QUALITY ASSURANCE PROJECT PLAN
FOR
PRELIMINARY ENDANGERMENT ASSESSMENT
MODESTO JUNIOR COLLEGE WEST CAMPUS
FORMERLY USED DEFENSE SITE
HAMMOND GENERAL HOSPITAL
2201 BLUE GUM AVENUE
MODESTO, CALIFORNIA

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ACRONYMS AND ABBREVIATIONS

%R	percent recovery
µg/L	micrograms per liter
BTEX	benzene, toluene, ethylbenzene, and total xylenes
COPCs	chemicals of potential concern
DCS	duplicate control sample
DHS	California Department of Health Services
DQO	data quality objectives
DTSC	Department of Toxic Substance Control
FUDS	Formerly Used Defense Site
HGH	Hammond General Hospital
Krazan	Krazan & Associates, Inc
LCSD	laboratory control sample duplicate
MDL	method detection limit
MJCWC	Modesto Junior College West Campus
mg/kg	milligrams per kilograms
MSD	matrix spike duplicates
NOA	naturally occurring asbestos
NIST	National Institute of Standards and Technology
PE	performance evaluation
PEA	preliminary endangerment assessment
Phase I ESA	Phase I Environmental Site Assessment
PHCs	Petroleum Hydrocarbon Constituents
PQL	Practical Quantitation Limits
QA	quality assurance
QA/QC	Quality Assurance and Quality Control
QAPP	Quality Assurance Project Plan
QC	quality control
RPD	relative percent difference
TPH-G	total petroleum hydrocarbons as gasoline
USEPA	U.S. Environmental Protection Agency
USTs	underground storage tanks
VOC	volatile organic constituents
YCCD	Yosemite Community College District

1.0 INTRODUCTION/BACKGROUND

This Quality Assurance Project Plan (QAPP) has been prepared by Krazan and Associates, Inc. (Krazan) on behalf of Yosemite Community College District (YCCD) to address quality assurance (QA) and quality control (QC) policies associated with the collection of environmental data at the Modesto Junior College West Campus (MJCWC) that is located on the Formerly Used Defense Site (FUDS)- Hammond General Hospital (HGH) (site). This QAPP presents the plan for sampling and analysis as part of the PEA Investigation (PEA) and any additional assessments performed under the direction of the California Environmental Protection Agency, Department of Toxic Substance Control (DTSC). The U.S. Environmental Protection Agency (USEPA) policy requires a QAPP for all environmental data collection projects mandated or supported by the USEPA through regulations or other formalized means (USEPA, 1998a). The purpose of this QAPP is to identify the methods to be employed to establish technical accuracy, precision, and validity of data that is generated at the site.

This QAPP contains general and specific details regarding field sampling, laboratory, and analytical procedures that apply to environmental sampling activities for the PEA and any subsequent environmental sampling. It provides field and laboratory personnel with instructions regarding activities to be performed before, during, and after field investigations. These instructions will insure data collected for use in project decisions will be of the type and quality needed and expected for their intended purpose.

Guidelines followed in the preparation of this QAPP are described in EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5 (USEPA, 2001) and EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5 (USEPA, 1998). Other documents that have been referenced in this plan include Guidance for the Data Quality Objectives Process, EPA QA/G-4 (USEPA, 2000) and Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (USEPA, SW-846, Third Edition, 1996). Procedures for data collection and evaluation described herein meet the requirements for quality assurance/quality control contained in the DTSC PEA Guidance Manual (1994).

