),
2. Names of the individuals collecting the samples,
3. Place the office phone number and fax number on the form,
4. Project location,
5. Client name, address, and name of client project manager,
6. Sample information:
    a) Sample identification/name
    b) Sample date and time
    c) Collection method
    d) Sample contents or type of sample collected
    e) Number of containers for the sample
    f) Comments regarding any samples
7. Page number of total number of pages,
8. Signatures, date, and time of sample custody and sample relinquishment.

The signatures of all individuals that retain the custody of the samples are required to maintain a continuous chain of custody from field collection through laboratory processing. The signatures, dates and times of relinquishment and receiving are required as follows:

1. Individual that prepared the sample cooler for sample collection,
2. Individual that collected the samples and maintains samples during collection,
3. Individuals receiving the samples from the collectors (any additional individual that the collectors have turned the samples over to maintain before arriving at the laboratory), and
4. Laboratory personnel that accept the samples upon delivery into the laboratory for processing.

Project Reference Callaway COLA	Project No. 3250079219			Sample Contents	Number of Containers Submitted	Comments
Collector's Signature:		Phone:				
Project Location (city, county, state)		Fax:				
Client Name:		Client Proj. Mgr.		Fish and Shellfish		
Client Address:						
Sample						
Sample ID	DATE	TIME	Collection Method			
				X		
				X		
				X		
				X		
				X		

Sample Cooler Prepared By:	Date							
Relinquished By: (Signature)	Date	Time	Received By: (Signature)	Date	Time	Relinquished By: (Signature)	Date	Time
Received for Laboratory By: (Signature)	Date	Time	Custody Intact	Sample Condition		Remarks		

Figure 12-1. Chain of Custody Form

12.3 Sample Packaging and Shipment

The following sample packaging and shipment procedures are to ensure that the samples will arrive at the laboratory with the chain-of-custody and sample bags intact.

a. The field sampler will be personally responsible for the care and custody of the samples until they are transferred or properly dispatched.

b. Sample containers will be identified by use of sample labels with sampling location ("PLANT NAME" Plant), MACTEC Project Number, collection method, date and time of collection, the collector's initials, and the number of sample containers.

c. Sample labels will be completed using waterproof ink unless prohibited by weather conditions. If an incorrect entry is made, the information will be crossed out with a single strike mark that is signed or initialed and dated by the sampler.

d. Samples will be accompanied by a properly completed chain-of-custody form that contains the associated sample information. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the form.

e. Sample bags will be placed in a sample cooler along with enough ice to ensure that the bags/specimens remain preserved and do not get damaged. Additional insulation material such as Styrofoam peanuts or additional bubble pack may be used to ensure the sampling bags are secure or fill any remaining void space in the sample cooler.

f. Sample cooler lids will be securely closed and taped across with custody tape (placed on the front right and rear left of the cooler lid). The sample cooler will then be sealed shut with shipping tape to ensure the cooler doesn't open during shipment to the MACTEC Laboratory. (If the cooler has a drain, ensure that it has been closed and taped over for shipment.)

g. Affix properly completed shipping label to the cooler and send sample cooler to:

MACTEC
Attn: Lana Smith
3199 Riverport Tech Center Drive
St. Louis, MO 63043

12.4 Laboratory Custody Procedures

Samples are received by the MACTEC Ecology Laboratory which records and files all shipping documentation (COCs). The Ecology Laboratory has full responsibility for ensuring that proper custody procedures are followed at the laboratory and that project specific files are maintained. Upon receipt by the Ecology Laboratory, samples proceed through an orderly processing sequence designed to measure continuous integrity of both the sample and its documentation. Upon receipt of a sample shipment, the Ecology Laboratory initiates a sample log-in for each sample shipment.

The samples are unpacked, inspected, and checked against the accompanying chain-of-custody record. At this time, an Ecology Laboratory employee will sign for receipt of the sample on the COC. Any discrepancies involving sample integrity, sample damage, preservation, and missing or incorrect documentation are immediately noted. If inconsistencies, discrepancies or inadequacies with respect to the received samples are identified, the Ecology Laboratory personnel will notify the MACTEC Project Manager who is responsible for resolving the problem. Resolution typically will involve contacting the plant field sampling personnel with

follow-up documentation of conversations and resolution. Samples will not be logged until the problems are resolved.

Once all sample receiving problems have been resolved (if any), the Ecology Laboratory will log the samples into the Project Specific Sample Processing logbook (see Chapter 6.0). A unique laboratory identification number will be assigned to each sample at the time of logging. Sample numbers will be assigned sequentially. Sample numbers will be used on any paperwork associated with the sample so that documentation throughout the laboratory can be matched to the appropriate sample.

Actual samples are transferred to the laboratory project designated storage area until sample processing begins. Each sample will remain in its storage location until the time of processing. Each sample removed for processing by an Ecology Laboratory personnel is documented in the Project Specific Sample Processing logbook as to the date, personnel, and sample number.

13.0 Ecology Laboratory Sample Logging

13.1 Scope and Applicability

This SOP is applicable to all aquatic ecological samples being sent to the Ecology Laboratory for sample processing conducted by MACTEC St. Louis personnel. This SOP governs treatment of samples after they are received by the laboratory via chain of Custody or direct transport by field sampling teams.

13.2 Procedures

13.2.1 Sample Logging

Field Team Leader Responsibilities

When the samples are brought into the lab, the Field Team Leader will:

- ✓ Put all samples in order according to sampling station and date of collection.
- ✓ Check all samples to make sure they are preserved properly and lids are on tight.
- ✓ Make sure all field collection sheets are filled out properly with date, initials, sample locations, etc.
- ✓ Inventory samples to make sure all field sheets and labels on jars agree.
- ✓ Leave all samples and data sheets in the order in which they are to be logged in the lab *(This is important, as the lab personnel may not be familiar with the project and station sample numbering scheme).*
- ✓ Make sure a log book is available for the project.

13.2.2 Logging Procedures

Fill out sample log completely. Appendix B provides an example of logbook data forms.

13.2.3 Fisheries

Sample Naming Convention

This information should be on the sample jar and on the data sheet. Sampling sites and stations are project specific and typically use five separate fields to create unique sample identification numbers. Prior to the initiate of any field data collection, the MACTEC Project Manager, in consultation with the MACTEC QA/QC Officer will devise and agree upon a project specific naming convention which will be used by all field crews.

Number of Jar

Fill in the number of jars used when the sample was collected. The number of jars used should be on the jar label. If more than one jar is used, jar labels should indicate 1 of 2, 2 of 2 for two jars. The data sheets should also indicate the number of jars used for the sample.

Collection Method

This refers to how the sample was collected and should be indicated on the field data sheet.

Example:
1 = Electrofishing
2 = Gill net
3 = Trawl
4 = Seine
5 = Ichthyoplankton – Sled (bottom)
6 = Ichthyoplankton – Push nets (top)
7 = Impingement
8 = Entrainment
9 = Hoop Net

Collection Date

Collection date refers to the date the sample was collected. This information will be on the jar label and on the field data sheet. All dates will be listed in the order of month, day, and year.

Collectors

This refers to the personnel who collected the sample. Their initials should be on the jar label and on the field data sheet.

Sample Labels

A label indicating the sample code will be placed inside and outside of each jar. From this point on all samples will be referred to by the sample code.

Outside Label

On each jar place a circular tag indicating the sample code the sample was given in the log book. If more than one jar was used for the sample, place a tag on each jar.

- For ichthyoplankton samples use green tags.
- For fish samples use yellow tags.
- Write sample code legibly with a waterproof pen.
- Make sure the number on the tag agrees with the number in the log book.

Inside Label

Inside of each jar place a label indicating the sample code.

- Use waterproof paper.
- Write in pencil (or waterproof ink) only.

14.0 Ecology Laboratory Sample Sorting

14.1 Scope and Applicability

This SOP is applicable to sample sorting conducted by the MACTEC Ecology Department Laboratory personnel.

14.2 Procedures

14.2.1 Sample Sorting

Initiation

Check log book for project. Projects will have separate logbooks. All samples should be sorted by numerical order. Find the number of the next sample to be sorted. This should be apparent by a blank in sorted column (benthic -column 9 and fisheries – column 6) of the log sheets. Place initials in the appropriate sorted/picked columns at the beginning of the sample sorting process and place the completion date in the column when you have completed sorting the sample.

Find the appropriate sample on the project shelf. Take the next sample in the numerical order of the samples that needs to be processed (**Do Not Skip Samples**).

Sample Rinse

Rinse contents of sample into the project appropriate size sieve if the sample contains mostly detritus or light material such as silt or clay.

- Rinse jar and lid thoroughly.
- Use a 30 for all benthic invertebrate sample sorting
- Use a #35 for all ichthyoplankton sample sorting.
- If sample volume is substantial, split with Folsom plankton splitter (See SOP Splitter) so as to limit picking time to 4 hours or less (unless otherwise indicated by project manager). Splitting has to be approved by the project manager prior to being performed on project samples. If the sample is split the appropriate split code must be added to all sample labels (See SOP Splitter).

Sorting Preparation

Get clean vials out of lab supplies for sample processing.

- Label each vial with the sample code.
- Fisheries samples – use a green label for ichthyoplankton and a orange label for fish samples.
- Fill each vial 1/2 full of 75 percent (%) alcohol for benthic samples and 40 % alcohol for ichthyoplankton samples.

Sample Starting

Place a small amount of sample from the sieve in to a white sorting pan with enough water to cover the material. Usually 1/4 inch of water is enough.

- AT LEAST 3/4 of the white pan should be visible in the bottom of the pan.

Sample Sorting

All fish eggs, larvae and juveniles will be sorted from the sample using a 10X magnifying lamp and submitted for taxonomic analysis. If samples contain a large number of specimens or large amounts of detritus, samples may be split using a Folsom plankton splitter or other appropriate device. Sub samples will be processed until a minimum of 200 identifiable specimens are found, but counts for individual sub samples will be maintained.

Sort through the white pan completely while looking through the magnifier lamp. Move all detritus and sand around with forceps. The white pan has sections on the bottom of it that can be used as a grid to follow to ensure that the entire pan has been sorted. Once the entire pan has been sorted through then swish the pan contents around and sort through it again. Repeat the swishing and sorting of the pan until the pan has been sorted through twice without finding any animals.

Pick out of the sample all animals or parts of animals found and place animals into appropriately labeled vials

- Put ichthyoplankton specimens in green-labeled jar.
- Fish samples in orange-labeled jar.

Place any large animals that do not fit the vials into a larger jar - place the sample information on the jar using the appropriate type label. Use a counter while picking to enumerate all specimens collected from the sample.

When processing ichthyoplankton samples use a counter to count the number of specimens that were placed in the sample vial/jar.

14.2.2 Sample Sorting Cycle

Rinse remaining contents (debris and sand) of the white pan after it has been sorted into a separate sieve. Put a waterproof label in this sieve indicating the sample code and that it is the sorted material. Continue steps above until entire unprocessed sample sieve contents have been sorted and are in the processed/sorted sieve.

14.2.3 Sample Processing Completion

Rinse all debris in the sample processed sieve back into the original sample jar. Put an additional label on the jar indicating the following information – sorters initials, date sorted, and the number of organisms obtained from the sample. Place the jar on the project specific shelf marked for QA/QC jars. Place jars back on the shelf in numerical order.

Place the sample vials in to vial rack marked for the project. (Put empty labeled vial in slot if no animals were found). Place any large jars for the sample into the box labeled "Misplaced Animal" for that project.

14.2.4 Sorting Documentation

Fill out appropriate log book accordingly indicating:

- Your initials and date.
- Time required for sorting.
- Total number of organisms collected from the sample.

15.0 Ecology Laboratory Sample Splitter

Scope and Applicability

This SOP is applicable to sample splitting conducted by the MACTEC St. Louis Ecology Department Laboratory personnel using the Folsom Plankton Splitter.

Procedures

Use the Folsom Plankton Splitter to split samples that have already been sorted from the debris but to numerous to count and identify all organisms. The project manager must approve the splitting of any samples before it is split.

Sample Splitting Preparation

- Set up the Folsom Plankton Splitter with the troughs in place
- Rinse vial of organisms into wheel.
- Dilute sample in wheel by adding 300 mL of water. Do not exceed 500 mL.
- Cautiously rotate wheel back and forth, mixing the solution until a good distribution is reached.
- Slowly pour sample into the wheel's troughs. This will separate the sample in two equal parts.
- Add a slight amount of water to wheel to rinse the remaining organisms out of the splitter and pour into the same two troughs.
- Sieve each trough separately, designating one trough as the "taxonomic sample" and the other as a "saved portion."
- Pour saved portion back into original vial.
- "X" vial.
- Check one trough to see if more than 200 organisms remain. If so, repeat splitting with one of the trough's samples.
- If a second split is necessary, pour the "taxonomic sample" in the wheel, split sample again and choose one of the troughs for a new "mount sample" and add the other portion to the previously split "saved portion" in the vial.
- After splitting is complete, return the saved portion to the original vial, add alcohol and mark the splitting code on the vial. The splitting code is as follows:
  - Split once = 1x
  - Split twice = 2x
  - Split thrice = 3x
- Mark the splitting code in the log book in column 18 or 22, respectively.

Mark Sample Vial Processed

- Put an "X" on vial once sample is analyzed.

Problem Situations to Avoid

- Too much water in wheel--contents dump out.
- Forgetting to mark split codes in log book, on vials, and on slides.
- Putting alcohol in the plankton splitter.

Re-Store Sample

Rinse all remaining debris in the sample processed sieve back into the original sample jar. Put an X on the sample label. Place the jar on project shelf marked QA/QC. Place all jars back on the shelf in numerical order.

16.0 Ecology Laboratory Sorting Quality Control

Scope and Applicability

This SOP is applicable to QA/QC of samples sorted by the MACTEC St. Louis Ecology Department Laboratory personnel.

Procedures

QA/QC is a critical aspect of laboratory processing of samples and is necessary to ensure that such processing is completed in a technically proficient manner and that sample integrity is not compromised. As a general rule, 10 percent of all samples sorted by each sorter will be checked for sorting efficiency.

Sample Sorting

QA/QC Assessment – Check the log book for the project and note the number of samples that have been denoted as sorted. Designate a subset of ten samples that have been processed to do a QA/QC check on the sample sorting. Randomly pick one of the ten samples in the set to be the QA/QC sample.

QA/QC Sample – Obtain the QA/QC sample from the project shelf marked for QA/QC and process the same for a second time following the SOP for Sample Sorting. The individual performing the resorted is to be an Ecology Laboratory person other than the original sorter. Any animals found by QA/QC person during the resorting process will be counted and recorded.

QA/QC Check – The number of animals found by original sorter for the sample that is being checked will be counted and recorded. The number of animals found by the QA/QC sorting process will be added to that original number to obtain a total sample number. Efficiency will then be calculated by dividing the number of animals found by the original sorter by the total number of animals found for the sample. The efficiency number/result will be recorded on the QA/QC column and samples will be noted on the project Resort Logsheets in the logbook. The QA/QC entries of log book will be filled in.

QA/QC Efficiency Standards – A 90 percent efficiency is required for the designated sample group to pass the QA/QC check.

Sample Fate

Passing Samples

If the sample checked passes the QA/QC check then that group of samples will be marked with an “N” in the log sheet column. These samples can now be finished processing following the SOPs for Sample Identification.

Failing Samples

If the checked sample fails the QA/QC check:

1. The designated samples in the sample group will be placed back on the shelf for resorting.
2. A “Y” will appear in the log sheet.
3. A list of the samples to be resorted and the original sorter’s initials will be placed on the resort logsheet of the project logbook.

Sample Resorting – All samples listed on the resort logsheets will be resorted. Place all animals from the resort in to the original sample vials. If vial has been marked X'ed, then make up a new vial. Put the new vial in to the large/oversized animal box and fill out the large/oversized animal form. Place the resorted samples back on to the projects QA/QC shelf. Mark "resorted" on the sample jar label. Fill in all appropriate columns of project logbook sheet for resorting.

Resort QA/QC Check – Ten percent of resorted samples will be QA/QC'ed using the above procedure.

QA/QC Corrective Actions – If a sorter continues to fail the QA/QC check, it is the responsibility of the sorter and the QA/QC person to identify the problem and set up a corrective action.

Possible Problems and Corrective Actions

Possible Problems

- Too much detritus in pan.
- Unfamiliarity of sorter with animals.
- Not swishing pan sufficiently to dislodge animals from detritus.

Corrective action

- QA/QC person may ask to check a pan after the sorter believes they have found all animals.
- The sorter may be asked to look through animals sorted from other samples and become more familiar with taxa.

In addition to the procedures outlined above, a QA/QC Audit Form should be completed by the auditor to detail the work subjected to the QA/QC review, the assessment of the technical accuracy of the work, and corrective measures required (if appropriate).

17.0 Ecology Laboratory Sample Identifications

Scope and Applicability

This SOP is applicable to sample sorting conducted by the MACTEC St. Louis Ecology Department Laboratory personnel. No identifications should begin until the sample has passed the QA/QC sorting check

Procedures

Adult and Juvenile Specimens

Proper taxonomic identification all fish collected will be accomplished by using properly trained personnel who are familiar with fish (native and non-native) occurring in Missouri. Standard keys that will be the primary taxonomic references include the following

- Pflieger, William L. 1997. The Fishes of Missouri. Missouri Department of Conservation.

Additional keys that will be used on an as-needed basis include the following:

- Smith, Phillip. 2002. Fishes of Illinois. University of Chicago Press Becker, George C. 1983. Fishes of Wisconsin. University of Wisconsin Press.
- Becker, George C. and Tom R. Johnson. June 1970. Illustrated Key to the Minnows of Wisconsin. Wisconsin State University.
- Hubbs, Carl L. and Karl F. Lagler. 1958. Fishes of the Great Lakes Region. Ann Arbor University of Michigan Press.
- Lee, Gilbert, Hocutt, Jenkins, McAllister, and Stauffer. 1980. Atlas of North American Freshwater Fishes. Publication Number 1980-12 of the North Carolina Biological Survey.
- Page, Lawrence M. 1983. Handbook of Darters. Illinois Natural History Survey.

Larval Fish Specimens

Taxonomic References

The following taxonomic references shall be used for the identification of larval fishes collected from the Missouri River (if applicable):

- Auer, Nancy A. December 1982. Identification of Larval Fishes of the Great Lakes Basin with Emphasis on the Lake Michigan Drainage. Great Lakes Research Division Special Publication 82-3.
- Hardy, J. D., G. E. Drewry, R. A. Fritzche, G. D. Johnson, P. W. Jones, and F. D. Martin. 1978.
- Tennessee Valley Authority. December 1976. Preliminary Guide to the Identification of larval Fishes in the Tennessee River. Technical Note B19.

Larval Fish Sample Identification

Obtain sample listed in the project book that is next to be identified.

a. All ID's should be done using one of the stereoscopes; polarized light set up should be used for ichthyoplankton taxonomy.
b. All ID's should be to the lowest practical taxonomic level (check with the lab manager or project manager for special cases).
c. Check misplaced animal form for additional specimens.
d. All identifications should be recorded on a bench sheet (see Appendix K).
e. Up to 30 specimens of each Representative Species (RS) and life stage (for Edwards Station see Appendix A) will be measured to the nearest 0.1 mm.

f. Subsampling using a Folsom Plankton Splittter may be conducted if the number of specimens in a given sample is large. However, for split samples the number of identified specimens must be no less than 200.
g. A reference collection of animals should be kept for each project.
   Use vials with tan labels.
   Indicate on bench sheet which animals were referenced.
h. After finishing a sample, return all animals to original "other" vial and place an "X" on label. (All misplaced animals should be put in original vial and additional vials cleaned out).
i. Fill in columns of log sheet.
j. Return vial of identified animals to its appropriate slot.
k. Fill out bench sheets completely. Include numbers and animal codes.
l. Put all bench sheets for that project in numerical order in a file.

Outside Taxonomic Verification

Taxa that are obscure or that require additional verification shall be sent to an outside recognized taxonomic expert for confirmation. Representative taxonomic experts who may be consulted to confirm species identifications may include:

- Dr. Brooks Burr, Southern Illinois University Carbondale (adult fish);
- Dr. Darryl Snyder, University of Colorado (larval fish);
- Dr. Bob Wallace (formerly of TVA) (larval fish); and
- Dr. Tom Simon, USFWS (larval fish).

Storage of Samples

Place all project samples upon completion of identification into a project specific storage box, labeled with the project specific information and documentations and place in the warehouse completed project storage area.

18.0 Ecology Laboratory Identification Quality Control

cope and Applicability

This SOP is applicable to QA/QC of sample identifications by the MACTEC St. Louis Ecology Department Laboratory personnel.

Procedures

QA/QC is a critical aspect of laboratory processing of samples and is necessary to ensure that such processing is completed in a technically proficient manner and that sample integrity is not compromised.

QA/QC Assessment

Check the log book for the project and note the number of samples that have been denoted as voucher specimens. Obtain the voucher collection for the project to be QA/QC checked from the project laboratory designated location.

QA/QC Vouchers

The individual performing the verification of the voucher collection is to be an Ecology Laboratory person other than the individual who performed the original identification. Alternatively, an independent third party known to be an expert in the taxonomic field subject to consideration, shall be identified and shall be contacted to verify the taxonomic identification of the voucher specimen.

QA/QC Check

The voucher collection specimens will be identified to confirm the original identification process of the organisms for the project. The verification of the voucher specimens will be noted in the sample logbook. The QA/QC entries of log book identification will be filled in.

QA/QC Efficiency Standards

A 100 percent efficiency is required for the designated project voucher collection to pass the QA/QC check.

Sample Fate

Passing Samples

If the voucher specimens pass the QA/QC verification then all sample identifications have been confirmed and that finishes the laboratory sample processing. The sample data collected can then be used for the project report following the SOPs for data processing and report generation.

Failing Samples

If the voucher specimen fails the QA/QC verification:

1. The designated specimen will be noted on the voucher specimen logsheet.
2. The specimen identification will be checked by a third party taxonomist.
3. The sample identification that is confirmed by the third party will be used.
4. If the identification is not that of the original taxonomist the data sheets will be corrected to the verified identification.

Overall QA/QC Check
Datasheets are reviewed to verify that information is filled out completely on the forms before they are sent for data processing.

QA/QC Corrective Actions
If a taxonomist continues to fail the voucher specimen QA/QC check, it is the responsibility of the project manager and the QA/QC person to identify the problem and set up a corrective action. Possible problems and corrective actions include the following:

Possible Problems
- Unfamiliarity of taxonomist with particular species of a geographical area.
- Organisms identified to a taxonomic level that is to low for confirmation.

Corrective action
- QA/QC person may ask to assist the taxonomist with particular aspects of the identification process.
- Taxonomist may work with various other/additional taxonomic keys to assist in an accurate identification.

19.0 References

Auer, Nancy A. December 1982. Identification of Larval Fishes of the Great Lakes Basin with Emphasis on the Lake Michigan Drainage. Great Lakes Research Division Special Publication 82-3.

Becker, George C. and Tom R. Johnson. June 1970. Illustrated Key to the Minnows of Wisconsin. Wisconsin State University.

Bode, R.W., M.A. Novak, and L.E. Abele. 1996. Quality assurance work plan for biological stream monitoring in New York state. Unpublished report prepared for New York State Department of Environmental Conservation.

Bystrak, D. 1981. The North American Breeding Bird Survey. Pp. 34-41 in C. J. Ralph and J.M. Scott, eds. Estimating numbers of terrestrial birds. Studies in Avian Biol. No. 6.

Droege, S. 1990. The North American Breeding Bird Survey. Pp. 1-4 in J. R. Sauer and S. Droege, eds. Survey designs and

Hilsenhoff, W.L. 1987. An improved biotic index of organis stream pollution. Great Lakes Entomologist 20:31-39.

Hubbs, Carl L. and Karl F. Lagler. 1958. Fishes of the Great Lakes Region. Ann Arbor University of Michigan Press.

Huggins, D.G. and M.F. Moffett. 1988. Proposed biotic and habitat indices for use in Kansas streams. Report No. 35. Kansas Biological Survey, Lawrence, Kansas. 128 pp.

Lee, Gilbert, Hocutt, Jenkins, McAllister, and Stauffer. 1980. Atlas of North American Freshwater Fishes. Publication Number 1980-12 of the North Carolina Biological Survey.

Lenat, D.R. 1993. A biotic index for the southeastern United States: derivation and list of tolerance values with criteria for assigning water quality ratings. Journal of the North American Benthological Society 12:279-290.

Missouri Department of Conservation (MDC). 1997. Department of Conservation Vegetation Monitoring Guidelines and Procedures.

Page, Lawrence M. 1983. Handbook of Darters. Illinois Natural History Survey.

Pflieger, William L. 1997. The Fishes of Missouri. Missouri Department of Conservation.

Smith, Phillip. 2002. Fishes of Illinois. University of Chicago Press Becker, George C. 1983. Fishes of Wisconsin. University of Wisconsin Press.

Taft, J.B., G.S. Wilhelm, D.M. Ladd, and L.A. Masters. 1997. Floristic Quality Assessment for Vegetation in Illinois, A Method for Assessing Vegetation Integrity. ERIGENIA, Number 15, Illinois Native Plant Society.

Tennessee Valley Authority. December 1976. Preliminary Guide to the Identification of larval Fishes in the Tennessee River. Technical Note B19.

The Nature Conservancy, Missouri. 2000. Missouri Flora.

Appendix A

Field Data Sheets

Vegetation Monitoring Data Sheet
Turtle Survey Data Sheet
Anuran Survey Data Sheet
Aviformes Survey Data Sheet (2)
Small Mammal Survey Data Sheet
Routine Wetland Determination Data Form
MACTEC Fisheries Field Form

Callaway Nuclear Plant
Vegetation Monitoring Data Sheet

Terrestrial Community: _____ **Date:** _____
Transect #: _____ **Personnel:** _____

BOTANICAL NAME	ABUNDANCE A-abundant C-common O-occasional U-uncommon R-rare	VEGETATION LAYER T-tree S-shrub H-herb

Comments:

Turtle Survey Data Sheet

MACTEC Engineering and Consulting, Inc.

Project: UniStar COL (Callaway Nuclear Plant)		**Project Number: 3250075219**
Location:		
Date:	**Time**:	**Personnel**:

Air Temperature (F):

Sky Code

- ☐ 0 – Few clouds
- ☐ 1 – Partly cloudy – scattered or variable sky
- ☐ 2 – Cloudy – cloudy or overcast
- ☐ 3 – Fog or smoke
- ☐ 4 – Drizzle or light rain
- ☐ 5 – Snow
- ☐ 6 – Showers

Wind Speed: Beaufot Scale

- ☐ 0 – Calm – (<1 mph) smoke rises vertically
- ☐ 1 – Light Air – (1-3 mph) smoke drifts, weather vane inactive
- ☐ 2 – Light Breeze – (4-7 mph) leaves rustle, can feel wind on face
- ☐ 3 – Gentle Breeze – (8-12 mph) leaves and twigs move around, small flag extends
- ☐ 4 – Moderate Breeze – (13-18 mph) moves thin branches, raises loose papers
- ☐ 5 – Fresh Breeze – (>19 mph) small trees begin to sway

Species	No.	*TCL (cm)	Sex	Comments

*TCL = Total Carapace Length

Anuran Survey Data Sheet

MACTEC Engineering and Consulting, Inc.

Location:	**Project No: 3250075219**	
Date:	**Time**:	**Personnel**:

Call Index

0 – None, no calls.
1 – Individuals – individuals can be counted; there is spacing between calls
2 – Overlapping – calls of individuals can be distinguished but there is some overlapping.
3 – Continuous Chorus – full chorus, calls are constant, continuous and overlapping

Sky Code

0 – Few clouds
1 – Partly cloudy – scattered or variable sky
2 – Cloudy – cloudy or overcast
3 – Fog or smoke
4 – Drizzle or light rain (not affecting hearing ability)
5 – Snow
6 – Showers – showers affecting hearing ability – do not conduct survey

Wind Speed: Beaufot Scale

0 – Calm – (<1 mph) smoke rises vertically
1 – Light Air – (1-3 mph) smoke drifts, weather vane inactive
2 – Light Breeze – (4-7 mph) leaves rustle, can feel wind on face
3 – Gentle Breeze – (8-12 mph) leaves and twigs move around, small flag extends
4 – Moderate Breeze – (13-18 mph) moves thin branches, raises loose papers
5 – Fresh Breeze – (>19 mph) small trees begin to sway

Site Name/No.					
Time					
Temperature (F)					
Wind Code					
Sky Code					

Species	Calling Index				
Acris crepitans (cricket frog)					
Bufo americanus (American toad)					
Hyla chrysoscelis – H. versicolor (gray treefrog)					
Pseudacris crucifer (n. spring peeper)					
Pseudacris triseriata (w. chorus frog)					
Rana areolata (northern crawfish frog)					
Rana catesbeiana (bullfrog)					
Rana clamitans (green frog)					
Rana sphenocephala (s. leopard frog)					
Other:					

Aviformes Survey Data Sheet

MACTEC Engineering and Consulting, Inc. Page__ of __

Location:		
Date:	**Time**:	**Personnel**:

Sky Code

0 – Few clouds
1 – Partly cloudy – scattered or variable sky
2 – Cloudy – cloudy or overcast
3 – Fog or smoke
4 – Drizzle or light rain (not affecting hearing ability)
5 – Snow
6 – Showers – showers affecting hearing ability – do not conduct survey

Wind Speed: Beaufot Scale

0 – Calm – (<1 mph) smoke rises vertically
1 – Light Air – (1-3 mph) smoke drifts, weather vane inactive
2 – Light Breeze – (4-7 mph) leaves rustle, can feel wind on face
3 – Gentle Breeze – (8-12 mph) leaves and twigs move around, small flag extends
4 – Moderate Breeze – (13-18 mph) moves thin branches, raises loose papers
5 – Fresh Breeze – (>19 mph) small trees begin to sway

Site Name/No.: _____ **Time:** _____ **Temperature:** _____

Wind Code: _____ **Sky Code:** _____

Species	Male	**Female**	**Juvenile**	**Undifferentiated**	**Total**

Aviformes Survey Data Sheet

MACTEC Engineering and Consulting, Inc.

Page__ of __

Project #: 3250-07-5219		**Project Name: CALLAWAY-UNISTAR**	
Location:	**Date**:	**Time**:	**Personnel**:

Sky Code
0 – Few clouds
1 – Partly cloudy – scattered or variable sky
2 – Cloudy – cloudy or overcast
3 – Fog or smoke
4 – Drizzle or light rain (not affecting hearing ability)
5 – Snow
6 – Showers – showers affecting hearing ability – do not conduct survey

Wind Speed: Beaufot Scale
0 – Calm – (<1 mph) smoke rises vertically
1 – Light Air – (1-3 mph) smoke drifts, weather vane inactive
2 – Light Breeze – (4-7 mph) leaves rustle, can feel wind on face
3 – Gentle Breeze – (8-12 mph) leaves and twigs move around, small flag extends
4 – Moderate Breeze – (13-18 mph) moves thin branches, raises loose papers
5 – Fresh Breeze – (>19 mph) small trees begin to sway

Site Name/No.:	**Temperature:**	**Wind Code:**	**Sky Code:**

Transect Stopping Points (1, 2, ...)	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**Total**
% Landcover (grassland, forestland, wetland, cropland, bare, etc…)																	
Species																	

Small Mammal Survey Data Sheet

MACTEC Engineering and Consulting, Inc.

Project: UniStar COL (Callaway Nuclear Plant)		**Project Number: 3250075219**
Location:		
Date:	**Time**:	**Personnel**:
Air Temperature (F):		

Sky Code

- ☐ 0 – Few clouds
- ☐ 1 – Partly cloudy – scattered or variable sky
- ☐ 2 – Cloudy – cloudy or overcast
- ☐ 3 – Fog or smoke
- ☐ 4 – Drizzle or light rain
- ☐ 5 – Snow
- ☐ 6 – Showers

Wind Speed: Beaufot Scale

- ☐ 0 – Calm – (<1 mph) smoke rises vertically
- ☐ 1 – Light Air – (1-3 mph) smoke drifts, weather vane inactive
- ☐ 2 – Light Breeze – (4-7 mph) leaves rustle, can feel wind on face
- ☐ 3 – Gentle Breeze – (8-12 mph) leaves and twigs move around, small flag extends
- ☐ 4 – Moderate Breeze – (13-18 mph) moves thin branches, raises loose papers
- ☐ 5 – Fresh Breeze – (>19 mph) small trees begin to sway

Species	Foot Leng. (cm)	Tail Leng. (cm)	Sex	Comments

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:		Date:	
Applicant/Owner:		County:	
Investigator:		State:	
Do normal circumstances exist on the site?	☐ Yes ☐ No	Community ID:	
Is the site significantly disturbed (atypical situation)?	☐ Yes ☐ No	Transect ID:	
Is the area a potential problem area?	☐ Yes ☐ No	Plot ID:	

(If needed, explain on reverse)

Remarks:

VEGETATION

Dominant Plant Species	Stratum	Indicator
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Percent of Dominant Species that are OBL, FACW, or FAC (excluding FAC-):

Hydrophytic Vegetation? ☐ Yes ☐ No

Remarks:

HYDROLOGY

Recorded Data (describe in remarks):
- _____ Stream, Lake, or Tide Gauge
- _____ Aerial Photographs
- _____ Other

_____ No Recorded Data Available

Field Observations:
- Depth of Surface Water: _____ (in.)
- Depth to Free Water in Pit: _____ (in.)
- Depth to Saturated Soil: _____ (in.)

Wetland Hydrology? ☐ Yes ☐ No

Wetland Hydrology Indicators:

Primary Indicators
- ☐ Inundated
- ☐ Saturated in upper 12 inches
- ☐ Water Marks
- ☐ Drift Lines
- ☐ Sediment Deposits
- ☐ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required)
- ☐ Oxidized Root Channels in Upper 12 Inches
- ☐ Water-Stained Leaves
- ☐ Local Soil Survey Data
- ☐ FAC-Neutral Test
- ☐ Other (Explain in Remarks)

Remarks:

SOILS

Map Unit Name
(Series and Phase): _____ Drainage Class: _____

Taxonomy (Subgroup): _____ Field Observations
Confirm Mapped Type? ☐ Yes ☐ No

Profile Description

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Color (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.

Hydric Soil Indicators

- ☐ Histosol
- ☐ Histic Epipedon
- ☐ Sulfidic Odor
- ☐ Aquic Moisture Regime
- ☐ Reducing Conditions
- ☐ Gleyed or Low Chroma Colors
- ☐ Concretions
- ☐ High Organic Content in Surface Layer in Sandy Soils
- ☐ Listed on Local Hydric Soils List
- ☐ Listed on National Hydric Soils List
- ☐ Other (Explain in Remarks)

Is the hydric soil criterion met? ☐ Yes ☐ No

Remarks:

WETLAND DETERMINATION

Hydrophytic Vegetation Present? ☐ Yes ☐ No
Wetland Hydrology Present? ☐ Yes ☐ No
Hydric Soils Present? ☐ Yes ☐ No

Is this Sampling Point Within a Wetland? ☐ Yes ☐ No

Remarks:

MACTEC Fisheries Field Form

Water Quality/Physical Data

Source Water Body: ____ River/Lake Stage: _____ Temp: _____ PH: _____ DO: ____ Conductivity ____

Fisheries Data

Sampling Method: Sample Location:

Sample ID: Effort (electofishing - mins; gill/hoop nets - hours; etc.):

Species (Common Name)	Length (mm)	Weight (g)	Condition (Live, Dead, etc.)	Abnor-malities	Batch Age Category	Batch Count	Batch Weight (g)	Voucher	Comments/Description of Sampling Conditions

Appendix B

Ecological Laboratory Logbook Data Forms

Project Personnel Identification Sheet
Ecology Laboratory Sample Processing Log – Fisheries
Large/Oversized Organism Sheet
Sorting and Resort QC Log
Voucher Collection and Verification Form
Sample Deviation - Additional Processing Information Form

Project Personnel Identification Sheet

Project Name: **Project Number:**

	Printed Initials *	Printed Name	Signature
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			

* - If your initials match those of someone else already listed on the sheet then speak with the project manager and together the decision will be made as to the designated initials that you will use for the entire project.

Ecology Laboratory Sample Processing Log -- Fisheries

Sample No.	Collection Data					Sorting				Identification	
	Sample ID	Collection Date	# Jars/ Containers	Collection Method	Collectors	Sorted-Picked by/Date/Time	Total # Fish	QA/QC by/Date	Need Resort	I.D. by/Date	QA/QC by/Date

Large/Oversized Organism Sheet

Sample No	Sample ID	Initials/Date (logged in by)	Container - Vial or Jar	Split Code (if applicable)	ID'ed By	Date/Time	Voucher Specimen

SORTING AND RESORT QC LOG

Sample No.	Original Sorting Information					Resort Information				
	QC Checked By	Date	Sorter (Initials)	% Efficiency	Resort Y/N	Resorter Initials	Resort Date	QC Checked By	% Efficiency	Resort Y/N

VOUCHER COLLECTION AND VERIFICATION FORM

Project Name/Number: _____ **Page __ of __**

Voucher Collection Specimen Location:

_____

Voucher No.	Sample ID (Source of Voucher Specimen)	Taxonomic Identification by/Date	Verification of Identification by/Date	Pass/ Fail	Corrective Action (CA) required	CA Completed by/date

SAMPLE DEVIATION - ADDITIONAL PROCESSING INFORMATION FORM

Project Name: ______________________________ **Page __ of __**

Project Number: ______________________________

Sample ID	Deviation, Issue, or Incident Occurring to Sample	Date of Occurrence	Initials	Informed Lab or Project Manager	Corrective Action (CA) Required	CA Completed by/date

Standard Operation Procedures (SOP) for the Callaway Nuclear Plant Unit 2 Siting Study

Historic Properties

Prepared for:

Paul C. Rizzo and Associates, Inc.

Prepared by:

MACTEC ENGINEERING AND CONSULTING, INC.
3199 Riverport Tech Center Drive
St. Louis, Missouri 63043

MACTEC PROJECT Number: 3250075219

December 21, 2007

MACTEC

Patrick H. Garrow, RPA — Date 12-21-07
Principal Scientist

Emmett Brown — 12-21-07
Emmett Brown, RPA
Senior Archaeologist

Table of Contents

List of Appendices

List of Abbreviations and Acronyms

APE	area of potential effect
CFR	Code of Federal Regulations
COLA	Combined Operating License Application
HPP	Historic Preservation Program
MDNR	Missouri Department of Natural Resources
NEPA	National Environmental Policy Act
NRC	U.S Nuclear Regulatory Commission
NRHP	National Register of Historic Places
SHPO	State Historic Preservation Office
SOP	Standard Operating Procedures

1.0 Introduction

1.1 Purpose

The purpose of this document is to establish a consistent procedure to perform historic properties investigations conducted by the MACTEC Engineering and Consulting, Inc. (MACTEC) in conjunction with the UniStar's Combined Operating License Application (COLA) for Unit 2 at the Callaway Nuclear Site (Figure 1-1).

1.2 Scope

These Standard Operating Procedures (SOP) are applicable to all historic properties investigations performed by MACTEC personnel. It provides procedures that are specific to the Callaway COLA documentation requirements. Historic properties inventory work to be performed is required to satisfy regulatory requirements for documenting and characterizing environmental conditions of the project vicinity and site, and in evaluating potential construction phase and operational phase effects.

1.3 Key Project Contacts

Various personnel are involved in the UniStar Callaway COLA Program and will be available for consultation and contact to discuss relevant issues, clarify applicability of this SOP, and resolve problems. The following table provides a list of key Program personnel and their contact information.

Key Client Contacts	Key MACTEC Contacts
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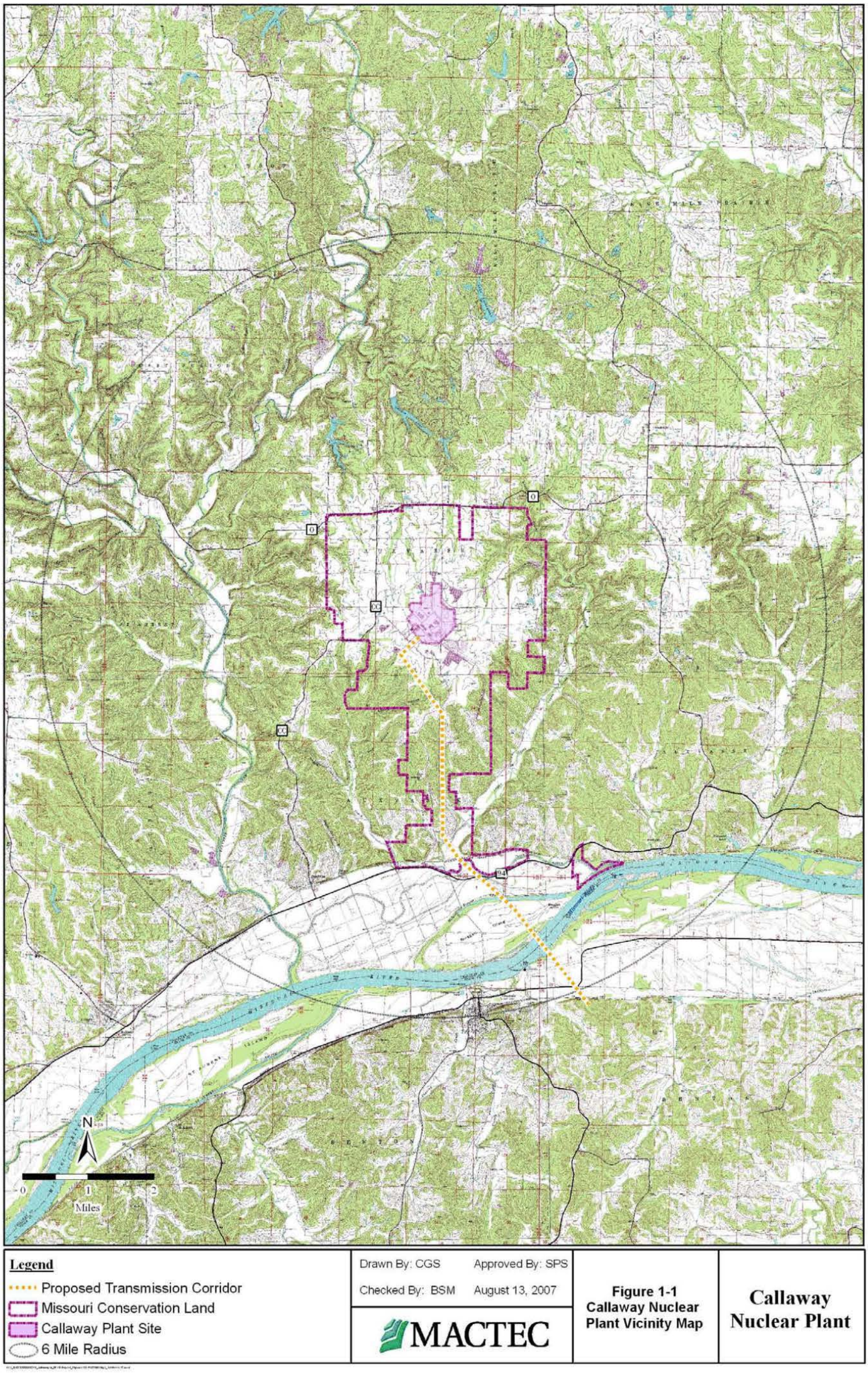
	Emmett Brown
	865-588-8544x1114
	Senior Archaeologist
	jebrown@mactec.com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CC
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B4
N
0
1
2
Miles
Legend
Proposed Transmission Corridor
Missouri Conservation Land
Callaway Plant Site
6 Mile Radius
Drawn By: CGS
Approved By: SPS
Checked By: BSM
August 13, 2007
MACTEC
Figure 1-1
Callaway Nuclear
Plant Vicinity Map
Callaway
Nuclear Plant

1.4 Previous Studies

Cultural resources investigations have previously been conducted at the Callaway Plant Site in the mid 1970s as part of the initial siting studies. This work was nearly comprehensive in evaluating lands within the project site boundary and will be used as a basis for the historic properties assessment for the Unit 2 COLA. Lands outside of this initial study area [or other lands as directed by the State Historic Preservation Office (SHPO)] will be assessed as needed using this historic properties SOP.

1.5 Regulatory Basis

The National Environmental Policy Act (NEPA) requires federal agencies to integrate environmental values into their decision making processes by considering the environmental impacts of their proposed actions and reasonable alternatives to those actions. The U.S Nuclear Regulatory Commission (NRC) staff is required by parts of 10 Code of Federal Regulations (CFR) 51 (Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions) Subpart A (National Environmental Policy Act – Regulations Implementing Section) to assess project environmental impacts. In addition the NRC has created many Regulatory Guides. NRC Regulatory Guides Division 4 was established to provide guidance on Environmental and Siting issues. In accordance with NRC Regulatory Guides 4.2 (Preparation of Environmental Reports for Nuclear Power Stations) and 4.7 (General Site Suitability Criteria for Nuclear Power Stations). It is anticipated that this environmental report will satisfy the requirements of NEPA, and the NRC Regulatory guides.

The NRC guidance document, NUREG-1555 (Environmental Standard Review Plan), provides guidance to Staff when performing environmental reviews for nuclear power plants pursuant to the provisions of 10 CFR 51 related to new site/plant applications. It is the intent of these environmental studies to satisfy all the terrestrial and aquatic ecosystem data needs to provide sufficient baseline characterization information to allow for a complete and thorough environmental review as required in NUREG-1555.

- The responsibility for protection of historic properties has also been assigned to the SHPO in accordance with Section 106 of the National Historic Preservation Act of 1966. The baseline data collected in these studies will also be utilized to support potential future construction and operational activities and to address the concerns of the many agencies and insure compliance with these laws and regulations.

1.6 Site and Vicinity Boundary

The NRC has created NUREG-1555 (Environmental Standard Review Plan) for providing guidance to Staff when performing environmental reviews for nuclear power plants. The format of NUREG–1555 includes 6 sections: area of review, acceptance criteria, review procedures, evaluation findings, implementation, and references. The area of review identifies data and information needs for Water (hydrology-wetlands) Ecology (terrestrial and aquatic) and Socioeconomics (historic properties) in addition to other environmental areas. The data and information requirements frequently mention the need to submit data on a site or vicinity basis. The site and vicinity boundaries defined in this regulation are larger boundaries then just

considering the footprint of new construction. NUREG-1555 under 2.2.1 (The Site and Vicinity) defines site and vicinity as follows:

- "Site" – The site is defined as that area of land owned or controlled by the applicant for the principal purpose of constructing and operating a nuclear power station. As a general rule, the applicant's "site boundary" should be accepted as defining the site.
- "Vicinity"- For small sites (on the order of two square kilometers), the vicinity is the area encompassed within a radius of ten kilometers (six miles). For larger irregularly shaped sites, the vicinity is a band or belt ten kilometers (six miles) wide surrounding the plant site. The intent is to investigate land use in an area in which the site makes up no more than ten percent of the area. If a lake or pond is to be created for use by the station, the entire water-body area should be included in the vicinity. The vicinity considered may follow natural or political boundaries.

In this report the site boundary definition will be used to limit field reconnaissance investigations. The site boundary generally coincides with the Missouri Department of Conservation Reform Conservation Area and is 7,528 acres in size. However, some sampling will be required off-site for the discharge pipe locations, along the discharge pipe alignment in the floodplain, and for the transmission line corridor routes.

In examining the vicinity definition, this site is a large site approximately 28.5 square kilometers. However, in this case it is prudent to investigate" an area in which the site makes up no more than 10 percent of the area". As required by NUREG-1555 part 2.5.3 a description of historic properties will be required within a radius of 10 miles of the site and 1.2 miles of proposed transmission lines.

2.0 Historic Properties Assessment

2.1 Introduction

The specific objectives of this work plan are as follows:

- Develop needed historic properties inventory information to supplement the results of the 1970's preconstruction inventory;

2.2 Methods for Discharge Pipeline Assessment

2.2.1 Phase I Survey Methods

Methods for the field study follow the Missouri SHPO *Guidelines for Phase I Archaeological Surveys and Reports*.

Accessible areas with greater than 25 percent ground surface visibility within the study area (good visibility area) will be examined by pedestrian survey with crew spaced no more than five meters apart. Artifacts and cultural features on the surface will be noted, described, and documented and a representative sample of temporally diagnostic artifacts may be collected. MACTEC estimates that the good visibility area may consist of anywhere from 10 percent to 95 percent of the study area, based on aerial photographs, which show that most of the study area lies in agricultural lands. The amount of good visibility area will depend on current land use and whether the ground has been recently plowed.

Shovel test pits (STPs) will be excavated in accessible areas within the study area where slope is less than 20 percent. STPs will be excavated to sterile subsoil, or to a maximum depth of 80 centimeters if sterile subsoil is not identified. Excavated soil will be passed through a ¼-inch hardware cloth and searched for artifacts. Shovel test stations will be placed in a single transect that follows the project centerline, with one STP every 15 meters (49 feet). It is anticipated that no more than 220 STPs will be necessary.

When artifacts or features are encountered, whether in STPs or on the surface, STPs will be excavated in lines radiating in each cardinal direction from the find spot, with an interval of 5 m between shovel tests. This will be continued until two negatives are found in each direction. The resulting pattern will be used to estimate the site's boundaries. A Missouri SHPO Site Form will be completed and filed with the SHPO for each identified archaeological site.

A geoarchaeological investigation will be carried out based on a study of soil profiles exposed in backhoe trenches, which will be excavated in selected locations in the study area. The purpose of the study is to identify buried landforms with potential for historic properties in the study area so that the project's potential to affect historic properties can be better understood. No less than five, and no more than 12, backhoe trenches will be excavated and studied. The geoarchaeological study will include fieldwork, analysis of notes and data, a Management Summary, and a Draft Report to be included as an appendix in the Draft Report of the archaeological investigation. Up to four organic samples from the trenches will be submitted for radiocarbon assays.

2.2.2 Reporting

Recovered cultural materials will be processed and recorded in general accordance with the requirements set forth by the SHPO. Analysis of the artifacts will focus on identifying temporally and culturally diagnostic artifacts, as required for the preparation of state site forms.

Specimens will be placed in archival bags with a permanent provenience designation and listed in an inventory. Upon completion of the analysis and preparation of the final report, artifacts, field notes, maps, and photographs pertaining to this investigation will be prepared for curation in keeping with 36 CFR Part 79.

A Management Summary will be prepared which will provide a brief description of the results of our investigation. This will be followed by a Draft Report which will provide more detailed information about our findings, in accordance with SHPO requirements. The Draft Report will include the results of the background research, a discussion of the culture history of the area, field and laboratory methodology, descriptions of the re-visited sites and artifacts recovered, the National Register eligibility recommendation for each site, and an assessment of project effects for each site. Site maps, project maps, photographs of each site and an artifact database will be included with the Draft Report. The Draft Report will be submitted by the client for review by the SHPO. Our recommendations for further work will also be included.

If needed, a Final Report will be prepared upon the completion of the Draft Report review process. A Final Report will be needed only if significant changes to the Draft Report are required by SHPO.

Geoarchaeological samples may be collected, transported to a laboratory, and analyzed as needed. Analysis of the samples will focus on soil and sediment structures and composition (but will not include detailed grain-size analysis), and radiocarbon assays. A Management Summary will be prepared which will briefly describe the results of the geoarchaeological investigation, to be followed by a Draft Report, which will provide more detailed information on the findings and conclusions of the geoarchaeological study. This Draft Report will include documentation, descriptions, and interpretations of each backhoe trench soil profile, as well as the results of any successful radiocarbon dates. This Draft Report will be included as an appendix in the archaeological Draft and Final Reports.

2.3 Methods for Well Field Collector System Assessment

A discovery plan prepared by MACTEC and Paul C. Rizzo Associates, Inc. that consisted of a remote sensing at proposed drilling locations established for the feasibility assessment of a well field collector system is presented in Appendix A. As proposed, monitoring was to be conducted by a MACTEC archaeologist at selected drilling locations determined to have a high probability to possess buried archaeological resources. A total of 10 drilling locations were monitored.

2.4 Methods for Proposed Transmission Line (Preliminary)

The cultural resources investigation will be designed to satisfy the requirements of Section 106 of the National Historic Preservation Act (36 CFR Part 800). The chief aim is identification of any cultural resources in the area of potential effect (APE) and assessment of project effects.

The APE will be determined by the lead consulting agency and client in consultation with the State Historic Preservation Officer. It is MACTEC understanding that the APE will consist of a 150 foot corridor that will require approximately 1.5 to 2 miles of new corridor location.

Approximately half of the corridor crosses eroded uplands, and other half lies in the floodplains of Logan Creek and the Missouri River. Most of the transmission line will be placed in the existing corridor in the uplands with new location in the floodplain. The existing transmission line corridor was previously surveyed using a walk-over with shovel tests at all stream crossings. No cultural resources were identified.

Unfortunately, information on the methods used and areas covered by these early studies is not fully described in the survey reports. Therefore, some areas (and sites) in the uplands may have to be reassessed, especially in the area of the Logan Creek River Valley.

The APE will have to be surveyed using a method that follows federal guidelines and acceptable to the Missouri SHPO. It is MACTEC's professional opinion that the floodplain areas have high potential for cultural resources, and the upland areas have medium to high potential. The following work plan is dependent on approval by the Missouri SHPO.

2.4.1 Records and Literature Review

A complete records search and literature review will be conducted prior to the initiation of the field investigation in order to determine whether the APE contains any known historic properties. The records search will include the site files of the Missouri Department of Natural Resources (MDNR)-Historic Preservation Program (HPP) in Jefferson City, Missouri, and the current listing of the National Register of Historic Places (NRHP) for Missouri. Cultural resource management reports describing previous archaeological investigations conducted in or near the project area will be reviewed. Early U.S. Department of Agriculture aerial photographs, historic atlases, geological survey maps, and early U.S. Geological Survey 15- and 30-minute topographic maps will be used to identify potential historic sites when available.

2.4.2 Phase I Survey

All accessible areas within the APE will be examined by pedestrian survey. Accessible areas are those that can be walked through and where the natural ground surface is visible. Shovel test pits (STPs) will be excavated in all accessible areas with less than 25 percent ground surface visibility where slope is less than 20%s. Shovel tests will be excavated to a maximum depth of 80 cm and all excavated soil will be passed through a ¼-inch hardware cloth and searched for artifacts. Shovel tests will be placed in or near the centerline and spaced 20 meters (65 feet) apart.

According to the current Callaway County Soil Survey, soils in the floodplain portions of the project area are 80-130 cm deep. In order to investigate soils below the 80 cm depth of the shovel tests, the Geoprobe will be used at each tower location (Task 3).

Each time cultural material is encountered, additional shovel tests will be excavated in lines radiating in each cardinal direction from the find spot. This will be continued until two negatives are found in each direction. The resulting pattern will be used to estimate the site's boundaries. An Archaeological Survey of Missouri Site Form will be completed and filed with the SHPO.

All fieldwork and results will be documented with field notes, digital photographs, and sketch maps.

2.4.3 Deep Testing

The floodplain of the Missouri River has the potential to contain deeply buried archaeological resources including both historic (including shipwrecks) and prehistoric sites. Deep testing can be restricted to each tower location where subsurface impacts are anticipated to be approximately 10 feet in depth. The Geoprobe will be used to retrieve soil cores from each tower location to test for buried landforms, buried cultural horizons, or deeply buried sites. If it is determined that buried landforms or potential cultural horizons are present, then avoidance will be recommended for that tower location. If avoidance is not feasible, then a backhoe trench will be placed at the tower location to determine if buried archaeological resources are present.

If a deeply buried archaeological site is determined to be potentially eligible for nomination to the National Register of Historic Places, all work will cease at that tower location and a Phase II investigation will be recommended.

2.4.4 Preparation of Site Survey Forms, Artifact Cataloging, Analysis, and Curation

The fourth task will consist of the completion of site survey forms, the processing of artifacts, and the comprehensive analysis of collected artifacts and data. This task will be accomplished upon the completion of the field survey by trained archaeological specialists under the direction of the supervising archaeologist in MACTEC's archaeological laboratory in Knoxville. All collected materials will be identified, sorted, and tabulated. All temporally diagnostic artifacts will be identified and inventoried. Artifacts will be separated into material and functional categories, and recognized type names will be applied where appropriate.

Upon completion of the analysis and final report, the artifacts, field notes, and photographs pertaining to the project will be prepared for curation in a proper facility in keeping with 36 CFR part 79. The collected materials will be curated temporarily at the facilities of the contractor selected to perform this study. This approach allows access to these materials during the analysis and report writing stages of the project. After acceptance of the final report, materials will be placed in storage containers and submitted to the facility chosen by Federal Energy Regulatory Commission, such as the Division of American Archeology, University of Missouri-Columbia. Responsibility for curatorial arrangements will be assumed by the Principal Investigator.

2.4.5 Reporting

Upon completion of the field work, recovered materials will be transported to MACTEC's Knoxville office, where they will be processed and recorded according to the requirements set forth by the SHPO. Analysis of the artifacts will be focused on identifying temporally and culturally diagnostic artifacts, as required for the preparation of state site forms. Specimens will be placed in archival bags with a permanent provenience designation and listed in an inventory. Upon completion of the analysis and preparation of the final report, artifacts, field notes, maps, and photographs pertaining to this investigation will be prepared for curation in keeping with 36 CFR Part 79.

Once the document review, field investigation, and artifact analysis are complete, a Management Summary will be prepared which will provide a brief description of the results of our investigation. This will be followed by a draft report which will provide more detailed information about our findings, in general accordance with SHPO requirements. The draft report will include the results of the background research, a discussion of the culture history of the area, field and laboratory methodology, descriptions of all the re-visited sites and artifacts

recovered, and the National Register eligibility recommendation for each site. Site maps, project maps, photographs of each site and an artifact database will be included with the report. Our recommendations for further work and will also be included. A final report will be prepared upon the completion of the draft report review process.

Appendix A

Cultural Resources Discovery Plan for Archaeological Monitoring of Soil Borings
Callaway Nuclear Plant COLA
Callaway County, Missouri

Paul C. Rizzo Associates, Inc.

ENGINEERS & CONSULTANTS

Final Cultural Resources Discovery Plan for Archaeological Monitoring of Soil Borings

COLA Unit 2
Callaway Nuclear Power Plant

Prepared for:

AmerenUE
St. Louis, Missouri

Ameren

Prepared by:

MACTEC Engineering and Consulting, Inc.
Knoxville, Tennessee

and

Paul C. Rizzo Associates, Inc.
Monroeville, Pennsylvania

June 2007
Project No. 06-3624

FINAL CULTURAL RESOURCES DISCOVERY PLAN FOR ARCHAEOLOGICAL MONITORING OF SOIL BORINGS CALLAWAY NUCLEAR PLANT COLA CALLAWAY COUNTY, MISSOURI

PROJECT NO: 06-3624.04
JUNE 15, 2007

PREPARED BY

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CULTURAL RESOURCES DISCOVERY PLAN FOR ARCHAEOLOGICAL MONITORING OF SOIL BORINGS CALLAWAY NUCLEAR PLANT COLA CALLAWAY COUNTY, MISSOURI

1.0 INTRODUCTION

The purpose of this Cultural Resources Discovery Plan is to provide a coordinated program for action in the event of the discovery of significant cultural resources or human remains during the proposed archaeological monitoring of exploratory soil borings. The soil borings are to be drilled during the first phase of a feasibility study for proposed horizontal intake wells to support the Callaway Nuclear Plant Combined License Application (COLA) near Reform in Callaway County, Missouri. Paul C. Rizzo Associates, Inc. (RIZZO) has been retained by AmerenUE to conduct the feasibility study and MACTEC Engineering and Consulting, Inc. (MACTEC) has been retained by RIZZO to plan, coordinate, and carry out cultural resources studies for the project as needed.

Fourteen soil boring (drilling) locations have been proposed. Archaeological monitoring will be carried out by one or more MACTEC Archaeologists and will consist of observing all soil and sediment removed from selected bore holes and identifying any historic properties, as well as identifying any historic properties that might be affected by movement of the drilling equipment through the project area to the soil boring locations. "Historic properties" is defined pursuant to 36 CFR Part 800 as any artifacts, sites, or cultural features that are listed on or eligible for listing on the National Register of Historic Places (National Register).

If historic properties are discovered inadvertently in the project area during the drilling project, the procedures outlined in this Discovery Plan will help ensure that they are preserved until a plan for avoidance or mitigation can be put into place. If human

remains are discovered, immediate consultation with Missouri state agencies and Native American tribal representatives will take place. This Plan identifies the individuals who will be contacted and the procedures to be followed in the event that historic properties or human remains are discovered during drilling activity in the project area.

2.0 PROJECT LOCATION

The Callaway Nuclear Plant is near Reform in Callaway County Missouri. The drilling locations are in Callaway and Osage Counties in the following sections: T. 45 N, R. 7 W, Section 6; T. 46 N, R. 7 W, Section 31; T 46 N, R. 8 W, Sections 35 and 36; T. 45 N, R. 8 W, Sections 1, 2, and 3; and T. 45 N, R. 8 W, Section 10 (***Figure 1***). Twelve soil borings will be located near the left descending bank of the Missouri River between river miles 115.2 and 120.0, and two will be located on the right descending bank, one opposite river mile 119.1 and one opposite river mile 116.9. Six of the soil borings will be located at the back side of a constructed levee on the south side of Bingelli Island, which faces the main channel of the Missouri River on the river's left descending bank. Five others will be placed near the river bank outside of Bingelli Island and three will be located near a creek approximately two miles north of the island.

3.0 REGULATORY SETTING AND BACKGROUND

Involvement of the Federal Energy Regulatory Commission (FERC) in the Callaway COLA requires compliance with the National Historic Preservation Act of 1966 (NHPA), as amended, and its implementing regulations (36 CFR Part 800, as revised). The NHPA established the federal government's policy and programs on historic preservation, including the establishment of the National Register. Cultural resources that are listed or eligible for the National Register are called historic properties and their eligibility is recognition of their significance. Section 106 of the Act requires federal agencies to take into account the effects of their undertakings, including funding, permitting and licensing on historic properties.

The Section 106 review process (36 CFR 800.3-800.6) consists of four steps: initiation, including consultation, identification of historic properties, assessment of adverse effects of the undertaking, and resolution of adverse effects. The lead agency completes these steps in consultation with the State Historic Preservation Officer (SHPO), any Indian tribe that attaches religious and cultural significance to historic properties that might be adversely affected, and interested member(s) of the public.

The need for archaeological monitoring of the drilling was identified after an informal consultation by RIZZO and MACTEC with the Missouri SHPO. The potential for buried historic properties in the project area extends far below the depths normally accessible by routine Phase I survey techniques such as shovel testing and backhoe testing. Therefore, it was determined that such techniques would be inadequate as identification tools in this situation. Archaeological monitoring is a technique that can be used in such situations to identify any cultural resources inadvertently discovered during drilling.

The purposes of this archaeological monitoring are as follows:

- Complete the Section 106 identification step;
- Evaluate possible adverse project effects to any buried cultural resources in the project area; and
- Prevent unnecessary adverse effects by halting drilling as soon as a significant discovery is made.

For the purposes of this archaeological monitoring, "significant discovery" will be defined as any evidence positively indicating the presence of an intact archaeological site, archaeological feature, or human burial that may be eligible for listing on the National Register. Such evidence could include (but is not limited to) milled timbers or lumber that is non-modern, diagnostic prehistoric artifacts combined with evidence of a cultural midden such as abundant charcoal and/or dense gastropod or mussel shell fragments, or human remains.

In the event that Native American burials or human remains are discovered in the project area, the drilling project also must comply with the Native American Graves Repatriation and Protection Act (NAGPRA) of 1990. This law requires agencies with undertakings that affect Native American burials, human remains, and artifacts associated with burials to inventory those items and make them available to Native American tribes for repatriation. Determining the party to whom such items should be offered for repatriation is the obligation of the lead agency and is done in consultation with SHPO and interested tribes.

4.0 POTENTIAL FOR DISCOVERY

The potential for discovery of archaeological remains was estimated by review of environmental characteristics of the project area, information about current land use, information gathered during the background research, and an assessment of the geological setting of the project area. MACTEC conducted a check of the site files and previous cultural resources surveys archived at the Missouri SHPO in Jefferson City. No previously recorded sites are located in the project area. Two cultural resources surveys intersected the project area, including a survey for a transmission line that crosses the eastern side of Bingelli Island (Evans and Ives 1979) and a recent survey for a proposed ferry landing and access road on the island (Warner 2005). Neither survey involved deep testing nor identified cultural resources within the project area. Other sources consulted include historical maps (Edwards Brothers 1876; Missouri River Commission 1892; Ogle and Company 1897, 1917; Callaway County plat maps dating to 1876, 1897, and 1930) and an atlas of shipwreck locations along the Missouri River (USACE 2000).

These historical maps document that the Missouri River has changed course repeatedly in historic times. According to an atlas showing historically documented shipwrecks along the Missouri River (USACE 2000), three historically recorded shipwrecks are located in Mollie Dozier Chute and in the general vicinity of some of the proposed drilling locations (***Figure 1***): the Alert (1840), the Mollie Dozier (1866), and the George Spangler (1879).

Five locations are shown on ***Figure 1*** because the two historical sources used to compile the shipwrecks atlas disagree on the locations of the Mollie Dozier and the George Spangler. All of the proposed drilling locations are more than 2,600 feet from the five possible shipwreck locations.

Based on a review of these sources and on general geological knowledge of the project setting, it has been determined that some of the proposed drilling locations have the potential to affect buried cultural resources in the project area. In addition, based on a soil boring previously drilled north of proposed drilling location (FSB-2), a terminal Pleistocene glacial outwash deposit is located at approximately 85-90 feet below ground surface in the project area vicinity. This indicates a potential for the presence of historic and prehistoric materials of any age up to 13,000 years.

This information indicates potential for unknown buried shipwrecks throughout the project area. From data obtained concerning the historic channel locations in and around the Alluvial Plain, five proposed drilling locations (FMW-1D/1S, -6, -7, -12, and FSB-3) appear to be located within apparent historic channels, on the north side of the Missouri River and five other proposed drilling locations (FMW-8, -9, -10, -11 and FSB-13) are located at or near the edges of the existing river bank and may be within historic channels. One proposed drilling location (FSB-14) is near the right bank of the modern river channel. Three potential drilling locations (FMW-5 and FBS-2 and -4) are located along a meandering creek of unknown origin. In the opinion of MACTEC and RIZZO, all 14 of these locations have potential for buried shipwrecks. Therefore, we propose to perform a magnetometer survey at the 14 locations prior to the drilling operation to obtain additional information.

It is MACTEC's opinion that 5 drilling locations have potential for buried cultural resources other than shipwrecks:(FSB-2, -3, -4, -14, and FMW-5). We proposed to carry out archaeological monitoring all five of these drilling locations. Eight locations are in areas that do not appear to have high potential for buried cultural resources due to modern disturbance and/or distance from the modern and historic river channels. One

location (FSB-12) may have potential for buried cultural resources depending on its placement, which has yet to be fully determined. If (FSB-12) is placed away from the river bank in an undisturbed location, then its drilling will be monitored; if it is placed in a disturbed location it will not be monitored. This determination is based on a review of available historic and geological evidence, and in consultation with the Missouri SHPO during a meeting in Jefferson City, Missouri on June 13, 2007. Also present at the meeting were representatives from MACTEC, RIZZO, and AmerenUE. Agreement was reached during the meeting that monitoring should be required only for the drilling of (FSB-2, -3, -4, -14 and FMW-5), and that the need for archaeological monitoring of (FSB-12) will be determined at a later date, based on its placement.

5.0 METHODS OF DRILLING AND REMOTE SENSING

RIZZO proposes to subcontract COLOG to conduct a magnetometer survey at each of the 14 proposed drilling locations that have potential for buried shipwrecks. COLOG, a division of the Layne Christensen Company, has conducted many magnetometer surveys. These surveys typically aid in the location of steamboat wrecks. Iron from the boat's boilers, engines, and paddlewheels creates a strong anomaly in the magnetic field in the vicinity. A description of the technique is given by Arnold (1974).

The magnetometer surveys would be conducted prior to any drilling. RIZZO proposes to conduct fourteen (14) 50 x 100 foot magnetometer surveys, each of which would be centered on one of the proposed drilling locations. The surveys will help identify previously undetected buried masses, if any. Based on these surveys an attempt will be made to determine the depth to any potential buried magnetic anomaly. If an anomaly is identified that indicates the possible presence of a shipwreck or other large cultural feature, the drilling location will be moved a distance of at least 100 feet. In such an event, a second magnetometer survey will be conducted at the new proposed drilling location and the same procedure will be followed.

Once the magnetometer surveys have been completed and each location to be drilled has been shown to lack significant magnetic anomalies suggestive of large cultural features or sites, the drilling will be initiated. The techniques and procedures to be used are as follows:

1. Initial advancement of the borehole will be conducted with the utilization of Hollow Stem Augers (HSA) to a depth of 20 feet, sampling with the 5-foot CME Continuous Sampling Tool (CST). The CST will provide a good overview of the upper 20 feet of material and the 3- inch diameter opening in the shoe of the CST will permit larger portions of material to be collected for cultural analysis than the standard 2-inch diameter split-spoons. The CST is pushed ahead of the lead auger whereas the split-spoon is driven with a 140 pound-per-inch blow, so the CST presents less damage to potential artifacts than the split spoon technique. The lower one half (1/2) foot of each 5-foot sample retrieved from the CST will be removed and set aside for possible grain-size analysis. To further decrease damage to possible buried artifacts, if the upper 20 feet of material is soft enough, the CST can be pushed 5 feet, retrieved, the contents examined, and then the HSA advanced 5 feet. This process can be repeated to the 20 foot depth, or, if desired (and the material is still soft enough) to a maximum depth of 25 feet, with the drilling technique proposed to change at a depth of 20 feet.
2. At a depth of 20 feet, surface casing will be set to stabilize the upper material of the borehole and drilling will be switched to mud rotary, with sampling conducted by grab samples at 5-foot intervals.
3. Subsurface lithology will be described on boring logs continuously from ground surface to a depth of 20 feet, then at 5-foot intervals from grab samples.
4. Approximately four or five selected soil samples from each of the boreholes at FMW-6 through FMW-12 will be collected and sent to a laboratory for grain-size analysis.
5. Up to ten Shelby tube samples will be collected and up to five samples will be sent for laboratory analysis of moisture content, unit weight, specific gravity, grain size, and permeability analyses.
6. If necessary split-spoon sampling will be available if requested by on-site archeologists or Burns & McDonnell geologists.
7. Upon reaching possible bedrock, the material will be penetrated by coring or rock drilling to ascertain that it is Dolomite (bedrock in this area). This will be carried out at several locations until a 'good feel' for the depth-to-bedrock can be determined. Once this depth is decided, rock penetration will only be conducted at locations where the depth to projected bedrock

deviates from the norm, shallower as to deeper, or at the discretion of the Field Geologist.