1.1 Project History and Objectives

The subject site is located within the northern half of Section 24, Township 3 South, Range 8 East, Mount Diablo Baseline and Meridian (MDBM). A small southeastern portion of the MJCWC is located within the southwestern quarter of the northwestern quarter of Section 19, Township 3 South, Range 9 East,

MDBM (See Figure 1). The MJCWC comprises approximately 168 and is at an elevation between 72 and 82 feet above mean sea level (MSL). The subject site is located in an area that is predominantly rural residential/agricultural setting with some light commercial uses. The subject site is bounded to the north by Shoemaker Avenue (rural residential and agricultural use); to the east by Brink Avenue (Union Pacific Railroad, beyond which is State Route 99, beyond which is commercial); to the south by Blue Gum Avenue (Commercial/Residential/Vacant Land); and to the west by 2nd Street (Alternative High School/Juvenile Detention Center/ Rural Residential) In March and June of 1942, the U.S. Army Corps of Engineers (USACE) acquired 220.82 acres of agricultural land located in Modesto, Stanislaus County, California, and immediately began building the U.S. Army Hammond General Hospital (HGH). HGH is identified as an U.S. Army Corps of Engineers (USACE) formerly used defense sites (FUDS) facility. The former HGH was a 2,556-bed military hospital which included medical wards and clinics, dental clinics, x-ray facilities, barracks, offices, warehouses, mess halls, and living quarters. HGH also maintained six detention wards for the mentally ill and prisoner patients. In addition to the medical facilities, the former HGH was designed to be a self-sustained facility which included: pump houses for water production from on-site water wells; a boiler house with associated heating fuel USTs; wastewater treatment and disposal facilities including sewer and storm drains, ponds and sludge drying beds; an incinerator; a crematorium; vehicle repair shop and fueling station; utility shops; equipment maintenance facilities; paint shops and spray booths; a cold storage facility; a laundry facility; a 40-acre military camp that included a shooting range and a gas chamber for chemical warfare training. The hospital barracks, employee quarters, and medical facilities were generally located within the southern portion of the subject site. Facility operations such as the maintenance facilities, the boiler house, the laundry, and the sewage treatment plant were generally located within the northern portion of the subject site. Reportedly, the former hospital was likely to have operated a landfill and burn pit for solid waste disposal. In December of 1945, U.S. Army closed the HGH and in 1946 transferred it to the War Assets Administration. HGH was subsequently transferred to the State of California Department of Mental Hygiene which operated the Modesto State Mental Hospital (MSMH) from approximately 1947 until 1966. The former MSMH maintained the hospital barracks, employee quarters, medical facilities and maintenance facilities that were utilized during operation of the HGH. MSMH ceased operations in approximately 1966 and the subject site was transferred to the Yosemite Community College District (YCCD) and converted to the existing MJCWC which has occupied approximately 168 acres of the former HGH and MSMH subject site from 1970 to the present.

According to the DTSC, the former on-site HGH is listed as a military site which needs further evaluation in order to determine the potential for impacts to the subsurface. Potential contaminants associated with the former HGH include mercury, solvents, formalin, fuels, waste oils, x-ray wastes (silver, lead shields), paints (various metals, solvents), pesticides, dioxins, furans, polychlorinated biphenyls (PCBs), chemical warfare materials, and asbestos. Potential releases may have occurred from USTs, leaking transformers, direct disposal to the ground, incineration, leakage from wastewater collections systems, the wastewater treatment plant disposal ponds, and sludge drying beds. Mr. Lance McMahan with the DTSC is the project manager for the former HGH.

The data collected will be further used to assess the relative threat associated with any detected releases of hazardous substances using the accepted methods for screening evaluations of human and ecological risk assessment. The field sampling program has been designed to include sufficient data through adequate numbers of samples, a comprehensive analytical program and proper quality control procedures. The procedures presented in this QAPP will determine the quality of the data used for this purpose.

2.0 PROJECT DESCRIPTION

This section presents information concerning the proposed sampling activities, selected analytical parameters, data objectives, and the resulting project decisions.