8. If, upon reaching bedrock the borehole has remained open and portions have not collapsed in upon it, electrical resistivity, geophysical spontaneous potential (SP) and gamma logs will be run, and then a 2-inch diameter PVC well, with a 20-foot slotted screen section will be installed. However, if portions of the borehole have collapsed in upon it, then the bore hole will be re-reamed and a 2-inch diameter PVC well, with a 20-foot slotted screen section will be installed. Then geophysical induction and gamma logs will be run.

6.0 DISCOVERY PROCEDURES: GENERAL

The archaeological monitoring project presents two primary management issues: 1) Identification and treatment of undiscovered historic properties; and 2) treatment of human remains. A process for identification, evaluation and treatment for historic properties which the project may encounter is presented in the following sections.

7.0 POLICIES AND PROTOCOLS

As a general policy, and as far as practically feasible, cultural resources will be avoided and actively protected, including isolated artifacts and significant historic properties. Instances may arise where modification of the project to accommodate avoidance is not possible. In those instances, the property in question will be treated in the manner described below.

Collection of artifacts by employees, drilling personnel or others with access to the project is prohibited. MACTEC employees, AmerenUE employees, RIZZO employees, drilling subcontractors, and other workers in the project area will be informed that any artifacts they may happen to discover should be left in place and reported to the archaeological staff immediately.

8.0 BRIEFING

Prior to drilling, the Archaeologist will brief the Drilling Supervisor and drilling crew on cultural resource issues. The briefing will include information on the legal context of cultural resources protection and on the prehistoric and historic cultural resources likely to be present in the drilling project area. The primary goals of this briefing are to familiarize drilling personnel with the procedures that will followed in the event of discovery of cultural material (see below), and to provide contact protocols and information to the Drilling Supervisor.

9.0 PERSONNEL QUALIFICATIONS AND CHAIN OF COMMUNICATION

The archaeological staff will consist of the Archaeologist in General Charge (Archaeologist), a MACTEC Staff Archaeologist, and one Archaeological Technician. Dr. Stephen C. Cole will serve as Principal Investigator (Archaeologist in General Charge) and Donna Rogers, RPA will serve as Field Director (Archaeologist in Direct Charge, or "Archaeologist") for the Project. All MACTEC Archaeologists meet The Secretary of the Interior's Professional Qualifications Standards. The Archaeologist will ensure that the provisions of this document are carried out and will be on-site throughout the duration of the Archaeological Monitoring Project. The Archaeologist will be the primary point-of-contact (POC) for MACTEC employees, AmerenUE, and RIZZO. The Archaeologist will be responsible for reporting daily work and documentation of any discoveries.

Any MACTEC Archaeologist on-site will have the authority to temporarily halt drilling activities while examining possible discoveries. The Archaeologist will have the responsibility to notify the Drilling Supervisor immediately of any discoveries judged to be significant as defined above. The Archaeologist will also have the responsibility to ensure that representatives from AmerenUE, RIZZO, and the MDNR SHPO are notified of any significant discoveries in a timely fashion. At the completion of the field survey, a

technical report will be prepared describing the results and presenting conclusions and recommendations. The report will be submitted to the SHPO for review and concurrence with conclusions and recommendations.

Anthony G. Fabina, P.G. (RIZZO Senior Project Geologist) will serve as the Field Team Leader. Mr. Fabina has over thirty years of experience and has conducted over several dozen similar field investigation campaigns.

Key personnel contact information is provided in ***Table 1*** below.

TABLE 1

PERSONNEL CONTACT LIST

CONTACT NAME	CONTACT PHONE NUMBER
Paul C. Rizzo Associates, Inc.	
Anthony G. Fabina, P.G., Senior Geologist	(573) 676-6304
Melissa Dubinsky, Ph.D., Project Manager	(412) 856-9700 ext. 1009
MACTEC Engineering and Consulting, Inc.	
Bill Elzinga, Senior Project Manager	(314) 209-5957
Steve Cole, Ph.D., Archaeologist in General Charge	(865) 588-8544 ext. 1145
Donna Rogers, Archaeologist in Direct Charge	(865) 771-1972 (cell)
Callaway County	
Emergency	911
Sheriff's Department	(573) 642-7291
Boone/Callaway County Medical Examiner	(573) 474-2700
AmerenUE	
Pat Cryderman	(573) 676-8299
Kenny Lynn	(314) 554-2978
Missouri State Historic Preservation Office	
Judith Deel, Archaeologist	(573) 751-7862

10.0 DISCOVERY PROCEDURES: SPECIFIC

1. The archaeological staff will examine cuttings and spoils excavated by the soil drilling equipment and any ground disturbed by the transport of the equipment within the project area, to identify any cultural remains or human remains.

2. If there is a discovery, the Archaeologist will ensure proper documentation and assessment of the discovery. The Archaeologist will record on standard forms all prehistoric and historic cultural material that is discovered. The initial effort will focus on establishing the nature, provenience and integrity of any discovery. Documentation methods will include photographs, sketches, scaled drawings, and written descriptions. Samples may be taken and transported to MACTEC's archaeological laboratory in Knoxville, Tennessee for identification or special analysis.

3. The primary goals of archaeological monitoring will be discovery and documentation of cultural material in the project that are inadvertently discovered by drilling activities, and avoidance of unnecessary adverse effects on historic properties from drilling activities.

4. In the event of a significant archaeological discovery, the Archaeologist will immediately contact the equipment operator, ask that drilling be suspended, and arrange for re-direction or the halt of drilling as needed until preliminary documentation can be completed. If this preliminary analysis leads the Archaeologist to conclude that the discovery is not significant, the Archaeologist may decide to allow drilling to continue. However, if the Archaeologist determines that the discovery is significant, the Archaeologist may assume that it is eligible for purposes of Section 106 and resolution of adverse effects [36 CFR 800.13 (c)]. If, in this instance, it is determined that continued drilling would cause an adverse effect on the historic property, the Archaeologist shall ask the Drilling Supervisor to cease drilling at the soil boring where the discovery was made.

5. All significant discoveries will be reported by the Archaeologist to the Drilling Supervisor immediately. The Archaeologist will ensure that the RIZZO Project Manager is fully briefed on the discovery in a timely fashion. The Archaeologist will assemble documentation and a preliminary assessment of significance that will accompany draft site records supplied to the Missouri SHPO. Criteria and integrity requirements for listing on the National Register (36 CFR 60.4) will provide the standards for identification and evaluation of significance for cultural material.

6. If a discovery is made during drilling and the Archaeologist determines that the discovery is significant, then she shall contact the Archaeologist in General Charge and the RIZZO Project Manager to notify them of the discovery. RIZZO will promptly notify AmerenUE, who will notify the property owner if not AmerenUE. SHPO will be notified of the discovery by the technical report, which will be issued after the archaeological fieldwork has been completed.

7. If project activities expose human remains, either burials or isolated teeth or bones, or other mortuary items, drilling activities in the vicinity of the find will be immediately stopped. The Archaeologist will assess whether the remains are modern or historic/prehistoric. She will inform the Drilling Supervisor and the RIZZO Project Manager of the discovery and her assessment of its age. If the Archaeologist cannot rule out that the find may be modern, the RIZZO Project Manager will ensure that the Callaway County Medical Examiner and local law enforcement are contacted. The County Medical Examiner will examine the remains and determine whether they constitute forensic evidence. If the remains are determined to be forensic evidence, the Medical Examiner will take charge of the discovery. Work at the drilling location where the discovery was made may continue only after permission has been given by the Medical Examiner and/or law enforcement officials.

8. If the remains are determined by the Archaeologist or the Medical Examiner to be historic or prehistoric, then the RIZZO Project Manager will contact AmerenUE officials, who will then see that any concerned Native American Tribes are consulted in a timely manner. This consultation will include information about the nature of the discovery and a request that any concerns be presented to the consulting agency and AmerenUE during the 30-day consultation period. Exposed burials or other human remains will be treated with respect and temporarily re-buried or backfilled pending development of a treatment plan by MDNR in consultation with the Missouri SHPO and any concerned Tribes. In no case will additional excavation be undertaken prior to Native American consultation, and no exposed human remains will be left unattended. The ultimate disposition of the remains will be determined in consultation.

REFERENCES

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Evans, David R. and David J. Ives, 1979, "A Cultural Resources Survey of the Proposed Union Electric Company Electric 345kV Transmission Line Right-of-Way, Gasconade and Osage Counties, MO." Union Electric Company, St. Louis, Missouri. MS on file at the Missouri State Historic Preservation Office as document number GA-008.

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Warner, Kathryn A., 2005, "Phase One Cultural Resource Survey, Chamois Ferryboat, Callaway County, Missouri." Prepared for Chamois Industrial Development Corporation, by SCI Engineering, St. Charles, Missouri. MS on file at the Missouri State Historic Preservation Office as document number CY-121.

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Health and Safety Plan (HASP) for Callaway Nuclear Plant MDC Reform Conservation Area

Prepared for:

Paul C. Rizzo Associates, Inc.
105 Mall Boulevard, Suite 270, Expo Mart
Monroeville, Pennsylvania 15146

Prepared by:

MACTEC Engineering and Consulting, Inc.
3199 Riverport Tech Center Drive
St. Louis, Missouri 63043

April 2007

MACTEC Engineering and Consulting Project No. 3250075219.02.10

MACTEC

Steve Stumne Project Manager	18 April 2007 Date	Bill Elzinga Principal Scientist	4/18/07 Date

Table of Contents

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1.0 Project Health and Safety Overview

This is a summary of specific portions of the Health and Safety Plan (HASP) developed for the AmerenUE Callaway Nuclear Plant (MDC Reform Conservation Area). This is not to be considered as the complete HASP, nor does it preclude the worker from reviewing the complete HASP. It is merely a summary of some of the Site-Specific Worker Site Safety Rules and Emergency Procedures. The HASP is a living document and will be revised as required based on field activities.

Emergency:
In the event of and emergency in the field, if trained and willing, initiate first aid and get medical attention for the injured person immediately. Immediately notify the Control Room Supervisor (CRS) of the type of medical emergency that has occurred. According to Callaway Plant Policy, CRS will then make an assessment of the situation and determine the appropriate level of medical response (ambulance or air evacuation).

Emergency Numbers:

Police:	**City of Fulton**	**573-642-3376**
Fire:	**Central Callaway Fire Protection District Station 1**	**911; 573-642-9144**
Control Room Supervisor:		**573-676-8233**

General Safety at Callaway Nuclear Plant
The Callaway Nuclear Plant and surrounding areas contain many local hazards, including rough, uneven surfaces, sheer cliffs, unstable rocks, fallen trees, dangerous overhang(s), ditches, mud, and sink holes, rapidly changing water depths, ice, slippery surfaces, and debris and varying terrain. Workers should pay special attention to footing, overhead obstacles, and other local conditions and take appropriate precautions. In addition, the sensitive ecological nature of this area will require special precautions and working arrangements. Site Specific Safety Procedures include, but are not limited to:

- All workers in this area need to be knowledgeable of the full Safety Plan and sign in daily to acknowledge they have read and understand the Plan and will abide by this Plan;
- All workers are to attend daily safety briefings before working in the field;
- Hard hats must be worn when workers in are in areas with overhead hazards;
- Life vests are to be worn anytime working on, in or within 25 feet of any water more than 3 feet deep;
- Work vests with fluorescent colors are to be worn at all times in the field;
- At least two (2) people must work within close proximity and site of each other at all times;
- At least one person in each group or team in the field must carry a radio or other communication device for use when accidents or other emergencies occur; and
- When working with chain saws and other cutting devices and heavy equipment; hearing protection must be worn and appropriate safety measures taken

2.0 Project, Site, and Task Information

Project Name: RIZZO	**Project Number: 3250075219**
Request Date:	**Date Needed:**
Site Location: Junction CC and Hwy O, Fulton, Missouri	
Start Date of Site Activities:	**End Date of Site Activities:**
Project Manager: Steve Stumne	

Site Information

Site description (e.g., landfill, UST, industrial site, significant geographic features):
Seven thousand acres of forest, grassland and cropland surrounding the AmerenUE Callaway Nuclear plant adjacent to the Missouri River. Site managed by MDC as a Conservation Area.

Site history (describe previous use(s)):
NA

Additional significant features or information (e.g., limited access, traffic):
Isolated area

Are site contaminants known or expected in (note concentrations and physical form)?: **NA**
Liquid ☐ Solid ☐ Gaseous ☐

Site Specific Conditions:

Task Information

Task Name	**Task Description** (include anticipated LOP, tools and equipment to be used)
1 Work Order 1	Waters of the U.S. Delineation and Cultural Resources Survey
2 Work Order 2	Perform Project Planning, Scoping, and Regulatory Review
3 Work Order 3	Terrestrial Faunal Surveys

3.0 HASP Approval

Scheduled Start-Up Date:	**Scheduled Start-Up Time:**
Project: Discharge Line Replacement Project	**Site: Callaway Nuclear Plant**
Project Number: 3250075219	**Location: Fulton, Missouri**

We have reviewed the attached HASP, including the HASP Request Worksheet, for the above referenced site. We recognize that when this form is completed, the attached HASP is approved for the field activities on the above referenced site. Changes to this HASP shall be documented in writing and approved.

Michael A. Brazier
Name and Signature of HASP Author — Date 4/18/07

Name and Signature of HASP Reviewer — Date 4/17/07

Project Manager Signature — Date 4/17/2007

Field Team Leader Signature — Date 4/17/07

Site Health and Safety Officer — Date 4/17/2007

4.0 HASP Acknowledgement

Project: Discharge Line Replacement Project	**Site: AmerenUE Callaway Plant**
Project Number: 3250075219	**Site Location: Fulton, Missouri**

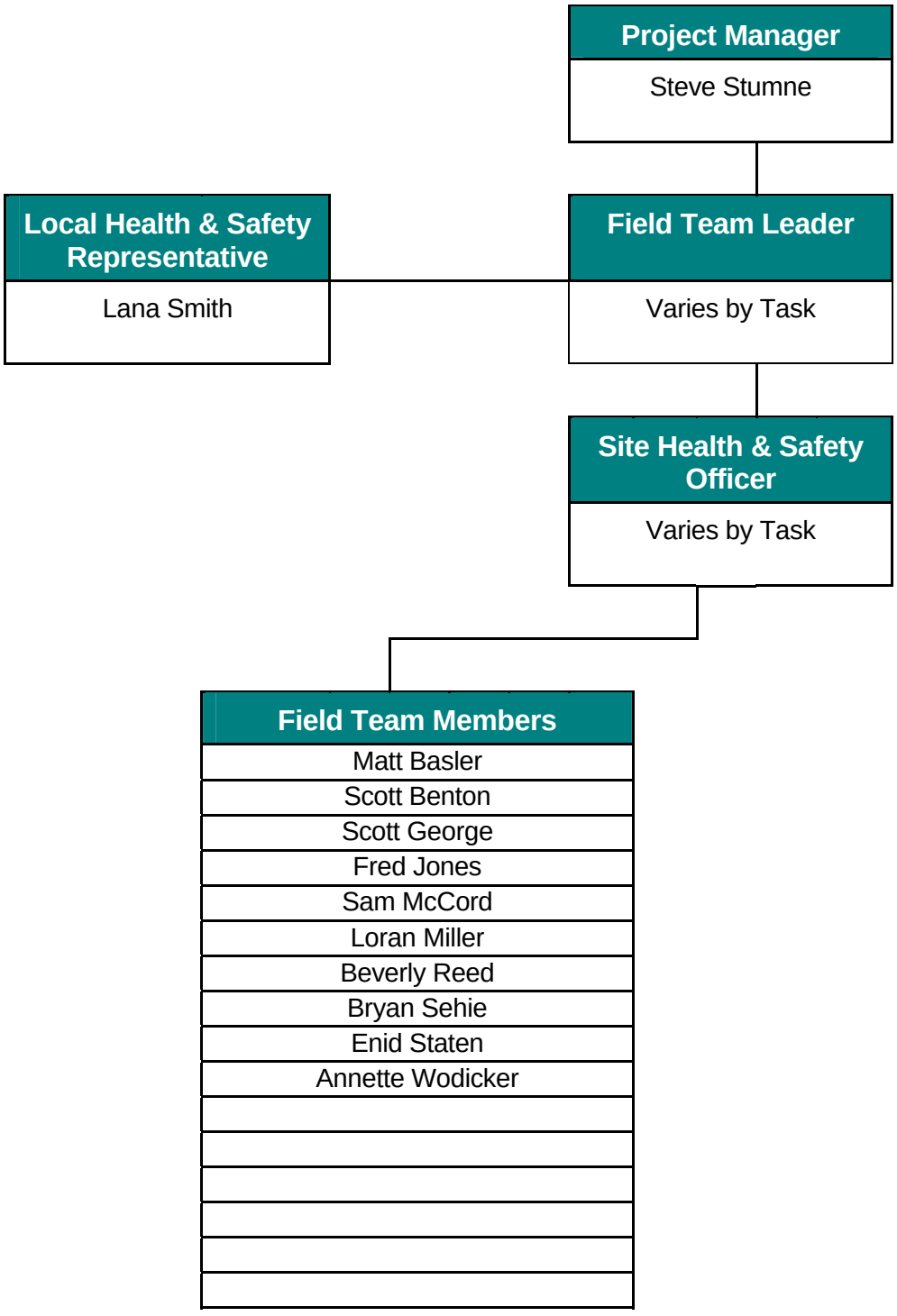
I acknowledge that I understand the requirements of this HASP, and agree to abide by the procedures and limitations specified. I also acknowledge that I have been given an opportunity to have my questions regarding the HASP and its requirements answered prior to performing field activities. Health and safety training and medical surveillance requirements applicable to my field activities at this site are current and will not expire during on-site activities.

Signature	Employee Number	Date

I acknowledge that I have verified that the employees listed above have fulfilled the health and safety training requirements for this site. I have also verified that the above employees have fulfilled the medical surveillance requirements and any client requirements to participate in a drug surveillance program for this site and do not have any medical restrictions that would prohibit them from working at this site.

Project Managers Signature: _____ Date: 4/18/2007

5.0 HASP Organization Chart



6.0 Identified/Suspected Site Contaminants

Contaminant Name (Synonyms)	Appearance & Physical Form (Pure substance)	OSHA PEL/ ACGIH TLV	STEL	IDLH	Routes of Entry	Potential Health Effects (Acute & Chronic)	PID Ionization Potential
NA							

Note:
ACGIH = American Conference of Governmental Industrial Hygienists
STEL = Short Term Exposure Limit (STEL)
IDLH = Immediately Dangerous to Life or Health
OSHA = Occupational Safety and Health Administration
PEL = Permissible Exposure Limit (OSHA)
TLV = Threshold Limit Value (ACGIH)
REL = Recommended Exposure Limit (NIOSH)
ppm = parts per million
NIOSH = National Institute for Occupational Safety and Health
ND = Not Determined
NA = Not Applicable
NE - Not Established
mg/m3 = milligrams per cubic meter
Ca/carc = Carcinogen

Abbreviations in table taken from the NIOSH *Pocket Guide to Chemical Hazards*

7.0 Task Hazard Evaluation

Hazards	Tasks					
	Task 1*	Task 2*	Task 3*			
Biological	☒	☐	☒	☐	☐	☐
Boating/Water	☒	☐	☒	☐	☐	☐
Chemical	☐	☐	☐	☐	☐	☐
Confined Space	☐	☐	☐	☐	☐	☐
Drilling/Boring	☐	☐	☐	☐	☐	☐
Electrical	☐	☐	☒	☐	☐	☐
Excavation	☐	☐	☐	☐	☐	☐
Fall	☒	☐	☒	☐	☐	☐
Fire/Explosion	☐	☐	☒	☐	☐	☐
Heavy Equipment	☐	☐	☐	☐	☐	☐
Noise	☐	☐	☐	☐	☐	☐
Temperature-Cold	☒	☐	☒	☐	☐	☐
Temperature-Hot	☒	☐	☒	☐	☐	☐
UST	☐	☐	☐	☐	☐	☐
Vehicular	☒	☐	☒	☐	☐	☐

***SPECIFIC JOB HAZARD ANALYSIS (JHAs) FOR THE TASKS ARE ATTACHED TO THIS HASP IN APPENDIX A.**

8.0 Levels of Protection

Task (Describe)	Anticipated LOP		Upgrade LOP			
	LOP	Airborne Levels	LOP	Airborne Levels	LOP	Airborne Levels
Task 1	D	NA	NA	NA		
Task 2	D	NA	NA	NA		
Task 3	D	NA	NA	NA		

9.0 Hazard Mitigation

9.1 General Safety Rules

- Eating, drinking, chewing gum or tobacco, smoking, and applying lip balm or make-up is prohibited in any area designated to be contaminated.
- Contact with contaminated surfaces should be avoided. Whenever possible, Field Team Members should not walk through puddles, mud, or discolored surfaces; kneel on the ground; or lean, sit or place equipment on drums, vehicles, or the ground.
- Smoking and other sources of ignition are prohibited in the vicinity of heavy equipment and flammable or contaminated material, including flammable vapors.
- Personnel must wash hands and face prior to eating and drinking. Field personnel should shower as soon as possible after leaving the site.
- Horseplay is prohibited in all work areas.
- Working while under the influence of intoxicants, narcotics, or controlled substances is prohibited.
- Good housekeeping procedures shall be followed to reduce slips, tips, and falls.
- Operations shall be restricted to daylight hours unless adequate lighting is provided (see Attachment F of MACTEC's UCEP Program).

9.2 Electrical Hazards

- Locate and mark buried electric lines before all subsurface work.
- For voltages 50 kV or less, maintain at least 10 feet of clearance from overhead power lines. For voltages exceeding 50 kV, the clearance shall be increased by 4 inches for every 10 kV over 50 kV.
- Electrical equipment, including pumps, sampling equipment, and power tools will be inspected prior to use to ensure that they are in good repair and have no frayed or loose connections.
- All electrical equipment used on site will be properly grounded or bonded.
- Ground Fault Circuit Interrupters (GFCI) will be used with electrical equipment on site.
- If electrical equipment must be connected by splicing wires, use properly insulated connectors and wrap with electrical tape.
- Do not perform work on electrical hook-ups and/or equipment when they are located in standing water. When water is present, either drain/dry the area or move the equipment to a dry location.

9.3 Temperature Hazards

9.3.1 For Heat

- When work is being performed under high temperatures and humidity, implement a heat stress monitoring program according to SOP. Monitoring should include heart rate and body temperature measurements.
- Work/rest periods should be modified as necessary based on the results of the monitoring program.
- Preventative measures should be taken to avert employee illness, including rest periods, work slowdowns, job rotation, and/or performing work during cooler hours of the day. Shade or air-conditioned shelter should be provided for employees during rest periods.

- Potable, cool water will be provided for employees. Workers should be encouraged to drink 16 ounces of water prior to their shift, and drink at every rest break (or every 15 to 20 minutes).
- The SHSO or FTL will discuss the signs and symptoms of heat related illnesses with workers and document on the Daily Safety Meeting Checklist.

9.3.2 For Cold

- In cold extremes, if feet or other body parts become wet they should be dried at the earliest possible time.
- After going through the decontamination procedures, employees should proceed directly to a protected area.
- At temperatures of 32 °F, the effects of wind speed become pronounced. A tarp or other barrier should be used to reduce the effects of wind speed if possible. A protected area will be provided for employees for rest breaks.
- Protective clothing shall be used, especially on the head, neck, and hands, to the extent possible to reduce chances of hypothermia and frostbite.
- Avoid skin contact with metal objects. Tools and equipment with nonmetallic handles should be used when possible.
- The SHSO or FTL will discuss the signs and symptoms of cold weather injuries with workers and document on the Daily Safety Meeting Checklist.

9.4 Vehicular Hazards

- The local traffic control authority shall be contacted prior to interrupting the flow of public travel.
- Employees exposed to public vehicular traffic shall wear warning vests marked with or made of reflective or high-visibility material.
- Public traffic shall be protected from site hazards by placing traffic cones, barricades, construction fencing, etc. at a safe distance around the work site.

9.5 Boating Hazards

9.5.1 General Boating

- Any employees assigned to operate a boat of behalf of MACTEC shall be thoroughly trained in the proper operation of the boat and outboard motor. This training may be provided by the employee's Supervisor, FTL, or a Coast Guard approved boating safety course. For the Supervisor or FTL to be considered adequately trained, attendance/certification from a Coast Guard approved course is required.
- A Safe Boating Checklist form shall be completed for the appropriate boat(s) prior to the field trip to ensure that all required equipment is present in the boat.
- An appropriate Coast Guard approved personal floatation device shall be worn by each individual on board the boat to protect against drowning.
- Ensure proper distribution of the load in the boat to avoid tipping and capsizing.
- Take a basic tool kit aboard the boat.
- Carry extra engine parts and fluids in the event of engine problems.
- Be alert and rid the area of any spilled gas and gas fumes before doing any work on electrical parts that may cause a spark.

- Fueling the boat shall be done with extreme caution to avoid static sparks and spills. Don't overfill the tanks; allow for fuel expansion.
- Keep an alert lookout and watch your speed when traveling in the boat.
- Watch your wake and the wake of other boats. Boat operators are responsible for their wake and any damage it may cause.
- Always remember that when you are trailering a boat, once underway it is easy to lose a feel for the tow. Allow more room to stop and greater clear distance for overtaking and passing other vehicles.
- Be alert for signs restricting trailers.
- Continually check and/or monitor that the trailer features (e.g., wheel bearings, tie downs, lights) are in good shape and proper working condition during the trip.
- A warning or signal shall be provided to protect employees from a moving truck and boat trailer. For signal person: where hand signals are used, only one person shall be the designated person, and shall be located to see the trailer and be clearly visible to the truck operator.
- All electrical equipment will be shut off during fueling operations.
- A two-way or marine radio shall be maintained on board the boat at all times. Radios should not be used for personal communications.

9.5.2 Electrofishing

- Generator, coffelt unit, and all electrofishing peripherals will be grounded to the boat.
- Field crew will be instructed with regard to what not to touch during electrofish sampling.
- Three safety (power shut-off) switches will be used to shut down the electrofishing system. The switches are the coffelt unit shut-off, the generator shut-off, and the operator safety mat.

9.6 Fall Hazards

Protection from falling objects shall be provided when work is being performed at 6 ft or more above the next lowest level. A system of toeboards and screens or guardrails, a canopy structure, or barricades may be used to provide protection. Employees shall also where hard hats in the affected areas.

Guardrails, safety nets, or personal fall arrest systems shall be provided for employees on walking/working surfaces 6 ft or more above the next lowest level:

9.6.1 For Guardrails

Guardrails shall consist of a 3 rail system. The top rail shall be 42" above the walking/working surface; the mid rail shall be installed at mid height between the walking/working surface and the top rail; and a toe board shall be installed at the surface level.

9.6.2 For Safety Nets

Safety nets shall be installed as close as practicable to the walking/working surface, but no more than 30 ft below. Minimum horizontal distances shall comply with 29 CFR 1926.502(c)(2). A drop test shall be performed prior to beginning work. The safety net shall be inspected at least weekly for wear and damage.

9.6.3 For Personal Fall Arrest Systems

- All materials must meet the specifications of 1926.502(d).
- Body belts, harnesses, and all components shall be designated for personal fall protection only, and shall not be used as hoists for work materials.
- Any component subjected to an impact loading shall be immediately removed from service.
- Prior to use, all components shall be inspected for wear and damage.

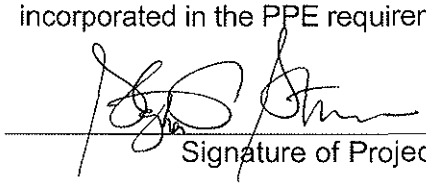
9.7 PPE Assessment – Levels of Protection

For Level D:

- Coveralls or appropriate work clothing;
- Steel toe boots or appropriate work boots;
- Safety glasses with side shields;
- Splash goggles will be worn when handling concentrated acids or caustics; and

Certification of PPE Hazard Assessment

I certify that the hazard assessment regarding personal protective equipment for MACTEC Engineering and Consulting, Inc's work at Callaway Nuclear Plant MDC RCA was completed on February 27, 2007 by Steve Stumne in accordance with 29 CFR 1910.132. The results of the hazard assessment are incorporated in the PPE requirements noted above.



Signature of Project Manager

9.8 Biological Hazards

9.8.1 For Plants/Animals

- Review the identification and habitat characteristics of rodents, snakes, spiders, ticks and bees/hornets to avoid bites or stings. Identify site personnel with a known reaction to any such bites or stings. Avoid nesting areas and habitats when possible and wear protective clothing and/or insect repellent. Always wear protective gloves when reaching into enclosed spaces where animals and/or insects are likely to hide.
- Keep all piping off the ground unless the ends are sealed against animals and insects.
- Review the identification characteristics of poison ivy and poison oak. Avoid contact with these plants and any unknown plants, and wear protective clothing.
- Avoid animal and bird droppings. These materials often contain mold, fungus, or bacteria which can cause respiratory problems such as lung disease and allergies. When entering nesting areas, wear protective clothing and use a dust mask or respirator with HEPA cartridges.

9.8.2 For Mold/Fungus

- Avoid contact with mold and fungus. Wear protective gloves and protective clothing if appropriate and use a dust mask or respirator with HEPA cartridges.

9.8.3 For Bloodborne Pathogens

- Always observe universal precautions.

- Avoid contact with any needles and sharp objects, or any materials contaminated with blood or body fluids. If contact cannot be avoided wear appropriate protective equipment.
- When administering first aid wear protective gloves and clothing. Wash hands immediately after help is rendered with soap and water. If hand washing facilities are not available, clean with antiseptic wipes, and then wash hands as soon as possible.

9.9 Noise Hazard

Hearing protection, with the appropriate attenuation factor, will be worn by all employees in the area if noise levels meet or exceed 85 dB(A). The Field Team Leader shall strictly enforce the use of appropriate hearing protection when noise levels exceed 90 dB(A).

9.10 Site specific/Additional Hazards

9.10.1 Lockout/Tagout

All hazardous sources of energy, including electrical, mechanical, pressure, thermal, stored energy, and hazardous chemical or agents must be locked out in accordance with MACTEC's Lockout/Tagout Program. Lockouts may only be performed by Authorized Employees who have successfully completed the training outlined in SOP.

Locks and tags shall be used whenever the equipment is capable of handling a lock. Tags alone are only permitted where the equipment was designed without the capability of being locked. Every energy source associated with the equipment must be locked/tagged out. Every individual working on the equipment shall apply his/her own lock. All lockout/tagout equipment must be approved by MACTEC for use. The lockout/tagout procedures outlined in SOP shall be followed.

Due to the nature of the Scope of Work, Equipment Specific Lockout/Tagout Procedures are not anticipated. Should lockout/tagout be required, work should stop until an appropriate SOP can be acquired from the Local Health and Safety Representative.

9.11 Medical Surveillance Requirements

All site personnel shall be actively participating in MACTEC's Medical Surveillance Program, including baseline and annual examinations at an Health Resources clinic and in accordance with 29 CFR 1910.120 and 29 CFR 1910.134. A copy of each employee's Medical Summary form will be retained for the project. At least one field team member will be trained and certified in CPR and First Aid.

For any exposure incidents while rendering first aid or CPR, the exposed individuals shall receive a medical evaluation and Hepatitis B vaccination in accordance with MACTEC's Bloodborne Pathogen Program. The LHSM and Continuum be notified **immediately** of any exposure incidents.

MACTEC's OSHA 300 Log is kept on file at The St. Louis Office at 3199 Riverport Tech Center Drive, St. Louis, Missouri.

To go with Bloodborne Pathogens – All personnel on site shall have completed the series for Hepatitis B vaccine, or have been tested and found to be immune. For those individuals who declined the vaccine, a copy of their signed declination statement (see Attachment C of the Bloodborne Pathogen Program) shall be kept on site.

To go with Lead – All personnel exposed to lead at or above 30 ug/m^3 on any day shall receive baseline biological monitoring, including blood testing and analysis for lead and zinc protoporphyrin levels (BLL and ZPP). Personnel who are exposed to lead at or above 30 ug/m^3 for 30 days in any consecutive 12-month period shall receive additional medical surveillance in accordance with 29 CFR 1926.62. The

additional medical surveillance shall include the required periodic BLL and ZPP testing and the appropriate medical examinations and consultations.

9.12 Training Requirements

At least one field team member shall be trained and certified in first aid and CPR. Personnel who have received this training must also receive bloodborne pathogen training in accordance with MACTEC's Bloodborne Pathogen Program and SOP.

Prior to commencement of site activities and daily thereafter, site specific training will be provided in accordance with SOP and will include an overview of HASP requirements. The Daily Safety Meeting Checklist included as part of this HASP will be used to document this training.

To go with Lockout/Tagout – Employees involved in any lockout and/or tagout procedure on site shall have successfully completed training for Authorized Employees in accordance with SOP. Employees working nearby or otherwise affected by the lockout/tagout activities shall receive training for Affected Employees in accordance with SOP.

To go with Fall Protection – All workers on site who may be exposed to fall hazards shall have successfully completed training in accordance with 29 CFR 1926.503. At a minimum training shall include recognizing fall hazards and the procedures to be followed to minimize these hazards. Training must be provided by a competent person as described in 29 CFR 1926.503(2).

To go with Bloodborne Pathogens – All workers on site who may be exposed to bloodborne pathogens shall have successfully completed training in accordance with SOP and MACTEC's Bloodborne Pathogen Program.

Site-Specific Training – All workers shall receive computer-based site-specific training conducted at the Callaway Nuclear Power Plant prior to commencement of work.

9.13 Site Control

Buddy System – All site personnel must practice the buddy system of at least 2 people who maintain visual or verbal contact. Contact should be either constant or at some frequent interval during field work (frequency should depend on nature of hazards present). The buddy may be an MACTEC employee, subcontractor, or client representative as appropriate.

Site Communications – On site communication will be verbal. When verbal communication is not possible, cell phones, two way radios or predetermined hand signals will be used.

10.0 Emergency Information

LOCAL RESOURCES	
Address & Phone Numbers	
control Room Supervisor: 573-676-8233	
Police: 911 or 573-642-3376	Fire: 911 or 573-642-9144
Ambulance: 911 or	
Medical Facility Name: Callaway Community Hospital, 10 South Hospital Drive, Fulton, MO 573-642-3376	
Directions to Medical Facility : From site take Hwy. CC to Hwy. O. Go west on Hwy O to Fulton to BR Hwy 54. Go north on BR Hwy 54 a short distance to Hwy F (4th Street) and turn left on 4th Street. Continue west on 4th Street pass Westminster College to North Hospital Drive. Turn left on North Hospital Drive and continue to 10 South Hospital Drive – Callaway Community Hospital.	
FTM Who Drove Route:	Date:
Alternate Medical Facility Name: University Hospital, One Hospital Drive, Columbia, MO 573-882-4141	
From the site take Hwy CC north to Hwy). Go west on Hwy O to Fulton to BR Hwy 54. Go north on BR Hwy 54 and Hwy 54 to Kingdom City and I-70. Go west on I-70 to Columbia. Exit I-70 south at Hwy 163 (Providence Road). Go south on Providence Road to Stadium Blvd. Take a left on Stadium Blvd. to Maryland Avenue. Left on Maryland Avenue to Hospital Drive and University Hospital. Helicopter service available.	
FTM Who Drove Route:	Date:
Poison Control Center: 800-366-8888	Waste Clean-up Contacts: Chemtrec 800-424-9300
National Response Center: (800) 424-8802	USCG: (216) 522-3919

SITE RESOURCES		
	Equipment	Location on Site
First Aid	Approved first aid kit and eyewash	Company Vehicle
Fire Control	ABC 10 lb. Fire extinguisher	Company Vehicle
Transportation	Company Vehicle	Work Site (in Support Zone)
Communication	Cell Phone	Company Vehicle/Personnel
Spill Control		
Rescue		

MACTEC ENGINEERING AND CONSULTING RESOURCES	
CHS: Howard Gordon	Phone: 303-273-5041
LHSM: Lana Smith	Phone: (314) 209-5925 or (314) 541-9962
CHM: Cindy Sundquist	Phone: (207) 828-3309 or (207) 650-7593
Health Resources: MACTEC	Phone: 800-219-8043
Office Manager: Paul Lorton	Phone: 314-209-5947 or 314-808-8329
Other/Client Contact:	Phone:

11.0 Contingency Plan

11.1 Emergency Communication Procedures

For all emergencies, contact the Control Room Supervisor (CRS) first and explain the nature of the emergency. The CRS will dispatch the appropriate emergency responder (police, fire, ambulance, etc.).

Control Room Supervisor: 573-676-8233
Police: 911 or 573-642-3376
Fire: 911 or 573-642-9144
Ambulance: 911

Standardized hand signals will be utilized for commnication between filed staff/ field team members in emergency situations. The standardized signals and their interpretation are presented below:

- Hand gripping throat -- Can't breathe, out of air
- Grip partners wrist or both hands on waist -- Leave immediately
- Hands on top of head -- Need assistance
- Thumbs up -- Yes, okay, I'm alright, I understand
- Thumbs down -- No, negative
- Hand up with palms extend/facing out -- Stop, don't come any closer
- Hand drawn across throat -- Shut off (kill) running equipment

Cellular phones will be available for off-site communication

11.2 For a Medical Emergency

Medical Facility Name: Callaway Community Hospital, 10 South Hospital Drive, Fulton, MO 573-642-3376

Directions to Medical Facility : From site take Hwy. CC to Hwy. O. Go west on Hwy O to Fulton to BR Hwy 54. Go north on BR Hwy 54 a short distance to Hwy F (4th Street) and turn left on 4th Street. Continue west on 4th Street pass Westminster College to North Hospital Drive. Turn left on North Hospital Drive and continue to 10 South Hospital Drive – Callaway Community Hospital.

Alternate Medical Facility Name: University Hospital, One Hospital Drive, Columbia, MO 573-882-4141

From the site take Hwy CC north to Hwy). Go west on Hwy O to Fulton to BR Hwy 54. Go north on BR Hwy 54 and Hwy 54 to Kingdom City and I-70. Go west on I-70 to Columbia. Exit I-70 south at Hwy 163 (Providence Road). Go south on Providence Road to Stadium Blvd. Take a left on Stadium Blvd. to Maryland Avenue. Left on Maryland Avenue to Hospital Drive and University Hospital. Helicopter service available.

If trained and willing, initiate first aid and get medical attention for the injured person immediately. Have the injured person transported to the nearest medical facility (see above) or call ambulance as necessary. As soon as possible, notify the injured person's supervisor or the project manager. Supervisors/PM's notify your LHSM and Health Resources immediately.

11.3 For a Chemical Exposure Emergency

- EYE CONTACT: Flush eyes with copious amounts of water for 15 minutes.
- SKIN CONTACT: Remove contaminated clothing. Flush skin with copious amounts of water for 15 minutes.
- INHALATION: Remove to fresh air.
- INGESTION: Consult Poison Control Center, MSDS or other appropriate medical resource (see above).

12.0 Daily Safety Meeting Checklist

Project:	**Site: Callaway Nuclear Plant**
Project Number: 3205075219	**Date: 4-6-2007**

To be reviewed on the first day of site activities and when new workers arrive on site:

Site Health & Safety Officer: _____

Alternate for Health & Safety: _____

Location of on-site HASP: _____

Site training requirements: _____

Specific medical surveillance requirements: _____

**** During the project, one or more of the agenda items could be selected for the required daily site training.***

Agenda	**Date:**					
			Check-off			
1. Planned work for this day (discuss)	☐	☐	☐	☐	☐	
2. Physical hazards and controls (discuss/review)	☐	☐	☐	☐	☐	
3. Chemical hazards and controls (discuss/review)	☐	☐	☐	☐	☐	
4. Biological hazards and controls (discuss/review)	☐	☐	☐	☐	☐	
5. Level of protection required (specify A, B, C, D) _____	☐	☐	☐	☐	☐	
6. Personal protective equipment required (specify type below)	☐	☐	☐	☐	☐	
Respirator _____						
Protective coveralls _____						
Safety glasses/goggles _____						
Hard had _____						
Foot protection _____						
Inner gloves _____						
Outer gloves _____						
Hearing protection _____						
Other _____						
7. Review inspection, decontamination & maintenance procedures and limitations of the above-stated PPE.	☐	☐	☐	☐	☐	
8. Decontamination procedure (discuss/review)	☐	☐	☐	☐	☐	
9. Exclusion zone established. Radius feet (specify)	☐	☐	☐	☐	☐	
10. Site emergency response plan (discuss/review)	☐	☐	☐	☐	☐	
11. Signs/symptoms of overexposure to chemicals anticipated onsite	☐	☐	☐	☐	☐	
12. General health and safety rules	☐	☐	☐	☐	☐	
13. Specific health and safety requirements relating to site activities including: (discuss/review)						
Drilling/boring	☐	☐	☐	☐	☐	
UST	☐	☐	☐	☐	☐	
Excavations	☐	☐	☐	☐	☐	
Heavy equipment	☐	☐	☐	☐	☐	
Confined space entry	☐	☐	☐	☐	☐	
Lockout/tagout	☐	☐	☐	☐	☐	
Working in temperature extremes	☐	☐	☐	☐	☐	
14. Other health and safety issues (discuss/note)	☐	☐	☐	☐	☐	

Daily Safety Meeting Checklist (continued)

Sign-Off Sheet

I have participated in the daily safety meeting discussing the topics indicated on the reverse and fully understand my responsibility for complying with all health and safety requirements. I have had the opportunity to have my questions on site health and safety issues and procedures answered.

Employee	Employee Number	Date

Signature of person conducting training

Date

13.0 Site Chemical Inventory for Callaway Nuclear Plant Project

Chemical Name (Match to MSDS)*	Estimated Quantity on Site at Any Given Time	Location on Site
Formalin		
Isopropyl Alcohol		
A current MSDS must be present on site for each chemical listed above. All chemical containers must be labeled in accordance with SOPs. Subcontractors must maintain their		

*** MSDS – ATTACHED TO THIS HASP IN APPENDIX B.**

14.0 Incident Accident Forms

The Incident Accident Forms and instructions are provided on the following pages.

MACTEC

Check one
Initial Report: ☐
Update: ☐
Final Report: ☐

Category C: ☐
Category B: ☐
Category A: ☐

INCIDENT ANALYSIS REPORT

Revision 0

Attorney-Client Work Product Prepared in Anticipation of Litigation

(Review instructions on page 9 prior to completing this form)

Local Office ID Number: _____ Division ES&H Manager Tracking Number: _____

Report Date: _____

Section 1 – General Information

Incident Date: _____

Employee Name: _____ Sex: ☐ M ☐ F Time of incident: _____

Job Title: _____ Hire Date: _____ Time employee began work: _____

Department: _____ Project Manager: _____ Client: _____

Office where employee works from: __ Immediate Supervisor: _____ Hours employee worked during last 7 days: _____ hr

Location where incident occurred: _____ Is this a Company controlled work site: ☐ Yes ☐ No

Section 2 – Incident Type (mark all that apply)

A. Type of incident being reported ☐ Near Miss ☐ First-aid case ☐ Medical treatment ☐ Hospitalization required

☐ Fatality ☐ Day Away Case ☐ Restricted/Transfer Case

☐ Environmental Release ☐ Regulatory Inspection

☐ Notice of Violation ☐ Other (please describe):

B. If an **injury or illness**: describe the part of the body that was affected and how it was affected:

C. If an **environmental release**: describe the quantity and name and CAS# of material released into the environment:

D. If an **inspection by a regulatory agency**, what agency, who were the inspectors, inspector contact information:

Section 3 – Incident Description (Attach and number additional pages, as needed, to ensure all details related to the incident are captured.)

A. List the names of all persons involved in the incident, and employer information:

B. List the names of any witnesses, their employer, and a local/company telephone number or address:

C. What was the employee(s) doing just prior to the incident?

D. What happened?

E. What object or substance directly harmed the employee:

F. List any damaged equipment or property (other than motor vehicles) model and serial number **and** estimated costs to repair/replace damaged equipment or property, if applicable:

Section 4 - Incident Analysis

A. Was a Job Hazard Analysis (JHA) completed for the work being performed? YES ☐ NO ☐ Who prepared the JHA?

B. When and who was the last safety officer (i.e. LHSR, supervisor, Division ES&H Manager, etc.) at your work site?

C. When and what safety training **directly related** to the incident has the person(s) involved had?

Section 5 - Incident Investigation Results

#	**Causal Factors** (Attach and number any additional pages as needed to completely address this section)
1	
2	
3	
4	
5	

Root Cause(s) Analysis (The below items represent major root cause categories which have been determined to be Less Than Adequate (LTA). A more detailed determination of the root cause will be facilitated, if needed, by your Division's ES&H Manager)

1. Equipment Reliability Program Implementation 2. Administrative / Management Systems 3. Immediate Supervision 4. Training	1. Human Factors Engineering 2. Communications 3. Personal Performance

Root Cause #	**Corrective Actions to be taken** (Attach additional pages as needed to completely address this section)	**Responsible Person**	**Proposed Completion Date**	**Closed on Date**	**Verified by and Date Verified**

Section 6 – Approvals

Incident investigated by:			
Employee(s):	Date:	Employee's Supervisor:	Date:
LHSR/Project/Office Manager:	Date:	Division ES&H Manager:	Date:

Instructions for Completing Incident Report Form

All required information must be completed as requested.

Attachment 3 provides additional guidance for completing this report.

The purpose of the Incident Analysis Report (IAR) form is to identify the facts associated with an incident investigation, to learn from its causal factors, and to make improvements to MACTEC's ES&H Management System so similar incidents can be prevented in the future. It is imperative that all applicable fields be completed in detail and that additional pages are used, as needed, to ensure that all appropriate information is provided in detail. **Attachment 3** provides a quick overview of the reporting requirements. Upon completing **Attachment 1**, all applicable signatures need to be completed via electronic signature or as an original prior to forwarding to the applicable Division ES&H Manager for review and approval. Upon approval, it will be forwarded to the Corporate Director of ES&H.

The following left to right, line by line instructions are provided to help facilitate the completion of each section of **Attachment 1**.

1. Mark in the box on the top left if this is the **Initial Report** containing all the information available at the issuance of the report, if it is an **Update** with more current information, or if it is the **Final Report**.

2. Mark if it is a **Category C, B** or **A** incident.

3. Indicate if there is a **Local Office ID Number** being used to track this report, indicate **NA** if none is being used.

4. The Division ES&H Manager will place a unique number in the **Tracking Number** line corresponding to their Corrective Action Tracking Database.

5. Complete **Section 1, General Information**, in its entirety.

6. Complete **Section 2, Incident Type**, by **marking all appropriate boxes** and **address questions** in **Subsections B, C, and D,** as appropriate, using additional pages as needed.

7. **Section 3, Incident Description**, requires the documentation of who was involved in the incident and witnesses who saw what happened. **Subsections C through F** requires as much objective information as possible to help document what happened. Use additional pages to properly document the detail of the incident to help incident reconstruction and determine causal factors.

8. **Section 4, Incident Analysis:** **Subsection A** addresses information regarding the job hazard analysis (JHA). **Mark the appropriate box** if one was or was not available prior to work beginning. Identify who prepared the JHA. **Subsection B** looks to define who the site safety representative was and when they last were present at the site prior to the incident occurring. **Subsection C** requires the listing of specific training information, type and date, directly related to the incident. For example, if the incident occurred while an employee was working on a telecommunication tower, training such as Fall Protection and Tower Climbing would be relevant while, training in Hazard Communication or Confined Space would not be relevant.

9. **Section 5**, **Incident Investigation Results**, list here and on additional paper, if needed, the causal factors associated with the incident. As indicated in the Definition Section 4 of the Procedure, causal factors are events or conditions in the incident sequence that contributed to the unwanted result. There are three types of causal factors: **direct cause**, which is the immediate event or condition that caused the accident; the **contributing causes**, which are the events or situations that collectively, with the other causes, increase the likelihood of an accident but that did not cause the incident, and the **root cause**, which, if corrected, would have prevent the recurrence of the incident. There are various methodologies in determining the root cause of an incident, two common approaches are 1) Events and Causal Factor Analysis and 2) Barrier Analysis. Both of these methods provide useful results in determining why an incident occurred and illuminates areas which if improved, can prevent reoccurrence.

a. **Events and Causal Factor Analysis** includes charting, which depicts the logical sequence of events and conditions (causal factors) that allowed the event to occur, and the use of deductive reasoning to determine events or conditions that contributed to the accident. As an aid in conducting this type of analysis, seven (7) major root cause categories are provided below. An incident usually results from one or a multiple number of the below categories. The investigation of these major root causes can lead to specific root causes that will need correction to prevent reoccurrence. They are:

1. **Equipment Reliability Program Implementation** – Incidents associated with the design and implementation of the maintenance program.
2. **Administrative / Management Systems** – Incidents attributed to inadequate or inadequately implemented policies, programs, procedures, instructions, job hazard analyses (JHAs), etc.
3. **Immediate Supervision** – Incident attributed to immediate supervision failing to provide adequate instructions, preparation, job scope definition, job oversight, conducting workarounds, etc.
4. **Training** – The lack, adequacy or timing, of training attributed to the incident.
5. **Human Factors Engineering** – Limitations and capabilities of an individual's interface with the design, development, production and control of systems, layout of the work environment and condition of the work environment (i.e. noise, thermal stress, physical or mental workload, etc.).

6. **Communications** – Failure to properly exchange information (e.g. face-to-face discussions, telephone, short written messages, log entries, etc.) attributed to the incident occurring.

7. **Personal Performance** – The incident can be attributed to employee's physical or mental well-being, attitude, mental capacity, attention span, lack of rest, substance abuse, etc.

b. **Barrier Analysis** reviews hazards (sometimes referred to as energy. It is this energy that impacts people or property) and the targets (people or objects) of the hazards, and the controls or barriers that management systems put in place to separate the hazards from the targets. Barriers may be physical, such as equipment design or protective clothing, or elements of management, such as training, procedures, job hazard analyses, and supervision. Providing answers to the following initial questions while conducting the investigation helps to establish the root cause(s).

1. What were the implemented barriers to prevent the incident from occurring on this job?
2. How did each barrier perform in preventing the incident from occurring?
3. Why did a barrier fail?
4. How did a barrier affect the incident?

Example (Effects and Causal Factor Analysis): A carpenter using a table saw cuts his hand on the rotating saw blade: Direct cause – hand is cut in table saw when blade makes contact with unprotected hand. Contributing factor – saw blade guard was removed from table saw prior to use. Root Causes – **Equipment reliability program implementation** was less than adequate (LTA) as the blade guard was very easy to remove, **Administrative / Management Systems** were LTA as the procedure that controlled the use of the table saw did not address use or removal of the saw blade guard, **Training** was LTA as no training program had been established so the carpenter was untrained in the proper use of the table saw, **Immediate Supervision** was LTA as the carpenter's supervisor was not on the job site providing the required oversight.

Example (Barrier Analysis): Same scenario as above**.** Target is the carpenter's hand. Energy is the rotating table saw blade. A physical barrier existed in the table saw's blade guard. By removing the guard, the only barriers would be training, supervision, and procedures. Training was not a barrier as none was provided. The supervisor could have been a barrier preventing the carpenter from removing the guard or instructing him on how to use the table saw correctly but he was not around. Finally, the existing potential barrier, the table saw procedure, did not address the use of or removal of the saw blade guard.

The table is to be completed by indicating the number of the Major Root Cause, the specific corrective actions that will be undertaken to prevent the reoccurrence of the incident, who will implement the corrective actions, when the corrective actions are expected to be implemented, the actual date the actions were completed and who and when these actions have been verified as being completed.

10. **Section 6, Approvals**. Prior to emailing an **initial, updated** or **final** IAR to your Division ES&H Manager for approval, obtain the required dated signatures. Signatures may be electronic or in ink. If the original signed copy of the IAR is retained in the office, send a PDF copy of the IAR documenting the appropriate signatures.

Guide to Reporting Incidents

Incident Category	**Category C:** A near miss, first-aid was rendered, minor equipment and/or property damage, or liability to the Company has occurred resulting in an estimated real or potential loss of less than $1,000. Release of a non-reportable quantity of chemicals.	**Category B:** An incident where an injury/illness has the potential of being classified as recordable or is classified as a recordable event, or has the potential to or has caused financial liability to the Company of greater than $1,000 but less than $10,000.	**Category A:** Serious incident resulting in a fatality, multiple injuries, serious injury /illness to an employee resulting in lost work. An event that has the potential to or has caused material financial liability to the Company of greater than $10,000.
Examples of Incidents	▪ Near miss ▪ First-aid injury – cut finger requiring an adhesive bandage. ▪ Minor damage to equipment or property (less than $1,000) ▪ Non-reportable quantity spill ▪ Unsafe condition or action ▪ Site visit from regulatory agency without any findings or Notice of Violations. Note: If there is a question as to Category C or B, follow Category B notification actions.	▪ Personal injury or illness other than first-aid to an employee, subcontractor or member of the public. ▪ *Any hazardous or toxic material exposure via inhalation, ingestion, puncture or dermal exposure greater than:* - OSHA Short Term Exposure Limit (STEL), or - OSHA Ceiling Value (CV). - OSHA Permissible Exposure Limit (PEL), or - Other industry-defined Best Practices {such as the American Conference of Governmental Industrial Hygiene (ACGIH) Threshold Limit Values (TLVs)}. ▪ *Any ergonomic injury or illness (i.e. musculoskeletal injuries, repetitive motion injuries, etc.)* ▪ Any contamination event leading to a release, suspected release or spread of hazardous or toxic material, on or off site, which requires special action by MACTEC. ▪ Any incident or series of incidents for which a formal investigation is deemed appropriate by MACTEC's management. ▪ Vehicle incident involving injury. ▪ Damage to property greater than $1,000 but less than $10,000. ▪ Any near miss incident that could have been very serious if a barrier separating the employee from the hazard had not been in place. ▪ Required non-emergency notification to a regulatory agency. ▪ Fire	▪ Hospitalization of any employee due to an occupational incident. ▪ Multiple injuries associated with a single occupational incident. ▪ Fatality ▪ Bloodborne pathogens exposure. ▪ *Release of a hazardous substance on or offsite in an amount exceeding the reportable quantity specified in 40 CFR Part 302.* ▪ *The discharge from a site of any substance which require any special action (e.g. reassurance monitoring of the environment).* ▪ Explosion. ▪ Multiple injuries of subcontractors or members of the public. ▪ Damage to equipment/property greater than $10,000. ▪ Work stoppage due to an unsafe condition or act. ▪ Regulatory agency response to an incident with the public or media involvement. ▪ Required emergency notification to regulatory agency due to an incident.
Reporting Requirements	Employee or witness reports incident to supervisor. Seek immediate medical attention if the injury is other than first-aid. Supervisor and all employees involved document incident on appropriate form(s) and submit within the required time frame.	Employee or witness reports incident. If injuries have occurred, seek immediate medical attention as needed by dialing 911, or site specific emergency response number. Supervisor and employees involved document incident on appropriate form(s). The Division ES&H Manager will provide assistance, as needed, to determine all applicable causal factors and appropriate corrective actions to prevent reoccurrence. Submit initial, updated or final report(s) within the required time frame.	Employee or witness reports incident. If injuries have occurred, seek immediate medical attention as needed by dialing 911, or site specific emergency response number. Supervisor notifies their Division's ES&H Manager by telephone or cellular telephone and then follows up by email. The Division ES&H Manager will notify the Corporate Director of ES&H. The Corporate Director of ES&H will chair or support an incident investigation team to determine all applicable causal factors and establish appropriate corrective actions to prevent reoccurrence.

VEHICLE INCIDENT REPORT

Revision 0

Attorney-Client Work Product Prepared in Anticipation of Litigation

(Review instructions on page 12 prior to completing this form)

Section 1 - General Information

Time incident occurred: ☐ AM ☐ PM / ☐ Dark ☐ Light / Road Condition: ☐ Dry ☐ Wet

Were police summoned to scene? ☐ Yes ☐ No Police Department and Location: _____

Report #: _____ Officer's Name and Badge Number: _____

Section 2 - Company Driver and Vehicle

Driver's name: _____ D/L # _____ State: _____

Driver's home office address: _____ Driver's Phone # _____

Company Vehicle # _____ Year _____ Model _____ License # _____ State _____

Company car? _ Owned by employee? _____

Leased/rented from _____

Passenger/Witness Name(s) _____ Address: _____ Phone: _____

Passenger/Witness Name(s) _____ Address: _____ Phone: _____

Passenger/Witness Name(s) _____ Address: _____ Phone: _____

Damage to vehicle: _____

Injuries to employee(s): _____

Injuries to others: _____

Vehicle was being used for: Company business ☐ Yes ☐ No Personal business ☐ Yes ☐ No

Towed: ☐ Yes ☐ No By Whom: _____ To Where: _____

Section 3 - Other Driver and Vehicle Information

Driver's Name: _____ D/L # _____ State _____

Current address _____ City _____ State _____

Telephone Home: _____ Work: _____ Cell: _____

Reg. Owner's Name: _____ Address: _____ City: _____ State: _____
(verify registration document)

The Other Vehicle: Make _____ Model _____ Year _____ License # _____ State _____

Insurance company name: _____ Address: _____ Phone # _____

Policy No. _____ Contact Person _____ Phone # _____

Passenger/Witness Name(s) _____ Address: _____ Phone: _____

Passenger/Witness Name(s) _____ Address: _____ Phone: _____

Damage: (*Make note of pre-existing damage and take pictures if possible. **Attach additional pages as needed**)* _____

Injuries to other driver/passengers: _____

Section 4 – Approvals (signatures required)

Form completed by: _____ Signature: _____ Date: _____
Please Print/Type

Things to Do First In The Event Of a Motor Vehicle Incident

1. Most important: **STOP**.
2. **Call 911 if there are injuries.**
3. Call for an officer if the incident occurred on public property (streets, highways or roads). Disputes often arise between the parties involved as to who was at fault; therefore, a police report is important. If an officer is unable to attend the scene of the accident, a counter police report may be filed at most stations. Insurance companies rely on police reports to determine liability.
4. Complete the Incident Investigation Report and the Vehicle Incident Report forms. It is important that both these forms are completed in detail. Include a diagram of the incident on the back of the report. Incomplete information may lead to delays in processing associated claims and in helping to prevent this type of incident from occurring again.
5. Express no opinion as to who was at fault. This is for the insurance companies to determine.
6. Give only information that is required by the authorities or as directed by MACTEC contractual requirements.
7. Sign only those statements required by the authorities or as directed by MACTEC contractual requirements. Do not sign away your rights or the company's rights.
8. If you are injured or think you were injured, tell your supervisor and see a physician. Your supervisor will notify MACTEC's Worker's Compensation insurance carrier, your Division's ES&H Manager and the Corporate Director of ES&H by phone, email or fax. For additional instructions on what to do, go to MACTEC's ES&H website on the intranet at:
9. http://intranet.mactec.com/EnvSafetyHealth/HealthSafety_Claims_Reporting.htm
10. Your supervisor will forward both completed incident reports immediately to your Division's ES&H Manager.

Instructions for Completing Vehicle Incident Report Form

All required information must be completed as requested.
Attachment 3 provides additional guidance for completing this report.

1. **Section 1, General Information**, **provides a foundation** for when, where, conditions at the time of the incident and what law enforcement representative responded to the incident scene.

2. **Section 2, Company Driver and Vehicle**, documents **who was driving** the MACTEC owned, rental or personal vehicle used for company business. Mark "See IAR" if any requested information has been previously provided on the IAR.

3. **Section 3, Other Driver and Vehicle Information**, provides contact information on the other party involved in the incident. Complete each question making sure that the registration information of the other driver's vehicle is reviewed and indicate any unusual relationship between the registered owner and the driver. If you have a digital camera, camera phone, etc. with you document the extent of the damage and any other issues that should be captured.

4. **Section 4, Approvals**, requires the electronic or ink signature of each of the four individuals required to complete the form. The form should then be **immediately sent** either as a PDF or WORD file to the applicable Division ES&H Manager and the Corporate Director of ES&H upon completion.

5. The **signed original must reside at the office** where the employee involved in the incident is based.

NOTE: Please provide area codes for all telephone numbers provided on form.

ATTACHMENT 3
Guide to Reporting Incidents

Incident Category	**Category C:** A near miss, first-aid was rendered, minor equipment and/or property damage, or liability to the Company has occurred resulting in an estimated real or potential loss of less than $1,000. Release of a non-reportable quantity of chemicals.	**Category B:** An incident where an injury/illness has the potential of being classified as recordable or is classified as a recordable event, or has the potential to or has caused financial liability to the Company of greater than $1,000 but less than $10,000.	**Category A:** Serious incident resulting in a fatality, multiple injuries, serious injury /illness to an employee resulting in lost work. An event that has the potential to or has caused material financial liability to the Company of greater than $10,000.
Examples of Incidents	Near miss First-aid injury – cut finger requiring an adhesive bandage. ▪ Minor damage to equipment or property (less than $1,000) Non-reportable quantity spill ▪ Unsafe condition or action ▪ Site visit from regulatory agency without any findings or Notice of Violations. Note: If there is a question as to Category C or B, follow Category B notification actions.	▪ Personal injury or illness other than first-aid to an employee, subcontractor or member of the public. ▪ *Any hazardous or toxic material exposure via inhalation, ingestion, puncture or dermal exposure greater than:* OSHA Short Term Exposure Limit (STEL), or OSHA Ceiling Value (CV). OSHA Permissible Exposure Limit (PEL), or - Other industry-defined Best Practices {such as the American Conference of Governmental Industrial Hygiene (ACGIH) Threshold Limit Values (TLVs)}. ▪ *Any ergonomic injury or illness (i.e. musculoskeletal injuries, repetitive motion injuries, etc.)* ▪ Any contamination event leading to a release, suspected release or spread of hazardous or toxic material, on or off site, which requires special action by MACTEC. ▪ Any incident or series of incidents for which a formal investigation is deemed appropriate by MACTEC's management. ▪ Vehicle incident involving injury. ▪ Damage to property greater than $1,000 but less than $10,000. ▪ Any near miss incident that could have <u>been very serious if a barrier separating the employee from the hazard had not been in place.</u> ▪ Required non-emergency notification to a regulatory agency. ▪ Fire	▪ Hospitalization of any employee due to an occupational incident. ▪ Multiple injuries associated with a single occupational incident. Fatality Bloodborne pathogens exposure. ▪ *Release of a hazardous substance on or offsite in an amount exceeding the reportable quantity specified in 40 CFR Part 302.* ▪ *The discharge from a site of any substance which require any special action (e.g. reassurance monitoring of the environment).* ▪ Explosion. ▪ Multiple injuries of subcontractors or members of the public. ▪ Damage to equipment/property greater than $10,000. ▪ Work stoppage due to an unsafe condition or act. ▪ Regulatory agency response to an incident with the public or media involvement. Required emergency notification to regulatory agency due to an incident.
Reporting Requirements	▪ Employee or witness reports incident to supervisor. Seek immediate medical attention if the injury is other than first-aid. Supervisor and all employees involved document incident on appropriate form(s) and submit within the required time frame.	▪ Employee or witness reports incident. If injuries have occurred, seek immediate medical attention as needed by dialing 911, or site specific emergency response number. Supervisor and employees involved document incident on appropriate form(s). The Division ES&H Manager will provide assistance, as needed, to determine all applicable causal factors and appropriate corrective actions to prevent reoccurrence. Submit initial, updated or final report(s) within the required time frame.	Employee or witness reports incident. If injuries have occurred, seek immediate medical attention as needed by dialing 911, or site specific emergency response number. Supervisor notifies their Division's ES&H Manager by telephone or cellular telephone and then follows up by email. The Division ES&H Manager will notify the Corporate Director of ES&H. The Corporate Director of ES&H will chair or support an incident investigation team to determine all applicable causal factors and establish appropriate corrective actions to prevent reoccurrence.

MACTEC, Inc.

SAFE BOATING CHECKLIST

Project Name : _____ Project Number : _____

Project Manager : _____

TRAILER	Yes	No	Comments
Winch and Cable (good and working condition)	☐	☐	_____
Running Boards	☐	☐	_____
License Plate	☐	☐	_____
Trailer Lights (working condition)	☐	☐	_____
Safety Chains	☐	☐	_____
Tire Pressure	☐	☐	_____
Spare Tire	☐	☐	_____
Grease Bearings	☐	☐	_____
Transom Saver	☐	☐	_____
Tie Downs	☐	☐	_____

BOAT & MOTOR	Yes	No	Comments
Battery (charged)	☐	☐	_____
Battery Cover	☐	☐	_____
Power Trim	☐	☐	_____
Motor Functional	☐	☐	_____
Navigation Lights	☐	☐	_____
Motor Oil	☐	☐	_____

EQUIPMENT	Yes	No	Comments
Spare Prop	☐	☐	_____
Two Oars	☐	☐	_____
Anchor with Rope	☐	☐	_____
Gas Tanks	☐	☐	_____
Fuel Line	☐	☐	_____
Drain Plug	☐	☐	_____
Air Horn	☐	☐	_____
Boat Cushions (one per person)	☐	☐	_____
Life Jackets (one per person)	☐	☐	_____
Life Ring with Rope	☐	☐	_____
First Aid Kit	☐	☐	_____
Fire Extinguisher	☐	☐	_____
Marine Radio	☐	☐	_____

Signature _____ *Date*_____

Additional comments may be placed on the back of this Checklist.

MACTEC, Inc.

Additional Comments:

Signature _____ *Date*_____

Appendix A

Job Hazard Analysis Forms

Job Hazard Analysis

Job Title: Electrofishing (Boat) **Date of Analysis:** 2/15/07

Minimum Recommended PPE*: Safety shoes with thick rubber soles, gloves with proper voltage resistance, pants and shirts with sleeves. *See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1) Electrofishing	1A). Electrical shock during general electrofishing operation.	1A). Electrical Shock • A minimum of two properly trained people are required for every electrofishing crew. • A crew leader and one other person should be trained in cardiopulmonary resuscitation (CPR), and First Aid. • Turn off electrofisher before making any connections or replacements. • Disconnect the power supply when electrofisher is not in use, or when transporting. • Check that the electrofisher gives an audible signal when there is voltage present at the anode. • Do not make any field modifications to electrofisher. • Ground the generator to the boat. • Check that all metal parts of the boat are bonded to each other electrically. • Run all cables through electrical conduit, or use a rubber-covered cord recommended for wet locations. • Make all electrical connections in water-tight junction boxes. • Each dip netter should have their own safety foot switch to control output, and it should be in a wired series with the emergency off switch of the boat operator. • Use only dip nets with insulated handles. • Wear lineman's gloves rated for 5,000 V minimum. • Never reach into the water in the vicinity of the electrode. • Take frequent breaks to avoid stress and fatigue endangering the crew. • Crew members need to be alert, and operators in control of power switch must constantly be aware on netters in the electrical field.
	1B). Fire	1B). Fire • Have fire extinguisher in boat and in a ready-to-use position. • Keep flammable objects away from generator. • Generator must have a cover or screen. • Only operate generators with a spark arrester.
	1C). Falling	1C). Falling • Wear boots with slip preventive soles. • Where personal flotation devices. • Maintain a well balanced or ergonomically correct body position while operating electrofisher.
	1D). Equipment Failure	1D). Equipment • Electrofisher will be checked prior to each operation to ensure it is in good working condition.
	1E). Noise	1E). Noise • Ear plugs will be used while the generator is in operation. • While the generator is in operation, communication will be done by hand signals.

Job Hazard Analysis

Job Title: Electrofishing **Date of Analysis:** 2/15/07

Minimum Recommended PPE*: Waders, traction devices on shoes, gloves with proper voltage resistance, long sleeved shirts and pants, safety glasses. *See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Mobilization	1A) See JHA Mob/ Demob/Site Preparation	1A) See JHA Mobilization/Demobilization/Site Preparation
2. Preparation	2A) Training	2A) Provide training on the hazards of Electrofishing to all workers
3. Walking to and from stream	3A) Insect bites/stings	3A) Insect bites/stings • **Avoid** wearing heavy fragrances. • Carry first-aid and sting relief kits. • Make sure all crew members are informed about others who are allergic and what to do if they need assistance. • Carry necessary emergency medication. • See JHA Insect **Bites and Stings**
	3B) Contact with poisonous plants or the oil from those plants:	3B) Contact with poisonous plants or the oil from those plants: • Look for signs of poisonous plants and avoid. • Ensure all field workers can identify the plants. Mark identified poisonous plants with spray paint if working at a fixed location. • Do not allow plant to touch any part of your body/clothing. • Wear PPE as described in the HASP and wear Tyveks, gloves and boot covers if contact with plant is likely • Always wash gloves before removing them. • Discard PPE in accordance with the HASP. • Use commercially available products such as Ivy Block or Ivy Wash as appropriate.
	 POISON IVY (Rhus toxicondendron L.) POISON OAK (Rhus diversiloba) POISON SUMAC (Rhus toxicondendron vernix)	
	3C) Slips and falls	3C) Slips and falls • Use traction devices on shoes. • Move slowly, take your time. • Use a walking staff to provide a three point support.
	3D) Eye injuries	3D) Eye injuries • Travel with care through heavy brush. • Use eye protection in brushy areas.
	3E) Scrapes and punctures	3E) Scrapes and punctures • Wear proper clothing, long sleeved shirts and pants. No shorts.
	3F) Cuts/Lacerations due to machette use	3F) Cuts/Lacerations due to machette use • Wear chaps or snake legs • Cut away from the body • Ensure blade of machete is sharp
	3G) Blow-down / heavy debris	3G) Blow-down / heavy debris • Be aware of your surroundings, including hanging or leaning debris that may be dislodged and fall.

Job Hazard Analysis

Job Title: Electrofishing **Date of Analysis:** 2/15/07

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	3H) Animal encounters	3H) Animal encounters • See JHA Dog and Wildlife Safety • Wild Animals: a. Make noise to avoid encounter. b. If you do encounter a wild animal, put a lot of room between you and the animal by walking around him/her if necessary. c. Do not look it in the eye. d. If charged, run away or climb a tree. e. Throwing something or shouting may deter an attack.
	3I) Severe injury in remote locations	3I) Severe injury in remote locations • Carry a two-way radio and know how to use it. • Work in teams. • Make sure someone on crew is certified in first aid. • Carry a first aid kit.
4. Equipment Preparation	4A) Malfunctioning Equipment	4A) Malfunctioning Equipment • Pre-check waders or hip boots and rubber gloves for leaks. • Take the time to do a pre-trip inspection of all equipment, including checking to make sure batteries are charged.
5. Equipment operation	5A) Electrical Shock	5A) Electrical Shock • Wear waders or hip boots in good repair. • Wear rubber gloves with proper voltage resistance. • Operators of electroshock unit must have appropriate training in the operation of equipment. • Operators must be trained in the prevention and treatment of electrical shock. • Carry a first aid kit and radio or cell phone. • Make sure the radio/cell phone works. Do a radio/cell phone check. Be aware that you may not be able to transmit in some areas. • Never electrofish alone. • Coordinate movements with other crew members. • Know where anode is at all times.
	5B) Noise	5B) Noise Ear plugs will be used while the generator is in operation. While the generator is in operation, communication will be done by hand signals.
6. Working in streams	6A) Slips, Falls	6A) Slips, Falls • Use additional traction devices to improve footing, such as felt soles or cleats. • Work only in water with safe velocity and depth. • Use wading stick if necessary**.**
	6B) High flow velocity	6B) High flow velocity • Evaluate a stream before entering. • Follow the "rule of 10" a. If stream is 1 foot deep and flowing @10 ft./sec, it is too hazardous to wade b. If stream is 2 feet deep and flowing at 5 ft./second, it is too hazardous to wade. c. If you do enter a stream and discover it is too dangerous to wade, back out using your wading pole for balance.

Job Hazard Analysis

Job Title: Electrofishing **Date of Analysis:** 2/15/07

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	6C) Hypothermia and Heat Stress	6C) Hypothermia and Heat Stress • Work in teams of two. • Wear proper clothing in layers to maintain body temperature. • Wear proper equipment that is in good condition. • Be aware of signs of hypothermia and heat stress, it's prevention, detection and treatment. • Have extra protection available, in case of an emergency such as blankets and heating devices. • Have warming/cooling devices available. • Don't work under extremely adverse weather conditions • Stay in tune to current weather and extended forecasts.
	2A) Sand or Mud – knee or ankle injury	2A) Sand or Mud • Use shorter steps • Use walking sticks to check firmness of soils • Use buddy system • If leg gets caught, use slight back and forth motion to soften mud and remove slowly. Don't try to pull leg out with twisting or jerking motion. • If possible, aeriate or bubble the mud to help releave suction.
	2B) Equipment	2B) Equipment • Secure packs and hip waders with quick release straps and be ready to discard, if an emergency arises. • Do not work in waders in water greater than 3 feet deep or in swift water. • Wear bike or rafting helmets to protect from blows to the head.
	6D) Heavy Brush	6D) Heavy Brush • Wear long sleeve shirts, full length trouser, hardhats and eye protection.
	6E) Severe weather	6E) Severe weather • Suspend measurements during lightning storms or when a storm is approaching.
7. Communications	7A) Dead Zones	7A) Dead Zones • Check radio communication periodically during assignment. • Know where nearest communication is available.

Job Hazard Analysis

Job Title: Field Work - General **Date of Analysis:** 2/15/07

Minimum Recommended PPE*: Safety boots/shoes, high visibility vest
*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Mob/Demob and Site Preparation	1A) See Mob/Demob and Site Preparation JHA	1A) See Mobilization/Demobilization and Site Preparation JHA
2. Communication	2A) Safety, crew unity	2A) Talk to each other. • Let other crewmembers know when you see a hazard. • Avoid working near known hazard trees. • Always know the wherabouts of fellow crewmembers. • Carry a radio and spare batteries or cell phone • Review Emergency Evacuation Procedures (see below**).**
3. Walking and working in the field	3A) Falling down, twisted ankles and knees, poor footing	3A) Always watch your footing. • Slow down and use extra caution around logs, rocks, and animal holes. • Extremely steep slopes (>50%) can be hazardous under wet or dry conditions; consider an alternate route. • Wear laced boots with a minimum 8" high upper and non-skid Vibram-type soles for ankle support and traction.
	3B) Falling objects	3B) Protect head agains falling objects. • Wear your hardhat for protection from falling limbs and pinecones, and from tools and equipment carried by other crewmembers. • Stay out of the woods during extremely high winds.
	3C) Damage to eyes	3C) Protect eyes: • Watch where you walk, ecpecially around trees and brush with limbs sticking out. • Exercise caution when clearing limbs from tree trunks. Advise wearing eye protection. • Ultraviolet light from the sun can be damaging to the eyes; look for sunglasses that specify significant protection from UV-A and UV-B radiation. If safety glasses require, use one's with tinted lenses
	3D) Bee and wasp stings	3D) See JHA for Insect Stings and Bites
	3E) Ticks and infected mosquitos	3E) See JHA for Insect Stings and Bites
	3F) Contact with poisonous plants or the oil from those plants:	3F) Contact with poisonous plants or the oil from those plants: • Look for signs of poisonous plants and avoid. • Ensure all field workers can identify the plants. Mark identified poisonous plants with spray paint if working at a fixed location. • Do not allow plant to touch any part of your body/clothing. • Wear PPE as described in the HASP and wear Tyveks, gloves and boot covers if contact with plant is likely • Always wash gloves before removing them. • Discard PPE in accordance with the HASP. • Use commercially available products such as Ivy Block or Ivy Wash as appropriate.

Job Hazard Analysis

Job Title: Field Work - General **Date of Analysis:** 2/15/07

Key Work Steps	Hazards/Potential Hazards	Safe Practices
		 POISON IVY (Rhus toxicondendron L.) POISON OAK (Rhus diversiloba) POISON SUMAC (Rhus toxicondendron vernix)
4. Environmental health considerations	4A) Back Injuries	4A) Back Injuries • Site personnel will be instructed on proper lifting techniques. • Mechanical devices should be used to reduce manual handling of materials. • Team lifting should be utilized if mechanical devices are not available.
	4B) Slips/Trips/Falls	4B) Slips/Trips/Falls • Maintain work areas safe and orderly; unloading areas should be on even terrain; mark or repair possible tripping hazards. • Site SHSO inspect the entire work area to identify and mark hazards.
	4C) Vehicular Traffic	4C) Vehicular Traffic • Spotters will be used when backing up trucks and heavy equipment and when moving equipment. • High visibility vests will be worn when workers are exposed to vehicular traffic at the site or on public roads.
	4D) Overhead Hazards	4D) Overhead Hazards • Personnel will be required to wear hard hats that meet ANSI Standard Z89.1. • All ground personnel will stay clear of suspended loads. • All equipment will be provided with guards, canopies or grills to protect the operator from falling or flying objects. • All overhead hazards will be identified prior to commencing work operations.
	4E) Dropped Objects	4E) Dropped Objects • Steel toe boots meeting ANSI Standard Z41 will be worn.
	4F) Noise	4F) Noise • Hearing protection will be worn with a noise reduction rating capable of maintaining personal exposure below 85 dBA (ear muffs or plugs); all equipment will be equipped with manufacturer's required mufflers. Hearing protection shall be worn by all personnel working in or near heavy equipment.
	4G) Eye Injuries	4G) Eye Injuries • Safety glasses meeting ANSI Standard Z87 will be worn.
	4H) Heavy Equipment (overhead hazards, spills, struck by or against)	4H) Heavy Equipment • Equipment will have seat belts. • Operators will wear seat belts when operating equipment. • Do not operate equipment on grades that exceed manufacturer's recommendations. • Equipment will have guards, canopies or grills to protect from flying objects. • Ground personnel will stay clear of all suspended loads. • Ground personnel will wear high visibility vests • Spill and absorbent materials will be readily available.

Job Hazard Analysis

Job Title: Field Work - General **Date of Analysis:** 2/15/07

Key Work Steps	Hazards/Potential Hazards	Safe Practices
		• Drip pans, polyethylene sheeting or other means will be used for secondary containment. • Ground personnel will stay out of the swing radius of excavators. • Eye contact with operators will be made before approaching equipment. • Operator will acknowledge eye contact by removing his hands from the controls. • Equipment will not be approached on blind sides. • All equipment will be equipped with backup alarms and use spotters when significant physical movement of equipment occurs on-site, (i.e., other than in place excavation or truck loading).
	4I) Struck by vehicle/equipment	4I) Struck by vehicle/equipment • Be aware of heavy equipment operations. • Keep out of the swing radius of heavy equipment. • Ground personnel in the vicinity of heavy equipment operations will be within the view of the operator at all times and will wear high visibility vests. • Ground personnel will be aware of the counterweight swing and maintain an adequate buffer zone. • Ground personnel will not stand directly behind heavy equipment when it is in operation. • Drivers will keep workers on foot in their vision at all times, if you lose sight of someone, Stop!
	4J) Struck/cut by tools	4J) Struck/cut by tools • Cut resistant work gloves will be worn when dealing with sharp objects. • All hand and power tools will be maintained in safe condition. • Guards will be kept in place while using hand and power tools.
	4K) Caught in/on/between	4K) Caught in/on/between • Workers will not position themselves between equipment and a stationary object. • Workers will not wear long hair down (place in pony-tail and tuck into shirt) or jewelry if working with tools/machinery.
	4L) Contact with Electricity/Lightning	4L) Contact with Electricity/Lighting • All electrical tools and equipment will be equipped with GFCI. • Electrical extension cords will be of the “Hard” or “Extra Hard” service type. • All extension cords shall have a three-blade grounding plug. • Personnel shall not use extension cords with damaged outer covers, exposed inner wires, or splices. • Electrical cords shall not be laid across roads where vehicular traffic may damage the cord without appropriate guarding. • All electrical work will be conducted by a licensed electrician. • All utilities will be marked prior to excavation activities. • All equipment will stay a minimum of 10 feet from overhead energized electrical lines (50 kV). This distance will increase by 4 inches for each 10 kV above 50 kV. Rule of Thumb: Stay 10 feet away from all overhead powerlines known to be 50 kV or less and 35 feet from all others.) • The SHSO shall halt outdoor site operations whenever lightning is visible, outdoor work will not resume until 30 minutes after the last sighting of lightning.

Job Hazard Analysis

Job Title: Field Work - General **Date of Analysis:** 2/15/07

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	4M) Equipment failure	4M) Equipment failure ▪ All equipment will be inspected before use. If any safety problems are noted, the equipment should be tagged and removed from service until repaired or replaced.
	4N) Hand & power tool usage.	4N) Hand & power tool usage • Daily inspections will be performed. • Remove broken or damaged tools from service. • Use the tool for its intended purpose. • Use in accordance with manufacturers instructions.
	4O) Heat Stress	4O) Take precautions to prevent heat stress • Remain constantly aware of the four basic factors that determine the degree of heat stress (air temperature, humidity, air movement, and heat radiation) relative to the surrounding work environmental heat load. • Know the signs and symptoms of heat exhaustion, heat cramps, and heat stroke. Heat stroke is a true medical emergency requiring immediate emergency response action. *NOTE: The severity of the effects of a given environmental heat stress is decreased by reducing the work load, increasing the frequency and/or duration of rest periods, and by introducing measures which will protect employees from hot environments.* • Maintain adequate water intake by drinking water periodically in small amounts throughout the day (flavoring water with citrus flavors or extracts enhances palatability). • Allow approximately 2 weeks with progressive degrees of heat exposure and physical exertion for substantial acclimatization. • Acclimatization is necessary regardless of an employee's physical condition (the better one's physical condition, the quicker the acclimatization). Tailor the work schedule to fit the climate, the physical condition of employees, and mission requirements. • A reduction of work load markedly decreases total heat stress. • Lessen work load and/or duration of physical exertion the first days of heat exposure to allow gradual acclimatization. • Alternate work and rest periods. More severe conditions may require longer rest periods and electrolyte fluid replacement.
	4P) Wet Bulb Globe Temperature (WBGT) Index	4P) WBGT • Curtail or suspend physical work when conditions are extremely severe (see attached Heat Stress Index). • Compute a Wet Bulb Globe Temperature Index to determine the level of physical activity (take WBGT index measurements in a location that is similar or closely approximates the environment to which employees will be exposed). WBGT THRESHOLD VALUES FOR INSTITUTING PREVENTIVE MEASURES 80-90 °F — Fatigue possible with prolonged exposure and physical activity.
		90-105 °F — Heat exhaustion and heat stroke possible with prolonged exposure and physical activity.

Job Hazard Analysis

Job Title: Field Work - General **Date of Analysis:** 2/15/07

Key Work Steps	Hazards/Potential Hazards	Safe Practices
		105-130 °F — Heat exhaustion and heat stroke are likely with prolonged heat exposure and physical activity.
	4Q) Cold Extremes	4Q) Take precautions to prevent cold stress injuries • Cover all exposed skin and be aware of frostbite. While cold air will not freeze the tissues of the lungs, slow down and use a mask or scarf to minimize the effect of cold air on air passages. • Dress in layers with wicking garments (those that carry moisture away from the body – e.g., cotton) and a weatherproof slicker. A wool outer garment is recommended. • Take layers off as you heat up; put them on as you cool down. • Wear head protection that provides adequate insulation and protects the ears. • Maintain your energy level. Avoid exhaustion and over-exertion which causes sweating, dampens clothing, and accelerates loss of body heat and increases the potential for hypothermia. • Acclimate to the cold climate to minimize discomfort. • Maintain adequate water/fluid intake to avoid dehydration.
	4R) Water	4R) Take precautions to prevent becoming wet and cold stress injuries • Wear neoprene gloves over cloth work gloves. • Wear waders to prevent boots/feet from becoming wet. • Wear rainsuit to prevent coat and cothing from becoming wet. • Wear a ski mask to cover exposed skin of facial areas.
	4S) Wind	4S) Effects of the wind • Wind chill greatly affects heat loss (see attached Wind Chill Index). • Avoid marking in old, defective timber, especially hardwoods, during periods of high winds due to snag hazards**.**
	4T) Thunderstorms	4T) Thunderstorms • Monitor weather channels to determine if electrical storms are forcased. • Plan ahead and identify safe locations to be in the event of a storm. (e.g., sturdy building, vehicle, etc.) • Suspend all field work at the first sound of thurnder. You should be in a safe place when the time between the lightning and thunder is less than 30 seconds. • Only return to work 30 minutes after the after the last strike or sound of thunder

Job Hazard Analysis

Job Title: Fish Surveys **Date of Analysis:** 2/15/07

Minimum Recommended PPE*: High visibility vest, shirts with sleeves and long pants, safety shoes, leather gloves. * See HASP for all required PPE.

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Walking to and from stream	3J) Insect bites/stings	1A) Insect bites/stings • Avoid wearing heavy fragrances. • Carry first-aid and sting relief kits. • Make sure all crew members are informed about others who are allergic and what to do if they need assistance. • Carry necessary emergency medication. • See JHA Insect Bites and Stings
	3K) Slips and falls	1B) Slips and falls • Use traction devices on shoes. • Move slowly, take your time. • Use a walking staff to provide a three point support.
	3L) Poisonous plants	1C) Poisonous plants See JHA poisonous plants
	3M) Eye injuries	1D) Eye injuries • Travel with care through heavy brush. • Use eye protection in brushy areas.
	3N) Scrapes and punctures	1E) Scrapes and punctures • Wear proper clothing, long sleeved shirts and pants. No shorts.
	3O) Cuts/Lacerations due to machette use	1F) Cuts/Lacerations due to machette use • Wear chaps or snake legs • Cut away from the body • Ensure blade of machette is sharp
	3P) Blow-down / heavy debris	1G) Blow-down / heavy debris • Be aware of your surroundings, including hanging or leaning debris that may be dislodged and fall.
	3Q) Animal encounters	1H) Animal encounters • Make noise to avoid encounter. • If you do encounter a wild animal put a lot of room between you and the animal by walking around him/her if necessary. • Do not look it in the eye. • If charged, run away or climb a tree. • Throwing something or shouting may deter an attack. • See JHA Dog and Wildlife safety.
	3R) Severe injury in remote locations	1I) Severe injury in remote locations • Carry a two-way radio and know how to use it. • Work in teams. • Make sure someone on crew is certified in first aid. • Carry a first aid kit.
2. Entering Stream	2C) Slips and falls	2C) Slips and falls • Use traction devices on shoes and waders. • Move slowly, take your time. • Use a walking staff to provide a three point support.

Job Hazard Analysis

Job Title: Fish Surveys **Date of Analysis:** 2/15/07

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	2D) Sand or Mud – knee or ankle injury	2D) Sand or Mud • Use shorter steps • Use walking sticks to check firmness of soils • Use buddy system • If leg gets caught, use slight back and forth motion to soften mud and remove slowly. Don't try to pull leg out with twisting or jerking motion. • If possible, aeriate or bubble the mud to help releave suction.
	2E) Equipment	2E) Equipment • Secure packs and hip waders with quick release straps and be ready to discard, if an emergency arises. • Do not work in waders in water greater than 3 feet deep or in swift water. • Wear bike or rafting helmets to protect from blows to the head.
	2F) Hypothermia and Heat Stress	2F) Hypothermia and Heat Stress • Work in teams of two. • Have warming/cooling devices available. • Wear proper equipment that is in good condition. • Be aware of signs of hypothermia and heat stress , it's prevention, detection and treatment. • Stay in tune to current weather and extended forecasts. • See JHA General Field Work
	2G) High flow velocity	2G) High flow velocity • Evaluate a stream before entering. • Follow the "rule of 10" a. If stream is 1 foot deep and flowing @10 ft./sec, it is too hazardous to wade b. If stream is 2 feet deep and flowing at 5 ft./second, it is too hazardous to wade. c. If you do enter a stream and discover it is too dangerous to wade, back out using your wading pole for balance.
	2H) Severe weather	2H) Severe weather • Suspend measurements during lightning storms or when a storm is approaching.
3. Fish Sampling from Boat		
3A) Prepare for Boat Operation	3A). NA	3A) Prepare for Boat Operation • Any employee assigned to operate a boat on behalf of MACTEC shall be thoroughly trained in the proper operation of the boat and outboard motor. This training maybe provided by the employee's Supervisor or a Coast Guard approved boating safety course. (Supervisor must be certified by Coast Guard) • A safe boating checklist form shall be completed for the appropriate boat(s) prior to the field trip to ensure that all required equipment is present in the boat.
3B) Attaching-Detaching Trailer to/from Vehicle	3B) Vehicle/Trailer Accident	3B) Vehicle/Trailer Accident • Be sure trailer tires are checked for wear and proper pressure. • Use spotter when backing up to trailer. • When lowering trailer onto vehicle hitch, never put hands or fingers under the hitch. • Lock trailer hitch in place • Use safety chains • Attach trailer light hook-up. • Check to make sure all trailer lights are working.

Job Hazard Analysis

Job Title: Fish Surveys **Date of Analysis:** 2/15/07

Key Work Steps	Hazards/Potential Hazards	Safe Practices
3C) Boat Transport to and from Jobsite	3C). Vehicle/Boat Trailer Accident	3C). Vehicle/Boat Trailer Accident • Prior to trip, make sure boat and trailer are compatible and that the boat is securely fastened to the trailer. • Once under way it is easy to lose a feel for the toe. Allow more room to stop and greater clear distance for overtaking and passing other vehicles. • Continually check and/or monitor that the trailer features (i.e., wheel bearings, tie downs, lights) are in good shape and proper working condition during the trip. • Be alert for signs restricting trailers. • When loading and unloading, be sure that the bow/stern straps are fastened/unfastened and the plug is in. • Care should be exercised when loading and unloading the boat on the trailer. Everyone should stand away except for one designated spotter helping the truck driver load and unload.
3D) Fueling Boat	3D). Fueling Accident	3D). Fueling Accident • Remove the tank from the boat before fueling • Fueling the boat shall be done with extreme caution to avoid static sparks and spills. Don't overfill the tanks, allow for fuel expansion. • Be alert and rid the area of any spilled gas and gas fumes before doing any work on electrical parts that may cause a spark. • All electrical equipment should be shut off during fueling operations. • Make sure a fire extinguisher and first aid kit is in the boat.
3E) Operating Boat	3E(1) Excessive Speed/Boat Accident	3E(1) Excessive Speed/Boat Accident • Keep an alert lookout and go at a safe speed when traveling in the boat. On the Missouri River, watch for Barge traffic and other river traffic. • Watch your wake and the wake of other boats. Boat operators are responsible for their wake and any damage it may cause. • Avoid any large debris that maybe floating.
	3E(2). Falls Overboard	3E(2). Falls Overboard • Ensure proper distribution of the load in the boat to avoid tipping and capsizing • An appropriate Coast Guard approved personal floatation device shall be worn by each individual on board to protect against drowning. • A throwable floatation device (ring) shall also be onboard during boat operation.
	3E(3). Equipment Malfunction	3E(3). Equipment Malfunction • Take a basic tool kit aboard the boat including boat plugs, fire extinguisher, and first aid kit. • Carry extra engine parts and fluids in the event of engine problems. • Be alert and rid the area of any spilled gas and gas fumes before doing any work on electrical parts that may cause a spark.
	3E(4). Communications	3E(4). Communications • A two-way or marine radio shall be maintained on board the boat at all times. If in a coverage area, a cell phone can be used for a communication device.

Job Hazard Analysis

Job Title: Fish Surveys **Date of Analysis:** 2/15/07

Key Work Steps	Hazards/Potential Hazards	Safe Practices
3F) Collecting Fish Samples	3F). Capsizing Boat/Falling Overboard	3F). Capsizing Boat/Falling Overboard • Make sure a proper anchor is in the boat to stabilize the boat at the sampling location. • Ensure proper distribution of the load in the boat to avoid tipping and capsizing. Standing in the boat should be minimized. • An appropriate Coast Guard approved personal floatation device shall be worn by each individual on board to protect against drowning.

Job Hazard Analysis

Job Title: Insect Stings and Bites **Date of Analysis:** 2/15/07

Minimum Recommended PPE*: Shirts with sleeves and long pants, light colored clothing
*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Traveling/working in areas with potential Tick Bites –Example outdoor wooded areas or fields.	1. Lyme Disease, Rocky Mountain Spotted Fever, etc.	1A) Spray clothing with insect repellant as a barrier. 1B) Wear light colored clothing that fits tightly at the wrists, ankles, and waist. 1C) Each outer garment should overlap the one above it. 1D) Cover trouser legs with high socks or boots. 1E) Tuck in shirt tails. 1F) Search the body on a regular basis, especially hair and clothing; ticks generally do not attach for the first couple of hours. 1G) If a tick becomes attached, pull it by grasping it as close as possible to the point of attachment and pull straight out with gentle pressure. Wash skin with soap and water then cleanse with rubbing alcohol. Place the tick in an empty container for later identification, if the victim should have a reaction. Record dates of exposure and removal. 1H) Do not try to remove the tick by burning with a match or covering it with chemical agents. 1I) If you can not remove the tick, or the head detaches, seek propmt medical help. 1J) Watch for warning signs of illness: a large red spot on the bite area; fever, chills, headache, joint and muscle ache, significant fatigue, and facial paralysis are reactions that may appear within two weeks of the attack. Symptoms specific to Lyme disease include: confusion, short-term memory loss, and disorientation.
2. Working/traveling in areas with potential bee and wasp stings- Example wooded areas and fields	2. Allergic reactions, painful stings	2A) Be alert to hives in brush or in hollow logs. Watch for insects travelling in and out of one location. 2B) If you or anyone you are working with is known to have allergic reactions to bee stings, tell the rest of the crew and your supervisor. Make sure you carry emergency medication with you at all times. 2C) Wear long sleeve shirts and trousers; tuck in shirt.. Bright colors and metal objects may attract bees. 2D) If you are stung, cold compresses may bring relief. 2E) If a stinger is left behind, scrape it off the skin. Do not use a tweezers as this squeezes the venom sack, worsening the injury. 2F) If the victim develops hives, asthmatic breathing, tissue swelling, or a drop in blood pressure, seek medical help immediately. Give victim antihistime, (Benadryl, chlo-amine tabs).
3. Traveling/working in areas of potential Mosquito Bites- Example- Woods, fields, near bodies of water and etc.	3. Skin irritation, encephalitis	3A) Wear long sleeves and trousers. 3B) Avoid heavy scents. 3C) Use insect repellants. If using DEET, do not apply directly to skin, apply to clothing only. 3D) Carry after-bite medication to reduce skin irritation.

Job Hazard Analysis

Job Title: Mobilization/Demobilization and Site Preparation **Date of Analysis:** 2/15/07

Minimum Recommended PPE*: High visibility vest, safety boots/shoes.
*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Prepare for Site Visit	1A) NA	1A) Prior to leaving for site • Obtain and review HASP prior to site visit, if possible • Determine PPE needs – bring required PPE to the site, if not otherwise being provided at the site (e.g., steel toed boots) • Determine training and medical monitoring needs and ensure all required Health and Safety training and medical monitoring has been received and is current • If respiratory protection is required/potentially required, ensure that training and fit-testing has occurred within the past year. • Familiarize yourself with route to the site
	1B) Vehicle defects	1B) Inspect company owned/leased vehicle for defects such as: • Flat tires • Windshield wipers worn or torn • Oil puddles under vehicle • Headlights, brake lights, turn signals not working
	1C) Insufficient emergency equipment, unsecured loads	1C) Insufficient emergency equipment, unsecured loads • Ensure vehicle has first aid kit and that all medications are current (if first aid kits are not provided at the site) • Ensure vehicle is equpped with warning flashers and/or flares and that the warning flashers work • Cell phones are recommended to call for help in the event of an emergency • Vehicles carrying tools must have a safety cage in place. All tools must be properly secured • Vehicles must be equipped with chocks if the vehicle is to be left running, unattended. • Ensure sufficient gasoline is in the tank
2. Operating vehicles – general	2A) Collisions, unsafe driving conditions	2A) Drive Defensively! • Seat belts must be used at all times when operating any vehicle on company business. • Drive at safe speed for road conditions • Maintain adequate following distance • Pull over and stop if you have to look at a map • Try to park so that you don't have to back up to leave.
3. Driving to the jobsite	3A) Dusty, winding, narrow roads	3A) Dusty, winding, narrow roads • Drive confidently and defensively at all times. • Go slow around corners, occasionally clearing the windshield.
	3A) Rocky or one-lane roads	3B) Rocky or one-lane roads • Stay clear of gullies and trenches, drive slowly over rocks. • Yield right-of-way to oncoming vehicles---find a safe place to pull over.
	3B) Stormy weather, near confused tourists	3C) Stormy weather, near confused tourists • Inquire about conditions before leaving the office. • Be aware of oncoming storms. • Drive to avoid accident situations created by the mistakes of others.
	3C) When angry or irritated	3D) When angry or irritated • Attitude adjustment; change the subject or work out the problem before driving the vehicle. Let someone else drive.

Job Hazard Analysis

Job Title: Mobilization/Demobilization and Site Preparation **Date of Analysis:** 2/15/07

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	3D) Turning around on narrow roads	3E) Turning around on narrow roads • Safely turn out with as much room as possible. • Know what is ahead and behind the vehicle. • Use a backer if available.
	3E) Sick or medicated	3F) Sick or medicated • Let others on the crew know you do not feel well. • Let someone else drive.
	3F) On wet or slimy roads	3G) On wet or slimy roads • Drive slow and safe, wear seatbelts.
	3G) Animals on road	3H) Animals on road • Drive slowly, watch for other animals nearby. • Be alert for animals darting out of wooded areas
4. Gain permission to enter site	4A) Hostile landowner, livestock, pets	4A) Hostile landowner, livestock, pets • Talk to land owner, be courteous and diplomatic • Ensure all animals have been secured away from work area
5. Mobilization/ Demobilization of Equipment and Supplies	5A) Struck by Heavy Equipment/Vehicles	5A) Struck by heavy equipment • Be aware of heavy equipment operations. • Keep out of the swing radius of heavy equipment. • Ground personnel in the vicinity of heavy equipment operations will be within the view of the operator at all times • Employees shall wear a high visibility vest or T-shirt (reflective vest required if working at night). • Ground personnel will be aware of the counterweight swing and maintain an adequate buffer zone. • Ground personnel will not stand directly behind heavy equipment when it is in operation.
	5B) Struck by Equipment/Supplies	5B) Struck by Equipment/Supplies • Workers will maintain proper space around their work area, if someone enters it, stop work. • When entering another worker's work space, give a verbal warning so they know you are there.
	5C) Overexertion Unloading/Loading Supplies	5C) Overexertion Unloading/Loading Supplies • Train workers on proper body mechanics, do not bend or twist at the waist while exerting force or lifting. • Tightly secure all loads to the truck bed to avoid load shifting while in transit.
	5D) Caught in/on/between	5D) Caught in/on/between • Do not place yourself between two vehicles or between a vehicle and a fixed object.
	5E) Slip/Trip/Fall	5E) 1E). Slip/Trip/Fall • Mark all holes and low spots in area with banner tape. Instruct personnel to avoid these areas. • Drivers will maintain 3 point contact when mounting/dismounting vehicles/equipment. • Drivers will check surface before stepping, not jumping down.
	5F) Vehicle accident	5F) Vehicle accident • Employees should follow MACTEC vehicle operation policy and be aware of all stationary and mobile vehicles.
6. Site Preparation	6A) Slip/Trip/Fall	6A) Slip/Trip/Fall • Mark all holes and low spots in area with banner tape. Instruct personnel to avoid these areas • Drivers will maintain 3 point contact when mounting/dismounting

Job Hazard Analysis

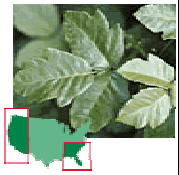
Job Title: Mobilization/Demobilization and Site Preparation **Date of Analysis:** 2/15/07

Key Work Steps	Hazards/Potential Hazards	Safe Practices
		vehicles/equipment. • Drivers will check surface before stepping, not jumping down.
7. Installation of soil erosion and sediment controls	7A) Overexertion	7A) Overexertion • Workers will be trained in the proper method of placing erosion controls. • Do not bend and twist at the waist while lifting or exerting force.
	7B) Struck by Equipment/Supplies	7C) Struck by Equipment/Supplies • Workers will maintain proper space around their work area, if someone enters it, stop work. • When entering another worker's work space, give a verbal warning so they know you are there.
8. Driving back from the jobsite	8A) See hazards listed under item #3	8A) See safe work practices under item #3

Job Hazard Analysis

Job Title: Poisonous Plants **Date of Analysis:** 2/15/07

Minimum Recommended PPE*: Shirts with sleeves, long pants, leather Gloves
*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Mobilization	1B) See JHA Mob/Demob and Site Preparation	1B) See JHA Mobilization/Demobilization/Site Preparation
2. Preparation	2B) Training – Identifying Poisonous Plants	2B) Provide training on identifying the specific poisonous plants that could be present at the site
		
	2C) Poison Ivy 	2C) Poison Ivy: • Grows everywhere in United States except Hawaii and Alaska. • In the East, Midwest, and the South, it grows as a vine. • In the Northern and Western United States, it grows as a shrub. • Each leaf has three leaflets. • Leaves are green in the summer and red in the fall. • In the late summer and fall, white berries may grow from the stems.
	2D) Poison Oak 	2D) Poison Oak: • Oak-like fuzzy leaves in clusters of three. • It has two distinct kinds: ▪ Eastern poison oak (New Jersey to Texas) grows as a low shrub. ▪ Western poison oak (Pacific Coast) grows to six-foot-tall clumps or vines up to 30 feet long. • It may have clusters of yellow berries.
	2E) Poison Sumac 	2E) Poison Sumac • Grows in standing water in peat bogs in the Northeast and Midwest and in swampy areas in parts of the Southeast. • Each leaf has clusters of seven to 13 smooth-edged leaflets. • The plants can grow up to 15 feet tall. • The leaves are orange in spring, green in summer and red, and orange or yellow in fall. • There may be clumps of pale yellow or cream-colored berries.

Job Hazard Analysis

Job Title: Poisonous Plants **Date of Analysis:** 2/15/07

Key Work Steps	Hazards/Potential Hazards	Safe Practices
3. Contact with poisonous plants	3A) Hand Contact	3J) Hand Contact • Apply IvyX (or similar product) to hands, forearms and other potentially exposed parts of the body, prior to starting work in the morning and again right after lunch. • Leather Gloves must be worn at all times when digging, screening or carrying field equipment. • Leather gloves should be of sufficient length to cover the entire wrist and cuff of the shirt. • Carefully remove gloves, without touching the exterior surface, when taking notes and prior to lunch or restroom breaks. • Gloves that become worn should be replaced immediately. • Do not scratch or rub the face or other exposed skin while wearing gloves • Workers will apply Tecnu (or similar product) to the hands and forearms immediately after removing their gloves, prior to lunch and again at the end of the day. Tecnu will help cleanse the urushiol oil from the skin before it can be absorbed. Sensitive individuals can also apply prior to showering in the evening.
	3B) Arm Contact	3K) Arm Contact • Apply IvyX (or similar product) to hands, forearms and other potentially exposed parts of the body, prior to starting work in the morning and again right after lunch • Wear light weight, long sleeved shirts as the sleeves will provide a physical barrier between the skin and any urushiol oil encountered. Disposable gauntlets may we worn over arms to keep oil from clothing as well. • Have the sleeves pulled down to the base of the hand, covering the forearm and wrist (all exposed skin). • Workers will apply Tecnu (or similar product) to the hands and forearms immediately after removing their gloves, prior to lunch and again at the end of the day. Tecnu will help cleanse the urushiol oil from the skin before it can be absorbed. Sensitive individuals can also apply prior to showering in the evening.
	3C) Leg Contact	3L) Leg Contact ▪ Wear long pants and boots. ▪ Assume boots are contaminated with the urushiol oil and only handle with gloved hands.
4. Handling Contaminated Equipment and Clothing	a. Exposure from Handling Contaminanted Equipment	4A) Exposure from Handling Contaminanted Equipment • Do not handle any field equipment that may have come in contact with poison ivy/oak/sumac without gloves • Decontaminate all equipment at the end of each workday with a solution of water and dish soap. • Scrub all surfaces of the screens and shovels with a brush. • Rinse with cool water using a portable garden sprayer.
	b. Exposure from Handling Contaminated Clothing	4B) Exposure from Handling Contaminated Clothing • Wash clothing potentially contaminated with urushiol oil prior to wearing again. • Handle contaminated clothing with gloves as the oil can remain on environmental surfaces for up to 5 years.

Job Hazard Analysis

Job Title: Streams/Wetlands Work **Date of Analysis:** 2/15/07

Minimum Recommended PPE*: High visibility vest, shirts with sleeves and long pants, safety shoes, leather gloves as needed. *See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Walking to and from stream - Wetland	1A) Insect bites/stings	1A) Insect bites/stings • Avoid wearing heavy fragrances. • Carry first-aid and sting relief kits. • Make sure all crew members are informed about others who are allergic and what to do if they need assistance. • Carry necessary emergency medication. • See JHA Insect Bites and Stings
	1B) Slips and falls	1B) Slips and falls • Use traction devices on shoes. • Move slowly, take your time. • Use a walking staff to provide a three point support.
	1C) Poisonous plants	1C) Poisonous plants See JHA Poisonous plants
	1D) Eye injuries	1D) Eye injuries • Travel with care through heavy brush. • Use eye protection in brushy areas.
	1E) Scrapes and punctures	1E) Scrapes and punctures • Wear proper clothing, long sleeved shirts and pants. No shorts.
	1F) Cuts/Lacerations due to machette use	1F) Cuts/Lacerations due to machette use • Wear chaps or snake legs • Cut away from the body • Ensure blade of machette is sharp
	1G) Blow-down / heavy debris	1G) Blow-down / heavy debris • Be aware of your surroundings, including hanging or leaning debris that may be dislodged and fall.
	1H) Animal encounters	1H) Animal encounters • Make noise to avoid encounter. • If you do encounter a wild animal put a lot of room between you and the animal by walking around him/her if necessary. • Do not look it in the eye. • If charged, run away or climb a tree. • Throwing something or shouting may deter an attack. • See JHA Dog and Wildlife safety.
	1I) Severe injury in remote locations	1I) Severe injury in remote locations • Carry a two-way radio and know how to use it. • Work in teams. • Make sure someone on crew is certified in first aid. • Carry a first aid kit.
2. Entering Stream - Wetland	2A) Slips and falls	2I) Slips and falls • Use traction devices on shoes and waders. • Move slowly, take your time. • Use a walking staff to provide a three point support.

Job Hazard Analysis

Job Title: Streams/Wetlands Work **Date of Analysis:** 2/15/07

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	2B) Sand or Mud – knee or ankle injury	2J) Sand or Mud • Use shorter steps • Use walking sticks to check firmness of soils • Use buddy system • If leg gets caught, use slight back and forth motion to soften mud and remove slowly. Don't try to pull leg out with twisting or jerking motion. • If possible, aeriate or bubble the mud to help releave suction.
	2C) Equipment	2K) Equipment • Secure packs and hip waders with quick release straps and be ready to discard, if an emergency arises. • Do not work in waders in water greater than 3 feet deep or in swift water. • Wear bike or rafting helmets to protect from blows to the head.
	2D) Hypothermia and Heat Stress	2I) Hypothermia and Heat Stress • Work in teams of two. • Have warming/cooling devices available. • Wear proper equipment that is in good condition. • Be aware of signs of hypothermia and heat stress , it's prevention, detection and treatment. • Stay in tune to current weather and extended forecasts. • See JHA General Field Work
	2E) High flow velocity	2J) High flow velocity • Evaluate a stream before entering. • Follow the "rule of 10" f. If stream is 1 foot deep and flowing @10 ft./sec, it is too hazardous to wade g. If stream is 2 feet deep and flowing at 5 ft./second, it is too hazardous to wade. h. If you do enter a stream and discover it is too dangerous to wade, back out using your wading pole for balance.
	2F) Severe weather	2K) Severe weather • Suspend measurements during lightning storms or when a storm is approaching.

Job Hazard Analysis

Job Title: Water Quality Boat Sampling **Date of Analysis:** 2/15/07

Minimum Recommended PPE*: High visibility vest, safety shoes, shirts with sleeves and long pants. *See HASP for all required PPE.

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1) Prepare for Boat Operation	1). NA	1) Prepare for Boat Operation • Any employee assigned to operate a boat on behalf of MACTEC shall be thoroughly trained in the proper operation of the boat and outboard motor. This training maybe provided by the employee's Supervisor or a Coast Guard approved boating safety course. (Supervisor must be certified by Coast Guard) • A safe Boating checklist form shall be completed for the appropriate boat(s) prior to the field trip to ensure that all required equipment is present in the boat.
2) Attaching/Detaching Trailer to/from Vehicle	2) Vehicle/Trailer Accident	2) Vehicle/Trailer Accident • Be sure trailer tires are checked for wear and proper pressure. • Use spotter when backing up to trailer. • When lowering trailer onto vehicle hitch, never put hands or fingers under the hitch. • Lock trailer hitch in place • Use safety chains • Attach trailer light hook-up. • Check to make sure all trailer lights are working.
3) Boat Transport to and from Jobsite	3). Vehicle/Boat Trailer Accident	3). Vehicle/Boat Trailer Accident • Prior to trip, make sure boat and trailer are compatible and that the boat is securely fastened to the trailer. • Once under way it is easy to lose a feel for the toe. Allow more room to stop and greater clear distance for overtaking and passing other vehicles. • Continually check and/or monitor that the trailer features (i.e., wheel bearings, tie downs, lights) are in good shape and proper working condition during the trip. • Be alert for signs restricting trailers. • When loading and unloading, be sure that the bow/stern straps are fastened/unfastened and the plug is in. • Care should be exercised when loading and unloading the boat on the trailer. Everyone should stand away except for one designated spotter helping the truck driver load and unload.
4) Fueling Boat	4). Fueling Accident	4). Fueling Accident • Remove the tank from the boat before fueling • Fueling the boat shall be done with extreme caution to avoid static sparks and spills. Don't overfill the tanks, allow for fuel expansion. • Be alert and rid the area of any spilled gas and gas fumes before doing any work on electrical parts that may cause a spark. • All electrical equipment should be shut off during fueling operations. • Make sure a fire extinguisher and first aid kit is in the boat.

Job Hazard Analysis

Job Title: Water Quality Boat Sampling **Date of Analysis:** 2/15/07

Key Work Steps	Hazards/Potential Hazards	Safe Practices
5) Operating Boat	5A). Excessive Speed/Boat Accident	5A). Excessive Speed/Boat Accident • Keep an alert lookout and go at a safe speed when traveling in the boat. On the Missouri River, watch for Barge traffic and other river traffic. • Watch your wake and the wake of other boats. Boat operators are responsible for their wake and any damage it may cause. • Avoid any large debris that maybe floating.
	5B). Falls Overboard	5B). Falls Overboard • Ensure proper distribution of the load in the boat to avoid tipping and capsizing • An appropriate Coast Guard approved personal floatation device shall be worn by each individual on board to protect against drowning. • A throwable floatation device (ring) shall also be onboard during boat operation.
	5C). Equipment Malfunction	5C). Equipment Malfunction • Take a basic tool kit aboard the boat including boat plugs, fire extinguisher, and first aid kit. • Carry extra engine parts and fluids in the event of engine problems. • Be alert and rid the area of any spilled gas and gas fumes before doing any work on electrical parts that may cause a spark.
	5D). Communications	5D) Communications • A two-way or marine radio shall be maintained on board the boat at all times. If in a coverage area, a cell phone can be used for a communication device.
6) Collecting Water Samples	6). Capsizing Boat/Falling Overboard	6). Capsizing Boat/Falling Overboard • Make sure a proper anchor is in the boat to stabilize the boat at the sampling location. • Ensure proper distribution of the load in the boat to avoid tipping and capsizing. Standing in the boat should be minimized. • An appropriate Coast Guard approved personal floatation device shall be worn by each individual on board to protect against drowning.

Job Hazard Analysis

Job Title: Working with Preservatives (Formalin and Isopropyl) **Date of Analysis:** 2/15/07

Minimum Recommended PPE*: Safety glasses/goggles, nitrile gloves.
*See HASP for all required PPE

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Adding chemicals to sample	1A) Chemical reaction	1A) Chemical reaction • Wear safety goggles and protective gloves.
	1B) Eye contact	1B) Eye contact • Wear safety goggles. • If chemicals splash in the eyes, flush eyes for 15 minutes with water. Seek medical advice.
	1C) Skin contact.	1C) Skin contact • Wear safety goggles and protective gloves.

Job Hazard Analysis

Job Title: Terrestrial Plant/Mammal/Bird Characterization **Date of Analysis:** 2/15/07

Minimum Recommended PPE*: Shirts with sleeves and long pants, high visibility vest and safety shoes. *See HASP for all required PPE.

Key Work Steps	Hazards/Potential Hazards	Safe Practices
1. Walking to and from Test Plot or Transsect	1A) Insect bites/stings	1A) Insect bites/stings • Avoid wearing heavy fragrances. • Carry first-aid and sting relief kits. • Make sure all crew members are informed about others who are allergic and what to do if they need assistance. • Carry necessary emergency medication. • See JHA Insect Bites and Stings
	1B) Slips and falls	1B) Slips and falls • Use traction devices on shoes. • Move slowly, take your time. • Use a walking staff to provide a three point support.
	1C) Poisonous plants	1C) Poisonous plants See JHA poisonous plants
	1D) Eye injuries	1D) Eye injuries • Travel with care through heavy brush. • Use eye protection in brushy areas.
	1E) Scrapes and punctures	1E) Scrapes and punctures • Wear proper clothing, long sleeved shirts and pants. No shorts.
	1F) Cuts/Lacerations due to machette use	1F) Cuts/Lacerations due to machette use • Wear chaps or snake legs • Cut away from the body • Ensure blade of machette is sharp
	1G) Blow-down / heavy debris	1G) Blow-down / heavy debris • Be aware of your surroundings, including hanging or leaning debris that may be dislodged and fall.
	1H) Animal encounters	1H) Animal encounters • Make noise to avoid encounter. • If you do encounter a wild animal put a lot of room between you and the animal by walking around him/her if necessary. • Do not look it in the eye. • Throwing something or shouting may deter an attack. • Wear gloves and stand to the side when releasing a trapped animal. • See JHA Dog and Wildlife safety.
	1I) Severe injury in remote locations	1I) Severe injury in remote locations • Carry a two-way radio and know how to use it. • Work in teams. • Make sure someone on crew is certified in first aid. • Carry a first aid kit.

Job Hazard Analysis

Job Title: Terrestrial Plant/Mammal/Bird Characterization **Date of Analysis:** 2/15/07

Key Work Steps	Hazards/Potential Hazards	Safe Practices
	1J) Sand or Mud – knee or ankle injury	1J) Sand or Mud • Use shorter steps • Use walking sticks to check firmness of soils • Use buddy system • If leg gets caught, use slight back and forth motion to soften mud and remove slowly. Don't try to pull leg out with twisting or jerking motion. • If possible, aeriate or bubble the mud to help releave suction.
	1K) Equipment	1K) Equipment • Secure packs and hip waders with quick release straps and be ready to discard, if an emergency arises. • Do not work in waders in water greater than 3 feet deep or in swift water. • Wear bike or rafting helmets to protect from blows to the head.
	1L) Hypothermia and Heat Stress	1L) Hypothermia and Heat Stress • Work in teams of two. • Have warming/cooling devices available. • Wear proper equipment that is in good condition. • Be aware of signs of hypothermia and heat stress , it's prevention, detection and treatment. • Stay in tune to current weather and extended forecasts. • See JHA General Field Work
	1M) High flow velocity	1M) High flow velocity • Evaluate a stream before entering. • Follow the "rule of 10" a. If stream is 1 foot deep and flowing @10 ft./sec, it is too hazardous to wade b. If stream is 2 feet deep and flowing at 5 ft./second, it is too hazardous to wade. c. If you do enter a stream and discover it is too dangerous to wade, back out using your wading pole for balance.
	1N) Severe weather	1N) Severe weather • Suspend measurements during lightning storms or when a storm is approaching.

Job Hazard Analysis

Job Title: Dog and Wildlife Safety **Date of Analysis:** 2/15/07

Minimum Recommended PPE*: Shirts with sleeves and long pants, safety shoes
*See HASP for all required PPE

Key Work Steps	Hazards/ Potential Hazards	Safe Practices
1. Working in areas with potential wild animals or dogs exist, example outdoor wooded areas, fields or residential areas.	1A) Preparation for Site Visit	A. Preparation for Site Visit • Call land owner prior to site visit. • Arrange for appointment time so animals can be restrained during the visit. • Wear field clothes such as long pants, long sleeves, and boots to provide protection if attacked.
	1B) Preventing Bites or Attacks	B. Preventing Bites or Attacks • Be aware of surroundings. Locate and work at safe distance from dens, nests, warrens, cages, leashed animals, or "homes" of animals. • Learn body language and warning signs of animals posturing to attack. • See attached drawings and explainations of animal behavior • Do not approach strange dogs especially one who's tied, tethered or confined behind a fence or in a car. They often feel vulnerable and will fight to protect their territory • Never hang over fences or put your hands through fence openings to touch a dog, even one you know. • Never approach a dog that is acting afraid, growling, showing teeth or who has puppies - even if the owner is there. • Don't disturb a dog while sleeping, eating, chewing on a toy, or caring for puppies. • Always let the dog sniff you first before petting. Pat on the back or side, reaching over a dog's head may scare him. • Never run past a dog. Joggers and children on bicycles can trigger their instinct to chase and attack • Never tease a dog by pulling ears, tail or feet or play too rough. Avoid games such as tug-of-war, jumping up for toys/food, wrestling and chase, all could lead to injury if the game gets out of hand • Be careful around older dogs. They may be blind, sensitive to touch or hearing-impaired • Never try to break up a dog fight with your hands. Use a water hose, stick or throw a blanket over the dogs to disorient them • Alert animal control to stray or roaming dogs.
	1C) Attacking Animal	C. Attacking Animal • If an animal shows aggressive behavior, slowly walk away from it. • If the animal approaches you, remain calm and quiet. Never turn your back, scream and run away. Avoid sudden movements. • If you say anything, speak calmly and firmly • If the animal still follows you, remain motionless with hands at your sides. Face the animal but turn your head away and avoid eye contact. If you are boring or not a threat, there is a good chance the animal will lose interest and move on. • If the animal does attack, put anything that you can put between yourself and the animal like a tree or car. • If lunged at, don't try to overpower the animal. • If you're holding something, put it into his mouth. If you don't have anything in your hand, put your arm up to protect your face. • If the animal jumps on you or knocks you down, don't move or scream or roll around. Pretend that you are a turtle: curl into a ball, face down, cover your head with your arms and use your hands to protect the back of your neck. Stay in this position until the animal leaves.

Job Hazard Analysis

Job Title: Dog and Wildlife Safety **Date of Analysis:** 2/15/07

Key Work Steps	Hazards/ Potential Hazards	Safe Practices
2. If bitten or wounded.	2A) Allergic reactions, excessive bleeding, broken bones	2A) Allergic reactions, excessive bleeding, broken bones • Field crews must maintain a stocked first aid kit. • Work using the buddysystem or maintain communicaitons by radio or cell phone. • If you or anyone you are working with is allergic. Make sure you carry emergency medication with you at all times. • If the victim develops hives, asthmatic breathing, tissue swelling, or a drop in blood pressure, seek medical help immediately. • If the person is bitten, apply pressure to stop bleeding. • Immediately wash the area thoroughly with soap and water. - Cover lightly with an antiseptic ointment. - Cover with a sterile bandage. - See medical attention for additional care and advice as appropriate. • If bitten, contact authorities (the local animal care and control agency) and tell them everything you can about the dog or animal: the owner's name and address, if you know it; color of the dog; size; where you saw it; if you've seen it before, if you know it is a stray, and in which direction the dog went. These details may help animal-control officers locate the dog or animal.
	2B) Rabid Animal	3E) Rabid Animal • If the animal is a vaccinated pet, follow the steps for basic bite care above. • If you can identify or safely capture the animal, this may help your doctor determine if you need anti-rabies therapy. The dog may need to be quarantined. • If it is a wild animal, only try to capture it if you can do so without getting bitten again. If the animal cannot be contained and must be killed to prevent its escape, do so without damaging the head. The brain will be needed to test for rabies.

Appendix B

Material Safety Data Sheets (MSDSs)

MSDS Number: **F5605** * * * * * *Effective Date:* ***05/08/03*** * * * * * *Supercedes:* ***09/14/00***

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865

J.T.Baker®

24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300
National Response in Canada
CANUTEC: 613-996-6666
Outside U.S. And Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

Formalin, 10% v/v Solution, Neutralized

1. Product Identification

Synonyms: None
CAS No.: 50-00-0
Molecular Weight: Not applicable to mixtures.
Chemical Formula: Not applicable to mixtures.
Product Codes: M518

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Formaldehyde	50-00-0	3 - 4%	Yes
Methyl Alcohol	67-56-1	1 - 1.5%	Yes
Water	7732-18-5	94 - 96%	No

3. Hazards Identification

Emergency Overview

DANGER! MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. STRONG SENSITIZER. MAY CAUSE BLINDNESS. COMBUSTIBLE LIQUID AND VAPOR. SUSPECT CANCER HAZARD. CONTAINS FORMALDEHYDE WHICH MAY CAUSE CANCER. Risk of cancer depends upon duration and level of exposure.

J.T. Baker SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Cancer Causing)
Flammability Rating: 0 - None
Reactivity Rating: 0 - None
Contact Rating: 2 - Moderate
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: Blue (Health)

Potential Health Effects

The perception of formaldehyde by odor and eye irritation becomes less sensitive with time as one adapts to formaldehyde. This can lead to overexposure if a worker is relying on formaldehyde's warning properties to alert him or her to the potential for exposure.

Inhalation:
May cause sore throat, coughing, and shortness of breath. Causes irritation and sensitization of the respiratory tract. Concentrations of 25 to 30 ppm cause severe respiratory tract injury leading to pulmonary edema and pneumonitis. May be fatal in high concentrations.

Ingestion:
Can cause severe abdominal pain, violent vomiting, headache, and diarrhea. Larger doses may produce decreased body temperature, pain in the digestive tract, shallow respiration, weak irregular pulse, unconsciousness and death. Methanol component affects the optic nerve and may cause blindness.

Skin Contact:
Toxic. May cause irritation to skin with redness, pain, and possibly burns. Skin absorption may occur with symptoms paralleling those from ingestion. Formaldehyde is a severe skin irritant and sensitizer. Contact causes white discoloration, smarting, cracking and scaling.

Eye Contact:
Vapors cause irritation to the eyes with redness, pain, and blurred vision. Higher concentrations or splashes may cause irreversible eye damage.

Chronic Exposure:
Frequent or prolonged exposure to formaldehyde may cause hypersensitivity leading to contact dermatitis. Repeated or prolonged skin contact with formaldehyde may cause an allergic reaction in some people. Vision impairment and enlargement of liver may occur from methanol component. Formaldehyde is a suspected carcinogen (positive animal inhalation studies).

Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye problems, or impaired liver, kidney or respiratory function may be more susceptible to the effects of the substance. Previously exposed persons may have an allergic reaction to future exposures.

4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.
Ingestion:
Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:
Flash point: 85C (185F) CC
Combustible liquid and vapor! Gas vaporizes from solution and is flammable in air.
Explosion:
Above the flash point, explosive vapor-air mixtures may be formed. Containers may explode when involved in a fire.
Fire Extinguishing Media:
Water spray, dry chemical, alcohol foam, or carbon dioxide.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Water spray may be used to keep fire exposed containers cool. Use water spray to blanket fire, cool fire exposed containers, and to flush non-ignited spills or vapors away from fire.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800)

424-8802.

7. Handling and Storage

Store in a tightly closed container. Protect against physical damage. Outside or detached storage is preferred. Inside storage should be in a standard flammable liquids storage room or cabinet. Separate from oxidizing materials. Storage and use areas should be No Smoking areas. Wear special protective equipment (Sec. 8) for maintenance break-in or where exposures may exceed established exposure levels. Wash hands, face, forearms and neck when exiting restricted areas. Shower, dispose of outer clothing, change to clean garments at the end of the day. Avoid cross-contamination of street clothes. Wash hands before eating and do not eat, drink, or smoke in workplace. Protect from freezing. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
0.75 ppm (TWA), 2 ppm (STEL), 0.5 ppm (TWA) action level for formaldehyde
200 ppm (TWA) for methanol
-ACGIH Threshold Limit Value (TLV):
0.3 ppm Ceiling formaldehyde, Sensitizer, A2 Suspected Human Carcinogen
200 ppm (TWA) 250 ppm (STEL) skin for methanol
Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.
Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded and engineering controls are not feasible, a full facepiece respirator with a formaldehyde cartridge may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. WARNING: Air purifying respirators do not protect workers in oxygen-deficient atmospheres. Irritation also provides warning. For Methanol: If the exposure limit is exceeded and engineering controls are not feasible, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. Breathing air quality must meet the requirements of the OSHA respiratory protection standard (29CFR1910.134). Where respirators are required, you must have a written program covering the basic requirements in the OSHA respirator standard. These include training, fit testing, medical approval, cleaning, maintenance, cartridge change schedules, etc. See 29CFR1910.134 for details.
Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

Other Control Measures:

See OSHA Standard for more information on personal protective equipment, engineering and work practice controls, medical surveillance, record keeping, and reporting requirements. (29 CFR 1910.1048)

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9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.
Odor:
Pungent odor.
Solubility:
Complete (100%)
Specific Gravity:
1.09
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
ca. 100C (ca. 212F)
Melting Point:
ca. 0C (ca. 32F)
Vapor Density (Air=1):
Essentially the same as water.
Vapor Pressure (mm Hg):
Essentially the same as water.
Evaporation Rate (BuAc=1):
Essentially the same as water.

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10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
May form carbon dioxide, carbon monoxide, and formaldehyde when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Incompatible with oxidizing agents and alkalis. Reacts explosively with nitrogen dioxide at

ca. 180C (356F). Reacts violently with perchloric acid, perchloric acid-aniline mixtures, and nitromethane. Reaction with hydrochloric acid may form bis-chloromethyl ether, an OSHA regulated carcinogen.

Conditions to Avoid:

Heat, flames, ignition sources and incompatibles.

---

11. Toxicological Information

Formaldehyde: Oral rat LD50: 100 mg/kg; skin rabbit LD50: 270 uL/kg, Irritation data: eye, rabbit, 750ug Severe; inhalation rat LC50: 203 mg/m3; investigated as a tumorigen, mutagen, reproductive effector; Cancer Status: an OSHA regulated carcinogen. Methanol: oral rat LD50: 5628 mg/kg; inhalation rat LC50: 64000 ppm/4H; skin rabbit LD50: 15800 mg/kg; investigated as a tumorigen, mutagen, reproductive effector.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Formaldehyde (50-00-0)	No	Yes	2A
Methyl Alcohol (67-56-1)	No	No	None
Water (7732-18-5)	No	No	None

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12. Ecological Information

Environmental Fate:

The following statements refer to the environmental fate of formaldehyde. When released into the soil, this material is expected to leach into groundwater. When released into water, this material is expected to readily biodegrade. When released into water, this material is not expected to evaporate significantly. This material is not expected to significantly bioaccumulate. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to be readily degraded by photolysis. When released into the air, this material is expected to be readily removed from the atmosphere by dry and wet deposition. When released into the air, this material is expected to have a half-life of less than 1 day.

The following statements refer to the environmental fate of methanol. When released into the soil, this material is expected to readily biodegrade. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material is expected to readily biodegrade. When released into the water, this material is expected to have a half-life between 1 and 10 days. When released into the air, this material is expected to exist in the aerosol phase with a short half-life. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to be readily removed from the atmosphere by wet deposition. When released into air, this material is expected to have a half-life between

10 and 30 days.

Environmental Toxicity:

The following toxicity information is for the formaldehyde portion. This material is expected to be slightly toxic to aquatic life. The LC50/96-hour values for fish are between 10 and 100 mg/l.

The methanol portion is expected to be slightly toxic to aquatic life. The LC50/96-hour values for fish are between 10 and 100 mg/l.

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13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

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14. Transport Information

Not regulated.

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15. Regulatory Information

--------\Chemical Inventory Status - Part 1\----------

Ingredient	TSCA	EC	Japan	Australia
Formaldehyde (50-00-0)	Yes	Yes	Yes	Yes
Methyl Alcohol (67-56-1)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\----------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Formaldehyde (50-00-0)	Yes	Yes	No	Yes
Methyl Alcohol (67-56-1)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\----------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Formaldehyde (50-00-0)	100	500	Yes	No
Methyl Alcohol (67-56-1)	No	No	Yes	No
Water (7732-18-5)	No	No	No	No

--------\Federal, State & International Regulations - Part 2\----------

No Changes.

Disclaimer:

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Formaldehyde (50-00-0)	100	U122	No
Methyl Alcohol (67-56-1)	5000	U154	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
Reactivity: No (Mixture / Liquid)

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: None allocated.
Poison Schedule: None allocated.
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

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16. Other Information

NFPA Ratings: Health: **2** Flammability: **2** Reactivity: **0**
Label Hazard Warning:
DANGER! MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. STRONG SENSITIZER. MAY CAUSE BLINDNESS. COMBUSTIBLE LIQUID AND VAPOR. SUSPECT CANCER HAZARD. CONTAINS FORMALDEHYDE WHICH MAY CAUSE CANCER. Risk of cancer depends upon duration and level of exposure.
Label Precautions:
Keep away from heat, sparks and flame.
Do not breathe vapor.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Do not get in eyes, on skin, or on clothing.
Physical and health hazard information is available from employer and from material safety data sheets.
Label First Aid:
If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. In all cases get medical attention immediately.
Product Use:
Laboratory Reagent.
Revision Information:

Ashland Chemical Co.

Date Prepared: 01/26/98
Date Printed: 07/13/98
MSDS No: 999.00014-4-008.006

ISOPROPANOL 99%

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Material Identity
Product Name: ISOPROPANOL 99%
Product Code: 3507000
General or Generic ID: ALCOHOL

Company
Ashland Chemical Co.
P.O. Box 2219
Columbus, OH 43216
614-790-3333

Emergency Telephone Number:
1-800-ASHLAND (1-800-274-5263)
24 hours everyday

Regulatory Information Number:
1-800-325-3751

2. COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient(s)	CAS Number	% (by weight)
ISOPROPANOL	67-63-0	100.0

3. HAZARDS IDENTIFICATION

Potential Health Effects

Eye
Can cause eye irritation. Symptoms include stinging, tearing, redness, and swelling of eyes.

Skin
May cause mild skin irritation. Prolonged or repeated contact may dry the skin. Symptoms may include redness, burning, drying and cracking of skin, and skin burns. Passage of this material into the body through the skin is possible, but it is unlikely that this would result in harmful effects during safe handling and use.

Swallowing
Swallowing small amounts of this material during normal handling is not likely to cause harmful effects. Swallowing large amounts may be harmful.

Inhalation
Breathing of vapor or mist is possible. Breathing small amounts of this material during normal handling is not likely to cause harmful effects. Breathing large amounts may be harmful. Symptoms usually occur at air concentrations higher than the recommended exposure limits (See Section 8).

Symptoms of Exposure
Signs and symptoms of exposure to this material through breathing, swallowing, and/or passage of the material through the skin may include: stomach or intestinal upset (nausea, vomiting, diarrhea), irritation (nose, throat, airways), central nervous system depression (dizziness, drowsiness, weakness, fatigue, nausea, headache, unconsciousness), low blood pressure, mild, temporary changes in the liver, effects on heart rate, respiratory depression (slowing of the breathing rate), loss of coordination, confusion, lung edema (fluid buildup in the lung tissue), kidney damage, coma.

Continued on next page

Explosive Limit
(for product) Lower 2.0 Upper 12.0 %

Autoignition Temperature
750.0 F (398.8 C)

Hazardous Products of Combustion
May form: carbon dioxide and carbon monoxide.

Fire and Explosion Hazards
Vapors are heavier than air and may travel along the ground or may be moved by ventilation and ignited by pilot lights, other flames, sparks, heaters, smoking, electric motors, static discharge, or other ignition sources at locations distant from material handling point. Never use welding or cutting torch on or near drum (even empty) because product (even just residue) can ignite explosively.

Extinguishing Media
alcohol foam, carbon dioxide, dry chemical.

Fire Fighting Instructions
Water may be ineffective. Water may be used to keep fire-exposed containers cool until fire is out. Wear a self-contained breathing apparatus with a full facepiece operated in the positive pressure demand mode with appropriate turn-out gear and chemical resistant personal protective equipment. Refer to the personal protective equipment section of this MSDS.

NFPA Rating
Health - 1, Flammability - 3, Reactivity - 0

6. ACCIDENTAL RELEASE MEASURES

Small Spill
Absorb liquid on vermiculite, floor absorbent or other absorbent material.

Large Spill
Eliminate all ignition sources (flares, flames including pilot lights, electrical sparks). Persons not wearing protective equipment should be excluded from area of spill until clean-up has been completed. Stop spill at source. Prevent from entering drains, sewers, streams or other bodies of water. Prevent from spreading. If runoff occurs, notify authorities as required. Pump or vacuum transfer spilled product to clean containers for recovery. Absorb unrecoverable product. Transfer contaminated absorbent, soil and other materials to containers for disposal. Per good environmental management practices, prevent run-off to sewers, streams and other bodies of water. Stop spill at the source. Cover sewer grates and dike the spill. Absorb spilled material on to absorbents. Shovel materials into container. Close container tightly and dispose of properly.

7. HANDLING AND STORAGE

Handling
Containers of this material may be hazardous when emptied. Since emptied containers retain product residues (vapor, liquid, and/or solid), all hazard precautions given in the data sheet must be observed. All five-gallon pails and larger metal containers, including tank cars and tank trucks, should be grounded and/or bonded when material is transferred. Warning. Sudden release of hot organic chemical vapors or mists from process equipment operating at

Continued on next page

Specific Gravity
.789 @ 60.00 F

Liquid Density
6.580 lbs/gal @ 60.00 F
.789 kg/l @ 15.60 C

Percent Volatiles
100.0 %

Volatile Organic Compounds (VOC)
100.000 %
789.000 g/l
6.580 lbs/gal

Evaporation Rate
7.70 (ETHYL ETHER)

Appearance
TRANSPARENT

State
LIQUID

Physical Form
NEAT

Color
CLEAR, PT-CO COLOR 10 MAX

Odor
SLIGHT ETHANOL/ACETONE-LIKE

pH
No data

Viscosity
2.4 cps

Freezing Point
-128.0 F (-88.8 C)

Molecular Weight
60.1

Solubility in Water
100%

Octanol/Water Partitiion Coefficient
1.400

Bulk Density
.880 lbs/ft3

10. STABILITY AND REACTIVITY

Hazardous Polymerization
Product will not undergo hazardous polymerization.

Continued on next page

CERCLA RQ - 40 CFR 302.4(a)
None listed

SARA 302 Components - 40 CFR 355 Appendix A
None

Section 311/312 Hazard Class - 40 CFR 370.2
Immediate(X) Delayed(X) Fire(X) Reactive( ) Sudden Release of Pressure( )

SARA 313 Components - 40 CFR 372.65
None

International Regulations

Inventory Status
DSL (CANADA) The intentional ingredients of this product are listed.
EINECS (EUROPE) The intentional ingredients of this product are listed.

State and Local Regulations

California Proposition 65
None

New Jersey RTK Label Information

ISOPROPYL ALCOHOL	67-63-0

Pennsylvania RTK Label Information

2-PROPANOL	67-63-0

16. OTHER INFORMATION

The information accumulated herein is believed to be accurate but is not warranted to be whether originating with the company or not. Recipients are advised to confirm in advance of need that the information is current, applicable, and suitable to their circumstances.

Burdick & Jackson
1953 South Harvey Street
Muskegon, MI 49442 USA

MATERIAL SAFETY DATA SHEET

Woodward Coke 1

Isopropyl Alcohol

Revision Date: December, 1993
Revision No: 1

Information/Emergency Telephone Number	616.726.3171
Chemtrec Telephone Number	800.424.9300
Canadian Emergency Telephone Number	613.996.6666

I. Identification

Chemical Name:	Isopropyl Alcohol	Molecular Weight:	60.09
Chemical Family:	Alcohol	Formula:	C_3H_8O
Synonyms:	2-Propanol, Isopropanol		
DOT Proper Shipping Name:	Isopropanol		
DOT Hazard Class:	Flammable Liquid, Hazard Class 3, P.G. II.		
DOT Identification Number:	UN1219	CAS Number:	67-63-0

II. Physical and Chemical Data

Boiling Point, 760 mm Hg:	82.26° C	Freezing Point	-88.0° C	Evaporation Rate:	(BuAc=1) ca 3
Vapor Pressure at 20° C:	32.4 mm Hg	Vapor Density (air=1):	2.1	Solubility in Water:	@ 20° C complete
% Volatiles by Volume:	ca 100	Specific Gravity (H_2O=1):	@ 20° C 0.785	Stability:	Stable

Hazardous Polymerization: Not expected to occur.
Appearance and Odor: Clear, colorless liquid with a slight alcoholic odor.
Conditions to Avoid: Heat, sparks, open flame, open containers, and poor ventilation.
Materials to Avoid: Strong oxidizing agents, strong acids, and reactive metals, including aluminum, which will displace hydrogen.
Hazardous Decomposition Products: Incomplete combustion can generate carbon monoxide and other toxic vapors.

III. Fire and Explosion Hazard Data

Flash Point (test method):	12° C (Tag closed cup)	Auto Ignition Temperature:	399° C
Flammable Limits in Air % by Volume: Lower Limit	2.0	Upper Limit:	12.0

Unusual Fire and Explosion Hazards: Volatile and flammable.
Extinguishing Media: Carbon dioxide, dry chemical, alcohol foam, water mist or fog.
Special Fire Fighting Procedures: Wear full protective clothing and self-contained breathing apparatus. Heat will build pressure and rupture closed storage containers. Keep fire-exposed containers cool with water spray.

IV. Hazardous Components

Isopropyl Alcohol	Wt. % ca 100	TLV	400 ppm	CAS No.	67-63-0

VI. Safety Measures and Equipment

Ventilation: Adequate ventilation is required to protect personnel from exposure to chemical vapors exceeding the PEL and to minimize fire hazards. The choice of ventilation equipment, either local or general, will depend on the conditions of use, quantity of material, and other operating parameters.

Respiratory: Use approved respirator equipment. Follow NIOSH and equipment manufacturer's recommendations to determine appropriate equipment (air-purifying, air-supplied, or self-contained breathing apparatus).

Eyes: Safety glasses are considered minimum protection. Goggles or face shield may be necessary depending on quantity of material and conditions of use.

Skin: Protective gloves and clothing are recommended. The choice of material must be based on chemical resistance and other user requirements. Generally, neoprene, nitrile rubber, or natural rubber offers acceptable chemical resistance. Individuals who are acutely and specifically sensitive to Isopropyl Alcohol may require additional protective equipment.

Storage: Isopropyl Alcohol should be protected from temperature extremes and direct sunlight. Proper storage of Isopropyl Alcohol must be determined based on other materials stored and their hazards and potential chemical incompatibility. In general, Isopropyl Alcohol should be stored in an acceptably protected and secure flammable liquid storage room.

Other: Emergency eyewash fountains and safety showers should be available in the vicinity of any potential exposure. Ground and bond metal containers to minimize static sparks.

VII. Spill and Disposal Data

Spill Control: Protect from ignition. Wear protective clothing and use approved respirator equipment. Absorb spilled material in an absorbent recommended for solvent spills and remove to a safe location for disposal by approved methods. If released to the environment, comply with all regulatory notification requirements. CERCLA Reportable Quantity: None

Waste Disposal: Dispose of Isopropyl Alcohol as an EPA hazardous waste. Contact state environmental agency for listing of licensed hazardous waste disposal facilities and applicable regulations. Hazardous waste number: D001 (ignitable).

Hazard Classification	
Immediate Health:	Yes (Irritant)
Delayed Health:	No
Fire:	Yes
Sudden Release:	No
Reactive:	No

Chemical Listings	
Extremely Hazardous Substances:	No
CERCLA Hazardous Substances:	No
Toxic Chemicals:	No

Isopropyl Alcohol is not subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA) and 40CFR Part 372. This product does not contain any other toxic chemical above 1% concentration or a carcinogen above 0.1% concentration.

KEY

ca	Approximately	STEL	Short Term Exposure Level (15 minutes)
na	Not Applicable	TLV	Threshold Limit Value
C	Ceiling	TWA	Time Weighted Average
		BuAc	Butyl Acetate

CERCLA	Comprehensive Environmental Response, Compensation and Liability Act of 1980
NSC	National Safety Council ("Fundamentals of Industrial Hygiene," 3rd Ed., 1988)

Quality Assurance Project Plan for The Callaway Nuclear Power Plant Unit 2 COLA ER

Natural Resources and Historic Properties Field Sampling and Analysis

Prepared for:

Paul C. Rizzo and Associates, Inc.

Prepared by:

MACTEC ENGINEERING AND CONSULTING, INC.
3199 Riverport Tech Center Drive
St. Louis, MO 63043

MACTEC PROJECT Number: 3250075219

April 30, 2007

QAPP APPROVAL

Project Name:	Callaway Unit 2 COLA ER
Project Number:	3250075219
Site:	Callaway Nuclear Power Plant
Site Location:	Reform, MO and environs

We have reviewed the QAPP, for the above referenced project. We recognize that when this form is completed, the attached QAPP is approved for the activities on the above-referenced project. Changes to this QAPP shall be documented in writing and approved.

MACTEC Project Manager _____ Date: 30 April 2007

MACTEC QA Project Manager _____ Date: 4-30-2007

MACTEC Project Principal _____ Date 30 April, 2007

TABLE OF CONTENTS

Section Page

TABLE OF CONTENTS (continued)

Tables

Figures

Appendices

TABLE OF CONTENTS (continued)

List of Acronyms and Abbreviations

Acronym	Definition
ANSI	American National Standards Institute
AOQL	Average Outgoing Quality Limit
ASQC	American Society of Quality Control
CA	Corrective Action
CFR	Code of Federal Regulations
COLA	Combined Operating License Application
DNR	Department of Natural Resources
DOE	Department of Energy
DQO	Data Quality Objective
IDs	Identifications
ISO	International Standards Organization
MACTEC	MACTEC Engineering and Consulting, Inc
NELAP	National Environmental Laboratory Accreditation Program
PM	Project Manager
QA	Quality Assurance
QA/QC	Quality Assurance and Quality Control
QAPD	Quality Assurance Project Document
QAPP	Quality Assurance Project Plan
QC	Quality Control
SOP	Standard Operating Procedures
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) addresses quality assurance and quality control (QA/QC) requirements for environmental measurements and information to be collected during the implementation of the Callaway Unit 2 studies.

An essential part of the proposed monitoring programs will be a quality assurance plan instituted to ensure that the data generated by the programs meet an acceptable standard of quality. Quality assurance (QA) is defined as an integrated system involving quality planning, quality control, quality assessment, quality reporting, and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence. The United States Environmental Protection Agency (USEPA) has published guidance documents (USEPA, 1995; USEPA, 1998; USEPA, 2001; USEPA, 2000a; USEPA, 2000b; and USEPA, 2006) for preparing and implementing project-specific quality assurance plans for their staff and for contractors funded by their organizations to follow, known as Quality Assurance Project Plans (QAPPs). A QAPP has four basic element groups: project management; data generation and acquisition; assessment and oversight; and data validation and usability. This plan provides the details of the QAPP for the Callaway Nuclear Plant Unit 2 Siting Study.

MACTEC Engineering and Consulting, Inc. (MACTEC) has prepared this site-specific QAPP for the activities at the Callaway Nuclear Site. This QAPP is broad in scope to cover the following program element activities:

- Terrestrial Ecology
  - Terrestrial Vegetation Community Characterization and Mapping,
  - Terrestrial Faunal Surveys
  - Wetland Delineation and Mapping
  - Forest Stand Delineation
- Aquatic Ecology
  - Adult/Juvenile Fish Community Characterization
  - Benthic Invertebrate Community Characterization
- Threatened and Endangered Species Survey
- Historic Properties Survey

This plan identifies the QA/QC procedures that will be used to ensure that technical data generated during assessment and ensuing restoration activities are accurate, complete and representative of actual conditions. QA is defined as an integrative program designed to assure reliability of monitoring and measurement data. QC is defined as the routine application of procedures for obtaining prescribed performance standards for monitoring, measuring, and assessment data.

The framework of this plan is general in nature and has been developed as a programmatic plan. All tasks will be governed by this QAPP and the MACTEC Quality Assurance Manual (MACTEC, 2005). MACTEC's QA Manual is intended to be compatible with:

- Code of Federal Regulations (10 CFR 50, Appendix A);
- American National Standards Institute / American Society of Quality Control (ANSI/ASQC) Standard E4;
- Department of Energy (DOE) 5700.6C (now codified as 10 CFR 830.120);
- National Environmental Laboratory Accreditation Program (NELAP); and
- International Standards Organization (ISO) Standard 9001.

Standard Operating Procedures (SOP) will be developed for every major project task to be performed and will provide specific information relative to the project task and will be reviewed and approved by the Technical Principal responsible for that task and the Project Manager or his deputy. Additionally, to the extent that procedures used in preparing previous environmental reports (Applied Biology, Inc. 1984; Applied Biology, Inc. 1986; Applied Biology, Inc. 1987; Applied Biology, Inc. 1991; Applied Biology, Inc. 1993; Camp Dresser & McKee, 1981; Camp Dresser & McKee, 1982; and Union Electric Company, 1985) are currently accepted they will be repeated to meet objectives of comparability.

1.1 Project Objectives

The overall objective of this project is to provide support to the preparation of a COL Application for Unit 2 at the Callaway Nuclear Site in consideration of all appropriate and applicable laws and regulatory requirements. More specifically, requirements of the Missouri Department of Natural Resources (DNR) and, in the absence of state guidance or requirements, requirements of the USEPA will be strictly followed.

1.2 Quality Objectives

The overall Quality Objective is to conduct all analyses, engineering and scientific studies, field data collection, laboratory testing, design and restoration activities within the Standards of the Industry and good engineering practice. The data collection and design should adhere to all relevant Standards and Codes and where such Standards or Codes do not exist, Quality Objectives shall be established prior to initiating the related activity.

All field data collection and laboratory analysis activities shall meet the project plans developed for that specific activity and meeting of those objectives shall be verified as established in this plan.

2.0 PROJECT MANAGEMENT

2.1 Organization and Responsibilities

A project organization chart identifies project personnel, whose qualifications (e.g., experience and specialized training) can be reviewed, as well as lines of communication and authority. The project organization chart shown below identifies individuals whose responsibility is to conduct various aspects of the quality assurance program.

Unistar Callaway Site COL

MACTEC Team Organization

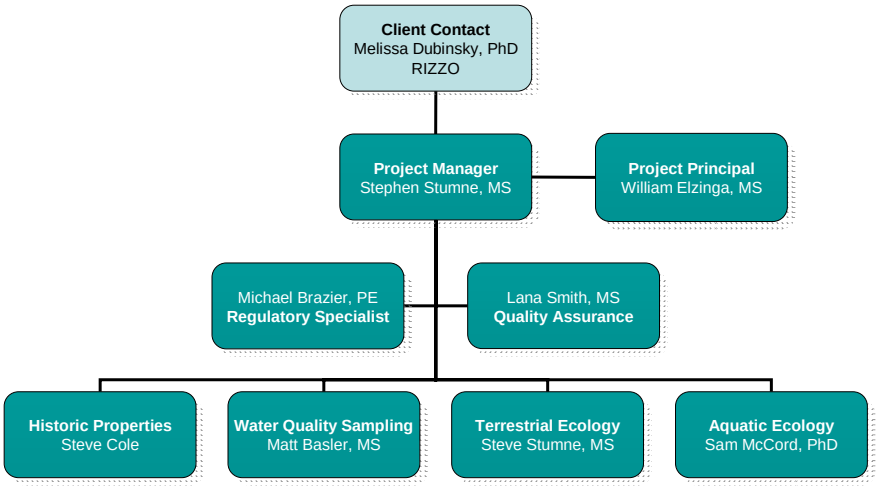

Figure 2-1 QA Program Organization Flow Chart

2.1.1 RIZZO Project Manager

Ms. Melissa Dubinsky has been identified as the Paul C. Rizzo and Associates, Inc. (RIZZO) Program Manager for this project. Ms.Dubinsky will have managerial authority on behalf of RIZZO for the project. In this role she will be the primary point of contact for RIZZO.

2.1.2 MACTEC Project Manager

Mr. Steve Stumne has been identified as the MACTEC Project Manager for this project. Mr. Stumne will have managerial authority on behalf of MACTEC for the project. In this role, he will be the primary point of contact for MACTEC. He has overall responsibility for completing the project on time and within the budget.

2.1.3 MACTEC QA Manager

Ms. Lana Smith will be the MACTEC QA Manager. The MACTEC QA Manager reports directly to the MACTEC PM and also has a line of communication to RIZZO. The MACTEC QA Manager will be responsible for ensuring that all the stated procedures for this project are being followed. Additional specific functions and duties include:

- ✓ Reviewing and approving QA plans and procedures;
- ✓ Providing QA technical assistance to project staff;
- ✓ Reporting on the adequacy, status, and effectiveness of the QA program on a regular basis to the MACTEC PM; and
- ✓ Reviewing field procedures as well as field and analytical data generated by the field team to ensure it meets the project requirements.

2.1.4 MACTEC Project Principal

Mr. William Elzinga is a principal scientist with 24 years of experience in all aspects of natural resource studies and NEPA compliance. He has been identified as the MACTEC Project Principal for this project. Mr. Elzinga will support the Project Manager and provide general oversight and direction to all technical aspects of the project.

2.1.5 MACTEC Regulatory Specialist

Mr. Michael Brazier, PE is trained and experienced in regulatory compliance, having been the former Chief of the Regulatory Branch of the St. Louis District of the Army Corps of Engineers. He is knowledgeable of all relevant regulatory requirements and will support the Project Manager in regulatory oversight for this project.

2.1.6 MACTEC Technical Project Team

Mr. Samuel McCord, PhD is a principal aquatic ecologist who has worked extensively on large and small rivers within Missouri and has directed fisheries and benthic invertebrate surveys of all types. He will serve in support of the Project Manager as the coordinator of St. Louis-based field sampling efforts.

Mr. Steve Stumne is an experienced terrestrial ecologist having performed a wide range of faunal inventories, wetland delineations, and restoration projects. In addition to his role as Project, Manager, Mr. Stumne will direct the terrestrial ecology task for this project.

Mr. Steve Cole, PhD is a senior archaeologist with more than 20 years of experience in performing historic properties evaluations throughout the Midwest, including Missouri. He will lead all historic properties evaluations as part of the project.

Mr. Matt Basler is a fisheries biologist who has worked previously on large river ecosystems such as the Missouri and Mississippi rivers, as well as smaller streams and rivers. He provides

additional expertise as it relates to fish population analysis and community surveys. He will provide direction to water quality sampling activities.

2.2 Quality Objectives and Definitions

This section defines the indicators that will be used to quantify data quality. These indicators include precision, accuracy, completeness, representativeness, and comparability. The data quality objectives (DQOs) are based on project requirements and ensure: (1) that the data generated during the project are of known quality, and (2) that the quality is acceptable to achieve the project's technical objectives. Field screening data must meet specified DQO, while definitive data must achieve different objectives. Field screening data will be collected during the field investigation. All results determined in laboratories must achieve DQOs relevant to definitive data. The criteria, i.e., objectives for each of these data quality indicators are presented in the appropriate SOPs.

2.2.1 Precision

Precision is an assessment of the variability of measurements under a given set of identical conditions. In environmental sampling, precision is the result of field sampling and analytical factors. Precision in the laboratory is easier to measure and control than precision in the field. Replicate laboratory analyses of the same sample provide information on analytical precision; replicate field samples provide data on overall measurement precision. The difference between the overall measurement precision and the analytical precision is attributed to sampling precision. For soil and sediment samples it is impossible to collect a true duplicate for precision purposes due to the heterogeneity of the soil/sediment matrix.

2.2.2 Accuracy

Accuracy is the degree of agreement between an observed value and an accepted reference value. Accuracy in the field is assessed through a review of the adherence to all protocols and requirements for sample collection, handling, preservation, labeling, and storage.

2.2.3 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared with the amount that was anticipated. MACTEC anticipates that no less than 90% of the data will be complete.

Table 2-1. Measurement Performance Criteria

Measurement Parameter	Precision	Accuracy Assessment Method	Completeness
Water Quality			
-- temperature	+ 0.5 °C	ASTM thermometer check	> 90%
-- dissolved oxygen	+ 0.1 mg/l	saturated air	> 90%
Fisheries			
-- fish count	< 10%	repeat count	> 95%
--taxonomic identification	< 10%	voucher specimen or taxonomist	
-- total length (mm)	< 3%	repeat measurement	
-- weight (g)	< 3%	repeat measurement	
Data Processing			
-- correct fields	< 1%	100% review of input accuracy	> 99%

2.2.4 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter, and variations at a sampling point, a process condition, or an environmental condition. Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the sampling procedures presented in the Sampling/Work Plan are followed and that proper sampling techniques are used.

2.2.5 Comparability

Comparability is an expression of the confidence with which one data set can be compared with another. Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the procedures in the Sampling/Work Plan are followed and that proper sampling techniques are used. Comparability is also dependent on similar QA objectives. To enhance comparability, procedures used in previous environmental studies of the Callaway Nuclear Plant and surrounding environment (Applied Biology, Inc., 1984; Applied Biology, Inc., 1986; Applied Biology, Inc., 1987; Applied Biology, Inc., 1991; Applied Biology, Inc., 1993; Camp Dresser & McKee, 1981; Camp Dresser & McKee, 1982; and Union Electric Company, 1985) will be duplicated to the extent that they are currently accepted.

3.0 DATA GENERATION AND ACQUISITION

This component of the QA program is the heart of the field and laboratory tasks undertaken for the Callaway Unit 2 COLA project. Elements include sampling design and methods; sample handling and custody; analytical methods; quality control; instrument maintenance and calibration; and data management.

3.1 Sampling Methodology

Sampling methods will be standardized so that they are repeatable and produce data that are comparable through time. This has been accomplished by preparing detailed SOPs for all activities, including sampling location and frequency; sampling gear and deployment; sample processing; data coding and recording; database entry; and to some degree data analysis. The SOPs can be reviewed by all parties to reach consensus on their applicability, and will be adhered to by all project personnel. The SOPs provide a description of procedures to follow if there are obstacles to sampling or when completion of all sampling activities are met so that the acquisition of quality data can be maximized. The SOPs describe procedures for sample handling and custody; including required signatures and blank forms for associated labels and logs. Also included are project-specific data sheets, variable definitions, reporting requirements, and chain of custody instructions. Equipment and instrument specifications are described, including levels of precision and calibration methods for ensuring accuracy.

Sampling procedures will be conducted using the protocol provided in the SOPs. These protocols were developed according to the Missouri Department of Natural Resources (DNR) "*Semi-quantitative Macroinvertebrate Stream Bioassessment*" (Missouri Department of Natural Resources, 2001) and U.S. EPA's Region 7 *Ecological Assessment Standard Operating Procedures and Quality Assurance Manual* (USEPA, 2006)

3.2 Sample Handling and Custody

Field data collection activities will be recorded using field data sheets. Entries will be made in ink, signed or initialed, and dated. No erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark that is signed or initialed and dated by the sampler.

Sample identification labels or numbers/locations will be assigned prior to sample collection.

For samples that are collected for laboratory processing, the following sample and/or specimen packaging and shipment procedures will ensure that the samples/specimens will arrive at the laboratory in good condition with the chain-of-custody intact.

1. The field team leaders will be personally responsible for the care and custody of the samples/specimens until they are transferred or properly dispatched.

2. Sample containers will be identified by use of sample labels with sample numbers, sampling locations, the date/time of collection, collectors, and if appropriate specimen identification.
3. Sample labels will be completed using waterproof ink unless prohibited by weather conditions.
4. When necessary, samples retained for further analysis will be accompanied by a properly completed chain-of-custody form that contains the associated sample identifications (IDs) and locations. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the form. This chain-of-custody form documents the custody transfer of samples from the field technician to another person, to the permanent laboratory, or to/from a storage area.
5. Sample/specimen containers will be placed in a box or cooler to ensure that the containers do not get broken. Additional insulation material such as Styrofoam peanuts or additional bubble pack may be used to ensure the sampling/specimen containers are secure or fill any remaining void space in the box or cooler.

As stated in the MACTEC QA Manual, requirements for sample handling, preservation, storage, packaging, and shipping are contained in many industry standards (e.g., USEPA) for samples that the MACTEC collects and/or tests. When collecting or performing tests on samples using these standards, the specified handling, preservation, storage, packaging, and shipping requirements shall be followed (MACTEC, 2005).

3.3 Quality Control

QC is defined as activities whose purpose is to measure and control the quality of a procedure so that it meets the needs of its user. QC activities monitor the outgoing quality of the data and can lead to response actions to bring the data within control limits through various actions, such as retraining of personnel, repair or recalibration of equipment, or other similar actions.

Systematic QC procedures will be instituted to verify recorded data. The primary area where these QC procedures will be used is sample processing. The sampling plans implemented under these procedures have a specified average outgoing quality limit (AOQL), which represents the maximum fraction of all items (e.g., measurements, taxonomic identifications or counts) or lots (e.g., whole samples) that could be defective as a worst case. A defective item could be a measurement or count that falls outside of a specified tolerance limit (e.g., plus or minus 1 to 10 percent).

Corrective Actions

Corrective or preventive action is required when potential or existing conditions are identified that may adversely impact data quantity or quality. Corrective action (CA) could be immediate

or long term. In general, any member of the project staff who identifies a condition adversely affecting quality can initiate corrective action by notifying their supervisor or the Project QA Officer in writing. The written communication will identify the conditions and explain how it may affect the data quality or quantity.

3.3.1.1 Immediate Corrective Action

Immediate CA is usually applied to spontaneous, nonrecurring problems (e.g., instrument malfunction). The individual who detects or suspects nonconformance to previously established criteria or protocol in equipment, instruments, data, or methods, will immediately notify their supervisor. The supervisor and the appropriate Task Leader will investigate the extent of the problem and take the necessary corrective steps.

If a large quantity of data is affected, the Task Leader must prepare a memorandum to the PM and Project QA Officer. These individuals will collectively decide how to proceed to correct the problem(s). Corrective measures will be coordinated with Rizzo and any significant corrective actions taken will be reported in a project QC summary submittal. If the problem is limited in scope, the Task Leader will decide on the corrective action measure and document the solution in the memorandum in addition to the corrective action request/routing form.

3.3.1.2 Long-Term Corrective Action

Long-term corrective action procedures are devised and implemented to prevent the recurrence of the potentially serious problem. The Project QA Officer will be notified of the problem and will conduct an investigation to determine the severity and extent of the problem. They will then file a corrective action request with the Task Leader and Project Manager. If the corrective action will impact project budget or schedule, the action requires involvement of Rizzo.

Corrective actions may also be initiated as a result of other activities including:

- ✓ System audits
- ✓ Laboratory/field comparisons, and
- ✓ QA project audits.

Examples of long-term corrective actions include:

- ✓ Staff training in technical skills or in implementation of QA Program,
- ✓ Rescheduling of work routines to ensure project schedule is maintained and is on budget, and
- ✓ Revision of QA Program or replacement of project personnel.

For either immediate or long-term corrective actions, steps comprising a closed loop corrective action system are as follows:

1. Define the problem,
2. Assign responsibility for investigating the problem,

3. Investigate and determine the cause of the problem,
4. Determine a corrective action to eliminate the problem,
5. Assign and accept responsibility for implementing the corrective action,
6. Establish effectiveness of the corrective action and implement the corrective action, and
7. Verify that the corrective action has eliminated the problem.

Depending on the nature of the problem, corrective action employed may be formal or informal. In either case, the occurrence of the problem, corrective action employed, and verification that the problem has been eliminated must be documented. Final resolution of the problem will be documented by the signature of the Project QA Officer who shall sign the corrective action form to indicate that the project problems have been resolved.

3.4 Preventative Maintenance

Preventative maintenance of field equipment is performed by field personnel routinely and preceding each field sampling event. More extensive maintenance is performed by manufacturers on the basis of hours of equipment in use. Sampling technicians report performance of the equipment after each sampling event. Critical spare parts are kept in stock. At times, it is necessary to perform routine maintenance in the field; therefore, each field instrument is provided with an operating manual and any appropriate maintenance tools.

Table 3-1 Field Equipment and Associated Preventative Maintenance

Instrument Probe	Activity	Frequency
Dissolved Oxygen (DO) Meter	Check battery Check to ensure that mechanical zero is set properly Check DO probe membrane Replace membrane	Daily and replace as needed Prior to each use As needed As needed
pH Meter	Battery replacement Probe replacement	As needed As needed
Conductivity Meter	Battery replacement Check loose connections Replatinization	As needed Daily As needed
Temperature Probe	Check connections Check against calibrated Thermometer	Daily Prior to field use
Turbidity Meter	Check battery Check loose connections Clean lens	Prior to use As needed As needed

3.5 Instrument Calibration and Frequency

In accordance with the MACETC QA Manual (MACTEC, 2005), tools, gages, instruments, and other measuring and test equipment used for laboratory or field testing, data gathering, or acceptance testing shall be controlled and at specified periods verified and/or calibrated and adjusted to maintain accuracy within necessary limits. Procedures shall be established and implemented to provide for the required control, calibration, and maintenance. The types of equipment covered by the program shall be defined. The following requirements apply:

1. Measuring and test equipment shall be calibrated, adjusted, and maintained at specified intervals (or immediately before and after use) on the basis of the item's required accuracy, intended use, frequency of use, stability characteristics, and other conditions affecting its performance.
2. Measuring and test equipment shall be labeled, tagged, or otherwise controlled to indicate calibration status and ensure traceability to calibration test data.
3. Measuring and test equipment shall be calibrated against standards having an accuracy that will ensure that equipment being calibrated is within required tolerances. If nationally recognized standards exist, calibration standards are to be traceable to them. If no nationally recognized standards exist, the bases for calibration shall be documented.
4. Measuring and test equipment found out of calibration or out of tolerance shall be tagged or segregated and not used until it is successfully recalibrated. The acceptability of items or processes measured, inspected, or tested with an out-of-calibration or out of tolerance device is to be determined.

Also, a copy of the instrument user manuals will be placed with the instrument and brought to the field. A record of the instrument calibration will be maintained in the field notebook or on the project specific data sheets by the Field Technician calibrating the equipment.

3.6 Data Management

Subsequent to recording of field data on data sheets, data will be directly recorded into field computers consisting of specific project forms. The field data will be entered into a project developed Access database and will be reviewed for accuracy and completeness. Reports will be generated from the database and/or from database information exported into Excel for reporting or calculation/statistical purposes. All electronic files (data, database, reports, etc.) will be stored on the office local area network under the project number in an appropriately named subdirectory. Original field logbooks and any additional raw data will be maintained in the project files located in the office central files under the project number. In addition hard copies of reports generated will be filed in the project file.

4.0 ASSESSMENT AND OVERSIGHT

This section addresses project and site activity assessments, audits, and follow-up action and is consistent with the MACTEC Quality Assurance Manual (MACTEC, 2005).

If unacceptable conditions are identified as a result of audits or are observed during field sampling and analysis, the QA officer, the PM, and the field team leader will document the condition and initiate corrective procedures. The specific condition or problem will be identified, its cause will be determined, and appropriate action will be implemented. Follow-up activities shall verify the implementation and effectiveness of the action taken to correct deficiencies (MACTEC, 2005).

A corrective action memorandum will be prepared, documenting the problem and detailing the corrective action to be initiated. The efficiency of any corrective action will be assessed by project management to ensure that the deficiency or problem has been adequately addressed.

In accordance with MACTEC's QA Manual, all project personnel have Stop Work Authority when they note that quality is at risk. In case of a disagreement on a Stop Work decision, the matter is referred to the Chief Scientist for resolution

A field audit may be conducted by the project QA officer or project manager at their discretion. Written records of audits and any recommendations for corrective action will be submitted to the project manager.

The QA Officer is required to notify the PM and Chief Scientist of any quality problems detected with the potential to invalidate data required to meet the project objectives. Upon review and evaluation of this information, and identification of potential corrective actions, the PM will notify Rizzo of the nature of the problem. The schedule for response by the management team will be specified in the notification, and will depend on the severity of the problem and the effect of corrective actions on project schedule.

5.0 DATA VERIFICATION, VALIDATION AND USABILITY

Data verification and validation will be conducted by qualified biologists (e.g., QA manager or field/lab supervisors) during the course of the project to ensure that the resulting data will be suitable for use as intended. Project records, including field sampling logs, raw data sheets, sample chain-of-custody forms, and instrument calibration logs, will be reviewed to verify that data were collected according to the QAPP. Data will be validated first by a review of datasheets and data files to find whether data are incomplete or appear to be inappropriate or out of a reasonable range of values. Data entry into the database also will undergo a 100 percent visual QC comparison to the data on the corresponding data sheets. Finally, data files will be subjected to error checking programs to detect outlying values either to investigate further or to eliminate if shown to be spurious. This investigation will require tracing the data to raw data sheets and consulting with field or lab personnel who recorded the data. All raw data sheets, log books and data files will be maintained for future reference. All computer files will be backed up on a daily basis while any data entry or editing procedures are ongoing.

Data generated through field activities or by the laboratory operation will be reduced and validated prior to reporting. No datum will be disseminated until it has been subjected to the procedures that are summarized in subsections below.

In accordance with the MACTEC QA Manual (MACTEC, 2005), control procedures prepared for specific individual projects to provide instructions for performance of test activities that affect quality shall include the following items: quality assurance measures, including but not limited to, data transcription checks, calculation checks, standardized and controlled data forms, controlled laboratory notebooks, review and approval of analytical results, identification of nonconforming or suspicious data and subsequent disposition, and documentation requirements.

Field Data Validation

Field data reduction procedures will be minimal in scope compared to those implemented in the laboratory setting. Only direct-read instrumentation will be employed in the field. The field instruments will generate measurements directly read from the meters following calibration per manufacturer's recommendations. Such data will be written into field log books immediately after measurements are taken. If errors are made, results will be legibly crossed out, signed or initialed and dated by the field member, and corrected in a space adjacent to the original (erroneous) entry. Later, when the results tables and figures required for this study are being completed, MACTEC will proof 100% of the tables and figures to determine whether any transcription errors have been made by the technical field staff. MACTEC tables and figures are generated with a legend notation as to the following information: created by, date, reviewed by, and approved by. The MACTEC project personnel place their initials by the appropriate task

that they have performed. Once created the tables and figures proceed to a peer reviewer who will then validate that the information on the tables and figures are correct. Once tables and figures are reviewed they are finalized for the reports by the approval of the PM.

Data entry of the field data sheets into the project database will be reviewed in a similar nature in that all data entered into the data base will be reviewed for accuracy and completeness. The data reports generated from the data base will be checked at a 20% frequency to ensure that the programs are performing correctly. Similarly statistical analysis performed on the data from the database will be check by verification of calculations to ensure validity of the analysis findings.

6.0 REFERENCES

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APPENDIX A

Quality Assurance/Quality Control Forms

Assessment Report Form

Type of Audit: _____ Field _____ Laboratory

Project Name/Number: _____

Auditor: _____

Report # _____ (assigned by PM)

Date of Assessment_____

Activities Observed:
Participants and Titles:
Problem Description:
Consequences if Uncorrected:
Recommended Action and Completion Date:

Corrective Action Report Form

Type of Audit: _____ Field _____ Laboratory

Project Name/Number: _____

Auditor: _____

Report #_____ (corresponds to Assessment Report. Form #)

Prepared By_____

Title_____

Date Corrective Actions Taken: _____

Date Corrections Verified: _____

Description of Actions Taken:
Comments:

Approved By:

_____ _____

Quality Assurance Officer **Project Manager**

Date _____ Date_____

Assessment Report Form

Type of Audit: __X__ Field _____ Laboratory
Project Name/Number: __Callaway Unit 2 COLA/3250075219_____
Auditor: __WJE_____ ` **Callaway Nuclear Plant**

Report # _001_____ (assigned by PM)

Date of Assessment __9-17-07_____

Activities Observed:
Pre-sampling/Set-up NA
Sample Collection Bird surveys were conducted within T-3 and T-2. Field crews were observed as to their competency in identification and tabulation of avifauna along each transect. Crew members were questioned as to the identification of particular bird species based on visual cues. Additionally, the crews were evaluated for their competency based on audible cues of typical bird calls (Eastern wood pewee, red bellied woodpecker, downy woodpecker, etc.). Partial audible cues such as that associated with the Eastern Towhee were also used to test observer competency. Crew members were determined to be competent as reflected by their correct identification of bird species by both visual and audible cues. Fragmentary audible cues such as alarm calls of cardinal and partial calls of the towhee were correctly identified. One crew member was reminded to carry his binoculars while walking to transect. This was immediately corrected.
Data Recording. Field data form was reviewed for completeness and accuracy. All appropriate data fields were properly and legible filled out. Line-out/initial procedures were properly used to make edits to data form entries.
Safety Procedures. Safety procedures were reviewed and discussed with the field crew. Crews were diligent about the use of insect repellent and other preventative measures to guard against tick/chigger bites.
Activity Participants and Titles:
Matt Basler, Biological Field Team Leader
Scott Benton, Biological Technician
Problem Description:
None
Consequences if Uncorrected:
NA
Recommended Action and Completion Date:
NA

Assessment Report Form

Type of Audit: __X__ Field _____ Laboratory
Project Name/Number: __Callaway Unit 2 COLA/3250075219_____
Auditor: __WJE_____ ` **Callaway Nuclear Plant**

Report # _002_____ (assigned by PM)

Date of Assessment __9-26-07_____

Activities Observed:
Pre-sampling/Set-up Observations were made regarding placement of small mammal live traps and pitfall traps within habitats represented by T-2, T-3 and T-4. Recommendations were made to improve pitfall trap effectiveness including providing a better seal between the fence and the underlying ground surface. Recommendations were implemented at these and all other pitfall trap locations. Small mammal traps were noted to be well positioned and properly baited and set.
Sample Collection Observations were made while traps were run along T-1, T-2, and T-3. Specimens were collected in both pitfall traps including a ground skink and American toad. Additionally two white-footed mouse specimens were collected from live traps. Specimens were properly identified (as verified by the auditor), and field crews further validated in the field using appropriate field guides. Mammal specimens were properly handled and appropriate measurements were made (hind foot length, tail length) and recorded. Captured specimens were also photographed for further verification.
Data Recording. Field data forms were reviewed for completeness and accuracy. All appropriate data fields were properly and legible filled out. Line-out/initial procedures were properly used to make edits to data form entries. The field crew leader was reminded to properly record the sampling event in a field notebook.
Safety Procedures. Safety procedures were reviewed and discussed with the field crew. Crews were diligent about the use of insect repellent and other preventative measures to guard against tick/chigger bites.
Activity Participants and Titles:
Loran Miller, Biological Field Team Leader
Fred Jones, Biological Technician
Problem Description:
None
Consequences if Uncorrected:
NA
Recommended Action and Completion Date:
NA

Assessment Report Form

Type of Audit: __X__ Field _____ Laboratory
Project Name/Number: Callaway Unit 2 COLA/3250075219
Auditor: WJE ` **Callaway Nuclear Plant**

Report # 003 (assigned by PM)

Date of Assessment 10-4-07

Activities Observed:
Pre-sampling/Set-up Observations were made on the second day of netting on the Missouri River. Nets had previously been deployed and set at each of six locations (6 gill nets, 6 hoop nets) as specified in the SOP. Field sampling was initiated at 0830 hrs. Placement of net sets was evaluated as they were run. It was recommended that for remaining field sampling events, nets should be shifted slightly as appropriate at each location to attempt to sample slightly different microhabitats. For example, hoop nets may be set in deep holes at the end of wing dikes to attempt to sample these particular microhabitats. Sampling gear on the boat was reviewed for completeness. It was noted that a large-weight spring scale was not available, and that it would be needed for particularly large specimens, if they were collected.
Sample Collection Accuracy of identifications was evaluated for all fish collected. Field technicians were evaluated as to their competency for identification of specimens by questioning them as to differentiating characteristics between particular species (e.g., goldeye/mooneye, river carpsucker/quillback, channel catfish/blue catfish, etc.). All field identifications were determined to be correct. Accuracy of length/weight measurements was evaluated for all fish collected and was so noted on each field data sheet. All length and weight values were determined to be accurate. Discussions were held with field crew members about the type of length measurement (total length vs. standard length). Measurement of total length was performed correctly as per the SOP.
Data Recording. Field data forms were reviewed for completeness and accuracy. This review included all data forms from gill netting, hoop netting, and electrofishing performed the previous day. All appropriate data fields were properly and legible filled out. Line-out/initial procedures were properly used to make edits to data form entries. The field crew leader was reminded to properly record the sampling event in a field notebook.

Activities Observed:
On-site project plans were reviewed. The crew had available a health and safety plan. However, the SOP on hand was that pertaining to historic properties, and not natural resources (inadvertently taken instead of the natural resources SOP). However, no quality-affecting issues were evident, as the field crew demonstrated competent familiarity with field sampling protocols. Sample jars preserved with seine samples were examined for accuracy of labeling. All labels were properly completed and filled out with proper sample ID codes. On jar contained a voucher specimen collected by electrofishing. The field crew leader was reminded to note that it is a voucher specimen on the label.
Safety Procedures. Safety procedures were reviewed and discussed with the field crew. All crew members were noted as wearing life jackets at all times. Other health and safety issues were discussed (e.g. catfish spine injuries, etc.)
Activity Participants and Titles:
Annette Wodicker, Biological Field Team Leader
Brian Sehie, Loran Miller, Biological Technicians
Problem Description:
None
Consequences if Uncorrected:
NA
Recommended Action and Completion Date:
NA

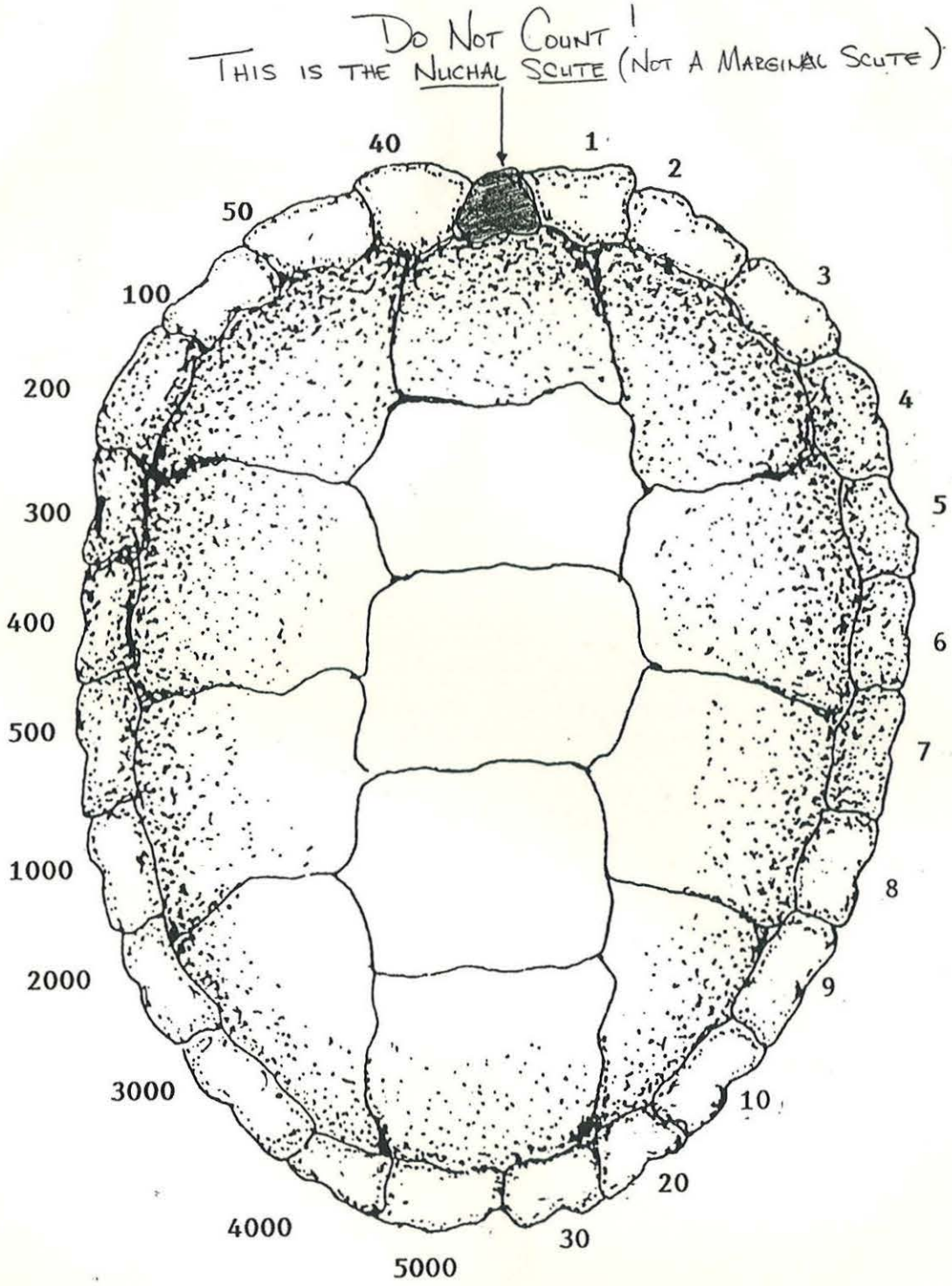
Assessment Report Form

Type of Audit: __X__ Field _____ Laboratory
Project Name/Number: Callaway Unit 2 COLA/3250075219
Auditor: SPS **Callaway Nuclear Plant**

Report # 004 (assigned by PM)

Date of Assessment 10-10-2007

Activities Observed:
Pre-sampling/Set-up NA
Sample Collection Observed Scott Benton and Loran Miller as they checked live turtle traps at Logan Creek (one trap), P-5 (two traps), P-6 (one trap) and one trap at the quarry pond. Turtles were identified to species, sexed, measured (total carapace length or TCL), marked and released unharmed. TCL was measured to the nearest tenth of a centimeter (cm) using an appropriate measuring board. Sex was accurately determined by observing the position of the cloaca on the tail. Species were identified using Tom Johnson's Amphibians and Reptiles of Missouri (2nd Edition, 2000). Marginal scutes were uniquely marked in accordance with the attached guide in order to identify recaptures.
Data Recording. Recorded species, sex, TCL (to the nearest tenth of a cm), and individual number on the Turtle Survey Data Sheets. Data sheets were properly completed.
Safety Procedures. Scott and Loran reviewed the following health and safety issues prior to the start of field activities: • Slips, trips, falls; • Working near water; and • Biological hazards such as snakes, ticks, and poison ivy.
Activity Participants and Titles:
Scott Benton, Biological Field Team Leader
Loran Miller, Biological Technician
Problem Description:
None
Consequences if Uncorrected:
NA
Recommended Action and Completion Date:
NA


DO NOT COUNT !
THIS IS THE NUCHAL SCUTE (NOT A MARGINAL SCUTE)
40
1
2
50
3
100
200
4
300
5
400
6
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7
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2000
9
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5000

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

	DATE	5 29 07
	NO.	
	SHEET	1 OF 1

FIELD ACTIVITY DAILY LOG

PROJECT NAME: Rizzo Baseline Water Quality | PROJECT NO.:

FIELD ACTIVITY SUBJECT: Surface Water Sampling

DESCRIPTION ON DAILY ACTIVITIES AND EVENTS:

1200 J. Friesner / J. Grib (MACTEC) arrive on site @ Rizzo Trailer. Had to pick up distilled water and ice for sample coolers prior to arrival. Will sort through sample containers to verify all sample containers present.

1325 Arrive at Date Near PG-9. Had to contact laboratory regarding odor analysis. D. Harvey (PACE) instructed to collect odor along with BOD/color/TSS/TDS and send to PACE in Venera. They will send sample to lab directly (2nd lab). Tomorrow, sample containers specifically for odor analysis will arrive.

1335 Water Quality meter (HORIBA U-10, MACTEC # MQ14-10) calibrated with auto-cal solution (Lot #5309 exp 6/5/08). Results

Solution pH 4.00
SC 4490 µS/cm²
TURB 0.0 NTU

Results pH 4.01
SC 4500 µS/cm
TURB ~10 → zeroed to 0
Temp. 25.7°C
DO 8.80

1415 Sample collected at PG-9 (see sample sheet)
1515 Sample collected at PG-8 (see sample sheet)
1600 Sample collected at PG-7 (see sample sheet)
1655 Sample collected at PG-6 (see sample sheet)
1720 Field Blank collected w/ distilled water purchased from store. No Type II available. NOTE no equipment blank will be collected — no equipment required for decon between locations. JEF
1730 Storm moving in. Beginning to rain lightly. Will drop off coolers at Rizzo trailer (empty containers) and leave for St. Louis. (cannot make drop in & Jefferson city).

VISITORS ON SITE:

CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
No type II DI; used distilled from store.
Heading back to St. Louis instead of staying in Jeff City due to late work (miss drop)

WEATHER CONDITIONS
Overcast to partly cloudy.
Warm (Low 80's).
Storm front move through ~1715/1730

IMPORTANT TELEPHONE CALLS

PERSONNEL ON SITE: JEF JG

FIELD ENGINEER: Jeff Leuder DATE 5/29/07

F-133

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

DATE	5	30	07
NO.			
SHEET	1	OF	1

FIELD ACTIVITY DAILY LOG

PROJECT NAME: ~~Fieldaway~~ Baseline Water Quality | PROJECT NO.:

FIELD ACTIVITY SUBJECT: Surface Water Sampling

DESCRIPTION ON DAILY ACTIVITIES AND EVENTS:

0850 Jack Friesner / Joe Grib (Mactec) arrive at Rizzo Trailer. Had stopped prior to get more distilled water and ice for coolers. Loading up truck. D. Carter will escort to river locations (Mo River; S-01, S-02)

0930 Arrive at S-01 location

0940 Mactec calibrates Horiba U-10 WQ meter (Mactec # M014-10) with Auto-cal solution (Lot 5245, exp 4/11/08)

Cal Standards
pH = 4.00
SC = 4490 µS/cm
Turb = 0

Cal Results:
pH = 4.00
SC = 4490 µS/cm
DO = 8.43 mg/L
Turb = 0 NTU
Temp = 24.3°C

1000 Sample collected at S-01 (See sheet)

1100 Sample collected at S-02

1155 Sample collected at PG-5

1230 Recalibrate WQ meter. Results
pH = 3.98
SC = 4510 µS/cm
Turb = 0 NTU
DO = 8.18
Temp = 24.6°C
Used Auto Cal Lot # 5309
Exp 6/6/08

1235 Sample collected at PG-4

JEF 1300 Duplicate marked SW-D with time of 1300

1340 Sample collected at PG-3.

1420 Sample collected at PG-2

1450 Field blank #2 ~~FB-08~~ JEF (FB-2) collected with distilled water (no Type 2 Lab DI available). Combined/mixed ~~4~~ JEF jugs (1-gal each) prior to field blank collection.

1545 Equipment/supplies unloaded and stored in Rizzo Trailer. Will depart site and pick up ice for sample coolers, pack coolers and prep for shipment.

VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
WEATHER CONDITIONS	IMPORTANT TELEPHONE CALLS

PERSONNEL ON SITE: JEF / JJG

FIELD ~~ENGINEER~~ Leader: [signature]

DATE 5/30/07

F-133

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

DATE	5 31 07
NO.	
SHEET	1 OF 1

FIELD ACTIVITY DAILY LOG

PROJECT NAME Baseline Water Quality	PROJECT NO.
FIELD ACTIVITY SUBJECT: Surface Water	

DESCRIPTION ON DAILY ACTIVITIES AND EVENTS:

1230 Jack Fruehauf & Joe Grib (MACTEC) arrive at Rizzo Trailer to get sample supplies to collect remaining surface water samples from SG-L1, SG-A3 and [redacted]PG-1.

1310 Arrive at SG-A3 (Aravaipa Creek location)

1315 Calibrate Horiba U-10 (MACTEC MO14-10): Results
pH 4.01
SC 4490 uS/cm
Turb 0 NTU
DO 8.44 mg/L
T 24.8
Used Auto cal Solution
Lot # : 5309
Exp date : 6/5/08
(pH 4.00, Turb = 0 NTU, SC = 4490 uS/cm)

1335 Samples collected at SG-A3.

1435 Samples collected at [redacted]PG-1.

1505 Samples collected at SG-L1.

1525 Field Blank #3 collected. Mixed 2.5 gal of distilled water prior to filling containers.

1550 Departing site. Will Return to St. Louis to ship off samples (Note PACE samples will be handed over to local Representative).

VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
WEATHER CONDITIONS	IMPORTANT TELEPHONE CALLS

PERSONNEL ON SITE: Jack Fruehauf, Joe Grib

FIELD ~~ENGINEER~~ Leader

DATE 5/31/07

F-133

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

DATE	6	04	07
NO.			
SHEET	1	OF	1

FIELD ACTIVITY DAILY LOG

PROJECT NAME	Rizzo Baseline Water Quality	PROJECT NO.	

FIELD ACTIVITY SUBJECT: Groundwater Sampling

DESCRIPTION ON DAILY ACTIVITIES AND EVENTS: ✓JJG

0900 J. Freisner (JEF) & ~~Joe~~ J. Grib (MACTEC) arrive on site. Deposit sampling equipment next to MW-1D.

0930 Praxair arrives with nitrogen tanks for bladder pumps. JEF/JJG to meet delivery truck in parking lot outside gate.

1000 Tanks dropped off in cage next to Rizzo Trailer (cage = tank cage for temporary storage provided by Ameren). Need field supplies (clamp for tubing, air fitting for pump line, etc). JEF/JJG heading to Fulton

1200 Return to MW-1D. Picked up tanks from cage along the way. Set up air tanks near well against protective post.

1350 Tanks not stable as set up. Will have to prop against cab of truck between side doors. Dan Carey obtained OK from Ameren (Carey) to lay tanks on ground - strapped together while using. Will

1420 Begin Pumping.

1425 Water bubbling in return line. Bubbling constant through fill/discharge cycles. JEF believes bladder is ruptured. Need to call Pine Environmental (pump rental supplier).

1500 Pine confirms JEF's analysis. They will send 2nd pump (at their cost) to arrive tomorrow. In at Mactec office before 8:00 am, purging will resume at MW-1D. Defective pump and tubing left in well (heavy from fitting). Will Remove/replace when needed.

1555 JEF/JJG Depart site

(Mactec #MD15-02)

NOTE: Horiba U-22 calibrated at 1400 with auto cal Solution (Lot #5309, Exp 05/08) (pH 4.00, Sc 4440 µs/cm, turbidity 0.0)

Results: pH = 4.00, Sc = 4520 µs/cm, turb = 0.0, DO = 7.47 mg/L, T = 28.8°C, ORP = 149 mV). JEF

VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
WEATHER CONDITIONS: Mostly clear, warm (mid 70's)	IMPORTANT TELEPHONE CALLS

PERSONNEL ON SITE: Jack Freisner (JEF) and Joe Grib (JJG)

FIELD ENGINEER [signature] DATE 6/4/07

F-133 Leader

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

	DATE	6	05	07
	NO.			
	SHEET		OF	

FIELD ACTIVITY DAILY LOG

PROJECT NAME	Rizzo Baseline Water Quality	PROJECT NO.
FIELD ACTIVITY SUBJECT:	Groundwater Sampling	

DESCRIPTION ON DAILY ACTIVITIES AND EVENTS:

0915 J. Fricsson / J. Grib (MACTEC) arrive. No bladder pump. Will do shallow wells today.

0945 Set up on MW-2S.
0950 Horiba U22 calibrated Results (pH = 4.00, SC = 4480 µS/cm, turb = 0, DO = 8.53 mg/L, T = 21.5°C, O.P = 131)
1135 Samples collected from MW-2S. Will Dispose of water at Facility water treatment basin.

1240 Set up on MW-3S.

1330 Phone conversation with DAN CAREY:
WATER LEVEL NOT STABILIZING IN MW-3S. Discussed alternatives (either volume purging or continue with low-flow outside ASTM Boundary Limits). Since well is 4" diameter and a storage/transport tank is not available, low flow techniques will be used to purge/sample the wells even if drawdown is greater than allowed by ASTM

1445 DAN CAREY Phone conversation: Bob Holden asked if the pump could be cycled off and on in order to achieve stabilization. JEF believed it could but questioned the validity of the method. Decided that water level stabilization could not be achieved and proposed to stop pumping and return tomorrow with tank and sample MW-3S by 3 well volume purge method. Dan Carey agreed to proposed. Packing up equipment will unload purge water prior to moving to next well.

1525 Set up on MW-5S
1605 Purging ceased at MW-5S due to excessive drawdown. Will have to purge MW-5S similar to MW-3S. Will collect equipment and field blanks.
1630 Field blank collected (FB-4)
1645 Equipment Blank collected (EB-1). 1725 Leaving Site

VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
WEATHER CONDITIONS	IMPORTANT TELEPHONE CALLS

PERSONNEL ON SITE:

FIELD ~~ENGINEER~~ Leader

DATE 6/5/07

F-133

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

DATE	8	23	2007
NO.			
SHEET	1	OF	1

FIELD ACTIVITY DAILY LOG

PROJECT NAME: Callaway Water Quality | PROJECT NO.: 3250075219 10.11

FIELD ACTIVITY SUBJECT: Surface Water

DESCRIPTION ON DAILY ACTIVITIES AND EVENTS:

0900 Joe Grib & Loran Miller Arrive on site @ S-02 & prep for Surface water sampling

0915 Calibrate Meter (Horiba U-22) M015.04
Cal Solution EXP = 6/5/08
Lot# = 5309
pH = 4.00 DO = 8.29
Cond = 4500 Temp = 25.4
Turb = 0.0 ORP = 280

0930 Sample taken @ S-02
1030 Sample taken @ S-01
1130 Sample taken @ SG-L1
1215 Field Blank 2 (FB-2) taken @ the SG-A3 location
1230 Sample ~~#~~ Dup-2 taken @ SG-A3
1430 Sample taken @ PG-9
1530 Sample taken @ PG-7
1545 End Surface Water Sampling, Sampling Complete
Clean up/pack Truck

1555 Joe Grib & Loran Miller off-Site
PDF Samples shipped FedEx STL Pace Samples given to Walter Nadeau of Pace

VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
NA	NA
WEATHER CONDITIONS	**IMPORTANT TELEPHONE CALLS**
Partly Cloudy 85°F—95°F throughout day	Contacted Tom Grothe & Paula Johnson in regards to Access @ PG-9

PERSONNEL ON SITE: Joe Grib (JJG) Loran Miller (LRM)

FIELD ENGINEER: Joseph J. Grib DATE: 8/23/07

F-133

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

DATE	8	21	2007
NO.			
SHEET	1	OF	1

FIELD ACTIVITY DAILY LOG

PROJECT NAME: Callaway Water Quality | PROJECT NO.: 32500752219.10.11

FIELD ACTIVITY SUBJECT: Surface Water Sampling

DESCRIPTION ON DAILY ACTIVITIES AND EVENTS:

0830 Joe Grib & Loran Miller arrive on site @ PG-8 & prep for surface water sampling

0855 Calibrate Meter (Horiba U-22) MO15-04
Cal Solution Exp = 6/5/08
pH = 4.01 ORP = 312 Lot# = 5309
Cond = 4500 DO = 8.11
Turb = 0.2 Temp = 27.8

0910 Sample taken @ PG-8, PG-8 is almost dry a max of ~0.4' of water @ PG-8

1040 Sample taken @ PG-6
1140 Sample taken @ PG-5
1230 Sample taken @ PG-4
1330 Sample taken @ PG-1
1415 Sample & Dup-1 taken @ PG-3
1515 Field Blank-1 (FB-1) taken @ the PG-2 location
1530 Sample taken @ PG-2
1615 End Surface water Sampling for the day & clean up/ pack Truck
1630 Joe Grib & Loran Miller off-site samples shipped FedEx STL.

VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
NA	NA
WEATHER CONDITIONS	**IMPORTANT TELEPHONE CALLS**
Sunny 85°F-95°F through out the day	NA

PERSONNEL ON SITE: Joe Grib (JJG) Loran Miller (LDM)

FIELD ENGINEER [signature] DATE 8/21/07

F-133

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

DATE	8	28	07
NO.			
SHEET	1 OF 2		

FIELD ACTIVITY DAILY LOG

PROJECT NAME: Rizzo-Callaway (Baseline Water Quality) | PROJECT NO.

FIELD ACTIVITY SUBJECT: Groundwater Sampling

DESCRIPTION ON DAILY ACTIVITIES AND EVENTS:

0845 Arrive at trailer. Picked up key to wells from Tony Fabina

0905 Setting up at MW-2S.

0910 Calibrated Water Quality meter (Horiba U-22, Macro MD15-04) w/ Auto cal solution (Lot 5612, Exp 2/19/08):

	Solution	Result
pH	4.00	4.00
Sc	4490 uS/cm	4500 uS/cm
Turb	0	0.1
DO	—	8.22 mg/L
ORP	—	239
Temp	—	27.8°C

1010 Sample collected from MW-2S. Packing up, label containers, and move to MW-3S

1040 Set up on MW-3S.

1100 Pump controller will not allow pumps to run at max. Therefore, the well will not be purged low-flow as the pump will be hooked directly on battery.

1150 Well has purged dry (at 1147). Packing up equipment. Will leave pump in well, move to MW-12

1200 Setting up on MW-12

1255 MW-12 has purged dry (at 1253). Will leave pump in well and move to MW-5S or MW-6S. Rizzo hydrologic crew is working on MW-5S and 6S. Will check on their progress.

1320 Set up on MW-6S. Spoke w/ Daniel of Rizzo (Hydrologic study crew) about Sampling MW-6S. They have done testing on MW-6S previously. Also MW-3S had been pumped dry yesterday (8/27), accounting for low water levels in MW-3S and 6S.

1355 MW-6S had purged dry at 1351. Will leave pump in well and move back to MW-12 to collect sample.

VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
	NONE
WEATHER CONDITIONS	**IMPORTANT TELEPHONE CALLS**
CLEAR, HOT (90°) at start	NONE

PERSONNEL ON SITE: Jack E Fruehauf (JEF) and Joe J. Grub (JJG)

FIELD ENGINEER: [signature] DATE 8/28/07

F-133 Leader

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

DATE	8	28	07
NO.			
SHEET	2 OF 2		

FIELD ACTIVITY DAILY LOG

PROJECT NAME Rizzo-Callaway (Baseline Water Quality) | PROJECT NO.

FIELD ACTIVITY SUBJECT: Groundwater Sampling

DESCRIPTION ON DAILY ACTIVITIES AND EVENTS:

1405 Returned to MW-12. Will collect sample and duplicate

1420 Sample from MW-12 collected; DUPLICATE (DUPLICATE-3) collected. After sample collection pack up and check levels in MW-35'

1515 Arrive at MW-35'.

1518 Depth to water = 55.9 ft. Need another 2' of water in well to fill all containers. Will allow well to recover overnight and collect sample tomorrow morning. Pump left in well. Move to MW-65'

1535 Arrived at MW-65' and checked water level. 8 Ft of water in well, ~~however~~, calculated that 14 ft of water needed in well (w/o recharge). Will collect field blank and then attempt sample collection at MW-65'.

1545 Field blank collected (FB-3). Set up to sample MW-65'. Will collect all containers minus Radiological. If well pumps dry, will go empty purge water and return.

1615 Samples (all) collected from MW-65'. Packing up equipment. Will Empty purge water and leave site.

1645 Purged water disposed in drainage basin. Leaving site. Will Ship Bio samples to PDC Labs. PACE Rep to pick up all samples to Lenexa. Will Hold Radiological samples

VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
—	NONE
WEATHER CONDITIONS	**IMPORTANT TELEPHONE CALLS**
Hot (95°) AT END.	

PERSONNEL ON SITE: JACQUE FRIESNER (JEF) and Joe J. Grib (JJG

FIELD ~~ENGINEER~~ Leader — DATE 8/28/07

F-133

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

DATE	8	29 07
NO.		
SHEET	1 OF 1	

FIELD ACTIVITY DAILY LOG

PROJECT NAME: Rizzo-Callaway (Baseline Water Quality) | PROJECT NO.

FIELD ACTIVITY SUBJECT: Groundwater Sampling

DESCRIPTION ON DAILY ACTIVITIES AND EVENTS:

0845 Arrive at Rizzo's trailer. Will drop off equipment at MW-1D before heading to MW-35 to collect sample.

0925 Arrive at MW-35.

0930 Phone call from Robin Rodriguez (MACTEC) regarding surface water samples.

1000 Set up to collect sample

1010 Sample collection time for MW-35. Duplicate (DUPLICATE-04) collected

1050 Sample containers filled and labelled. Packing up equipment. Will Pick up Nitrogen tanks by Tan metal Shed (Soil Shed?) North of visitors parking before moving back to MW-1D.

~~JEF~~ JEF

1125 Arrive at MW-1D. Picked up Nitrogen. Setting up.

1210 Calibrated Horiba-U22 (MACTEC M015-04) w/ auto cal solution (Lot 5613, exp 2/19/08)

	Solution	Result
pH	4.00	4.01
SC	4490 µs/cm	4510 µs/cm
TURB	0	0
Temp	—	32.8°C
ORP	—	304 mV
DO	—	7.63 mg/L

1217 Start purging

1315 Collected Field blank (FB-4).

1400 Begin Sample collection (SAMPLE TIME) at MW-1D.

1430 Samples collected. Begin Packing equipment

1520 Nitrogen tanks replaced by Rizzo Shed. Leaving site. Will ship BG samples to PDC and have PACE Rep pick up samples for Kenexa KS office.

VISITORS ON SITE:

CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
Holding Radiological samples. Combine Shipment/pickup on 8/30.

WEATHER CONDITIONS

IMPORTANT TELEPHONE CALLS
0930 Robin Rodriguez - PDC questions about Surface samples.
1400 NJ

PERSONNEL ON SITE: Jack E. Friesner (JEF) and Joe J. Grib (JJG)

FIELD ~~ENGINEER~~ Leader

DATE 8/29/07

F-133

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

DATE	8	30	07
NO.			
SHEET	1	OF	1

FIELD ACTIVITY DAILY LOG

PROJECT NAME: Rizzo-Callaway (Baseline Water Quality) | PROJECT NO.

FIELD ACTIVITY SUBJECT: Groundwater / Surface Water Sampling

DESCRIPTION ON DAILY ACTIVITIES AND EVENTS:

1000 Arrive at MW-55. Set up to purge/sample.

1010 Calibrated Horiba U-22 (Macro MQS-04) w/ auto-cal Solution (Lot 5612, exp 2/9/08)

	Solution:	Result
pH	4.00	3.99
SC	4490 µS/cm	4510 µS/cm
Turb	0	0
Temp	—	25.4°C
DO	—	7.89 mg/L
ORP	—	263

1021 Begin purging MW-55

1100 Begin Sample collection (Sample time applied) at MW-55.

1120 Well pumped dry. Will collect Field blank to give well time to recover

1135 Field blank collected (FB-5)

1210 Sample collection completed. Packing equipment

1230 Lunch

1250 Arrive at Wildwood. Bert Konle to escort to well house.

1310 Sample collected. Packing samples and heading to Auxvasse Creek sample location (SG-A3). — Resample due to label detaching off bottles.

1345 SG-A3 collected w/ DUP-2. Will send 2nd SG-A3 sample to lab and instruct to contact Bob Halden for confirmation to run analysis.
FB-2 collected.

1415 Sample collected from PG-7 Location. Heading to water treatment basin in plant to dump purge water.

1445 Leaving site. Will Ship Bio Samples to PDC and have Pace rep pick up today's Samples AND Radiological.

VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
NONE	After Groundwater Samplings is completed, Surface waters for chlorophyll at SG-A3 and PG-7 will be collected along with field blank and duplicate for SG-A3.
WEATHER CONDITIONS	**IMPORTANT TELEPHONE CALLS**
Mostly Cloudy, Warm (80°)	1420 JEF Called Robin Rodriguez to discuss sample that was collected at SG-A3. originally just duplicate needed, however for Lab QC, original sample required. Will contact Bob Halden

PERSONNEL ON SITE: ~~JEF~~ JACK E. FRIESNER (JEF) and JOE J. GRIB (JJG)

FIELD ~~ENGINEER~~ Leader

DATE 8/30/07

F-133

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

DATE	11	07	07
NO.			
SHEET		OF	

FIELD ACTIVITY DAILY LOG

PROJECT NAME: Rizzo-Calgary Bottline Water Quality | PROJECT NO.

FIELD ACTIVITY SUBJECT: Surface Water Sampling

DESCRIPTION ON DAILY ACTIVITIES AND EVENTS:

0810 ARRIVE ON SITE. STOP BY FORMER RIZZO TRAILER TO PICK UP EMPTY, UNPRESERVED containers for filtering (collect sample in unpres. container then filter into proper container

0905 ARRIVE at PG-9. Contacted Tom Grothe regarding access Per QAPP.

0910 Begin Sample collection (See Surf. water sample form for details)
USING HORIBA-U22 water quality meter (model: MULTI-11). No calibration solution on site, however, unit was calibrated previously on 10/30/07.
RESULTS AT THAT TIME: pH = 4.00 (4.00), SC = 44900 µS/cm (44900)
Used cal solution (Lot SL12, Exp 2/19/08)

0925 SAMPLE COLLECTED AT PG-9. Pack up and move to PG-8

1030 SAMPLE COLLECTED AT PG-8. Move to PG-7

1115 SAMPLE COLLECTED AT PG-7. Move to ~~PG-8~~ PG-6.

1205 SAMPLE COLLECTED AT PG-6. MOVE TO PG-3. WILL BREAK FOR LUNCH PRIOR / ON THE WAY.

1325 SAMPLE COLLECTED AT PG-3. Move to PG-2. TRACE Green flecks in water at ~~PG-3~~, Possibly algae or moss.

1415 SAMPLE COLLECTED AT PG-2. Move to PG-1

1515 SAMPLE COLLECTED AT PG-1. Duplicate (DUP-1) collected at PG-1 location. Packs samples and will proceed with field blank collection

1600 FIELD BLANK #1 collected <FB-1>. Packing samples and will head back to office. Plan to have W. Dotson w/ PACE to pick up samples for Lenexa, KS Lab (all but RAD and BIO). Will HOLD RAD samples until ALL (surface and ground water samples) are collected. Will ship BIO SAMPLES TO PDC Lab upon return to OFFICE

VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
	No cal solution. Instrument was calibrated prior to event.
WEATHER CONDITIONS: mostly clear 30° at start w/ high ~ 50°.	IMPORTANT TELEPHONE CALLS: Notified Tom Grothe prior to Sampling PG-9.

PERSONNEL ON SITE: JACK FRIESNER (JDF), JOE GRIB (JJG)

FIELD ~~ENGINEER~~ Leader

DATE 11/7/07

F-133

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

	DATE	11	8	07
	NO.			
	SHEET	1	OF	

FIELD ACTIVITY DAILY LOG

PROJECT NAME: Rizzo Calloway Baseline Water Quality | PROJECT NO.

FIELD ACTIVITY SUBJECT: Surface Water Sampling

DESCRIPTION ON DAILY ACTIVITIES AND EVENTS:

0900 ARRIVE ON SITE. WILL MOBE TO SG-A3 After restroom break.
0920 ARRIVE AT SG-A3 (Auxvasse Creek). Will Calibrate HORIBA U-22 (Meadoc M015-11) w/ Cal (Auto) Solution (Lot 5612, exp 2/19/08)
Solution: pH = 4.00, SC = 4490 µS/cm, 0 NTU
Results: pH = 4.00, SC = 4510 µS/cm, 0 NTU
DO = 10.80, T = 13.8°C, ORP = 182 mV
0935 SAMPLE COLLECTED AT SG-A3. MOVE TO PG-4.
1030 SAMPLE COLLECTED AT PG-4. Move to PG-5. DUPLICATE (DUP-2) collected at PG-4
1120 Sample collected at PG-5. Move to SG-L1.
1215 SAMPLE COLLECTED AT SG-L1. SAMPLE COLLECTED FROM POOL ~150 ft west (downstream) from Bridge
1230 Break for lunch.
1330 ARRIVE AT S-01 Location. Get ready to sample
1345 Sample collected at S-01.
1400 Field Blank #2 (FB-2) collected. Move to ~~S-03~~ S-02.
1450 SAMPLE COLLECTED AT S-02. Pack up and heading to office.
Will call W. Dotson (PACE Lab rep) for sample pick-up
Will hold RAD samples until end of next week (after GW completed)
Will Ship off Samples to PDC by FedEx.

VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
WEATHER CONDITIONS	IMPORTANT TELEPHONE CALLS

PERSONNEL ON SITE: JLF (JACK FRIESNER), JJG (JOE GRIB)

FIELD ~~ENGINEER~~ Leader — DATE 11/8/07

F-133

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

	DATE	11	13	07
	NO.			
	SHEET	1	OF	1

FIELD ACTIVITY DAILY LOG

PROJECT NAME: Rizzo-Callaway Baseline Water Quality | PROJECT NO.

FIELD ACTIVITY SUBJECT: Ground Water Sampling

DESCRIPTION ON DAILY ACTIVITIES AND EVENTS:

1045 Arrive on site. Picking up Nitrogen tank from Rizzo Storage building. Will set up and sample MW-1D.

1125 Set up on MW-1D

1135 Calibrated Horiba U-22 (Machec M015-M) w/ Auto Cal Solution (Lot 5612, exp 2/19/08).

Solution
pH = 4.00
SC = 4490 µS/cm
Turb = 0 NTU

Results
pH = 4.00
SC = 4490
Turb = 0.0
Temp = 17.5
DO = 9.52
ORP = 374

1320 Pump failed at 1317. Apparent bladder rupture. Call Machec Field Operations for repair instructions.

1335 Jeff spoke with B. Cunningham (Machec) and Charles w/ Pine Environmental (equipment rental company). They will send out replacement pump to arrive tomorrow. Jeff/JJG will plan to sample shallow wells tomorrow and finish Deep well (MW-1D) on thursday

Pump failure has possibly pushed back schedule by 1 day.

Packup equipment and will head back to office

1440 Depart Site

VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
WEATHER CONDITIONS: overcast, 50°-55°	IMPORTANT TELEPHONE CALLS: Called B. Cunningham (Machec) and Charles w/ Pine regarding failed pump.

PERSONNEL ON SITE: Jeff (Jack Friesner), JJG (Joe Grib)

FIELD ~~ENGINEER~~ Leader

DATE 11/13/07

F-133

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

DATE	11	14	07
NO.			
SHEET	1 OF 2		

FIELD ACTIVITY DAILY LOG

PROJECT NAME Rizzo Callaway Baseline Water Quality | PROJECT NO.

FIELD ACTIVITY SUBJECT: Groundwater Sampling

DESCRIPTION ON DAILY ACTIVITIES AND EVENTS:

0930 ON SITE. WILL TRY TO LOCATE RIZZO CREW to discuss their well work schedule before mobing to shallow wells to sample.

0955 Setting up on MW-55. NOTE: No Low FLOW CONTROLLER, therefore the well (and all shallow wells) will be purged of 3 well volumes (or dry) prior to sample collection. Will take water quality at beginning and at each well volume.

1005 Calibrated U-22 (Master MW15-11) w/ auto-cal solution (lot 5612, exp 2/19/08)
SOLUTION: pH = 4.00, SC = 4490, Turb = 0
Results: pH = 3.99, SC = 4510 µS/cm, Turb = 0
*DO = 8.32, Temp = 16.2 orp = 212

*NOTE: D.O. Sensor error. D.O. Readings inaccurate due to inability to calibrate. Will ATTEMPT TO RECALIBRATE after sampling MW-55.

1045 SAMPLE COLLECTED AT MW-55

1055 Recalibrated Horiba U-22. D.O. Calibration successful.
Results: pH = 3.98, SC = 4470 µS/cm, turb = 0 NTU
DO = 9.57, T = 15.9°C, orp = 182

1110 Set up on MW-65

1140 Well MW-65 purged dry at 1138. Will leave pump in well, move to MW-12 to purge then return to collect sample

1205 Set up on MW-12.

1240 Well MW-12 purged dry. Will go back to MW-65 to collect sample, then return.

1310 SAMPLES COLLECTED AT MW-65. DUPLICATE (DUP-3) collected.

1325 Field blank (FB-3) COLLECTED. Move to MW-12

1405 SAMPLE COLLECTED AT MW-12. Move to MW-25 to Purge (next page)

VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
WEATHER CONDITIONS	IMPORTANT TELEPHONE CALLS

PERSONNEL ON SITE: JEF (JACK FRIESNER), JJG (JOE GRIB)

FIELD ENGINEER DATE

F-133

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

DATE	11	14	07
NO.			
SHEET	2 OF 2		

FIELD ACTIVITY DAILY LOG

PROJECT NAME	PROJECT NO.
FIELD ACTIVITY SUBJECT:	

DESCRIPTION ON DAILY ACTIVITIES AND EVENTS:

1420 Arrive at MW-2S. Setting up to purge/sample.
1450 Samples collected at MW-2S. Move to MW-3S
1505 Begin Purging MW-3S
1630 MW-3S Purged dry. Will allow well to recover overnight and will sample tomorrow morning. Will pack up equipment. Leaving pump in well overnight. Will empty purge water at basin in plant.
1650. Purge Water disposed in basin. Approx 85 gallons emptied into retention basin. JEF had notified Tom Grothe last week of activities.

the Departing Site.

VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
WEATHER CONDITIONS	IMPORTANT TELEPHONE CALLS Called Marie Deakle @ Windward to set up sample time (1500) tomorrow.

PERSONNEL ON SITE:

FIELD ~~ENGINEER~~ Leader

DATE 11/14/07

F-133

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

	DATE	11	15	07
	NO.			
	SHEET	1 OF 1		

FIELD ACTIVITY DAILY LOG

PROJECT NAME: Rizzo Calloway Baseline Water Quality | PROJECT NO.:

FIELD ACTIVITY SUBJECT: Ground Water Sampling

DESCRIPTION ON DAILY ACTIVITIES AND EVENTS:

0905 Arrive on site. Will go to MW-35 to collect sample

0940 Sample collection at MW-35. Duplicate <DUP-4> collected.

1040 Set up on MW-1D. New bladder pump sent to Matrix and will be used in place of failed unit.

1045 Calibrated Horiba U-22 (Matrix MA15-11) w/ auto-cal solution (Lot 5612, exp 2/19/08).

Solution: pH = 4.00 (4.00) SC = 4490 µS/cm (4520), Turb = 0.0 NTU (0.0)

DO = 11.70 T = 9.1 ORP = 188

1225 Sample collected at MW-1D. Break down equipment. Will empty remaining purge water at retention basin.

1445 Arrived at Wildwood. Meet with Mark Deake to arrange access to well.

1455 Sample collected from Wildwood well. Sample collected from garden hose after approx 10 gallons flowed through.

1515 Leaving Wildwood. Heading back to office

VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS.
WEATHER CONDITIONS: mostly clear, windy, 35°-40°	IMPORTANT TELEPHONE CALLS

PERSONNEL ON SITE: Jack Rissman (JRF), Jon Grub (JJG)

FIELD ~~ENGINEER~~ Leader

DATE 11/15/07

F-133