2.1 Analytical Scope

The planned sampling effort includes sampling and analysis of soil samples, groundwater samples, and soil gas samples for potential hazardous Constituents of Concern (CoCs) within the following Areas of Concern (AoCs):

Potential Release Mechanisms, AoCs and Respective CoCs

The potential release mechanisms, Areas of Concern (AoCs) and Constituents of Concern (CoCs) are as follows:

1.) Landfill/burn pit that is reportedly located within 1,000 feet of OU1-Ag Housing and OU3-Ag Pavilion Project Areas - CoCs in soil at the landfill and immediate vicinity of the landfill include landfill gas emissions and dioxins and furans in soil associated with the burn pit;

2.) Former Incinerator T-155 located within the OU1-Ag Housing Project Area - CoCs in soil include dioxins and furans;

3.) Former Sewage Treatment Plant T-154 located within the OU1-Ag Housing Project Area- CoCs in soil include VOCs, SVOCs, Nitrates, TKN, General Minerals, and Metals;

4.) Gas Chamber Building T-149, (potential chemical warfare materials) located within the OU3-Ag Pavilion Project Area – CoCs in soil are unknown but may include VOCs and SVOCs;

5.) Possible UST(s) (buried railroad car used for fuel storage at the former HGH boiler house building T-117), located northwest of OU2-Allied Health Project Areas and adjacent to the north of the OU6-Alternate Baseball Complex – CoCs in soil and groundwater include PHCs;

6.) Former Sewage Treatment Effluent ponds within the OU5-Beef Unit Project Area – CoCs in soil include VOCs, SVOCs, Nitrates, TKN, General Minerals, and Metals;

7.) Former firing range within the OU6-Alternate Baseball Complex Project Area - CoCs in soil include lead; and

8.) Soil beneath sewer and storm drain lines on and adjacent to operable units proposed for redevelopment – CoCs in soil include VOCs, SVOCs, and Metals.

The PEA workplan provides the specific number of samples and locations of samples to be collected. Samples will be collected in accordance with Krazans-approved procedures, which follow industry standards. Soil samples will be collected from designated locations according to the work plan.

Selected soil samples will be analyzed for: VOCs, SVOCs including Poly Nuclear Aromatics (PNAs), Organo Chlorine Pesticides (OCPs), CAM-17 Metals, Dioxins/furans, PCBs, tetraethyl lead (TEL), Chemical Warfare Agent (CWAs), and asbestos (See Table I). Groundwater samples may be analyzed for the following CoCs: VOCs, SVOCs including PNAs, OCPs, CAM-17 Metals, Dioxins/furans, PCBs, TEL, and CWAs (See Table II). Passive soil gas samples may be analyzed for the following CoCs: VOCs including BTEX, SVOCs, and CWAs (See Tables III) and Active soil gas samples for the following CoCs: Explosive Gases including Methane (See Table IV). Groundwater samples will be analyzed for TPH-G, BTEX and MTBE (Table 1). The sample detection limits may vary from these limits and will be reviewed for adequacy against the anticipated limits. It is anticipated that Sierra Analytical Laboratories in Laguna Hills, California, a California Department of Health Services (DHS) certified laboratory, will be used to analyze soil and groundwater samples.

Table I
Soil CoCs
Analytical methods and detection limits

Constituents of Concern	Analytical Method	Detection Limits
VOCs including BTEX	EPA Method 5035 - 8260B	0.0050 mg/kg
SVOCs	EPA Method 8270C	0.33 mg/kg
Poly Nuclear Aromatics (PNAs)	EPA Method 8270 or 8310	0.66mg/kg
Organochlorine Pesticides (OCP)	EPA Method 8081A	0.001 mg/kg
CAM-17 Metals	EPA Method 6010B and 7470	Varies
Dioxins/furans	EPA Method 8280	Varies

PCBs	EPA Method 8082	0.020 mg/kg
Asbestos		
Tetraethyl lead TEL	HMU 900	0.5 mg/kg
Chemical Warfare Agent	EPA Method 8270 Modified	Varies
Perclorate Explosives		Varies
Pathogens		Varies
Asbestos		
Lead Based Paint		
TPH Carbon Range (C4-C40)	EPA Method 8015B	Varies

Table II
Groundwater CoCs
Analytical methods and detection limits

Constituents of Concern	Analytical Method	Detection Limits
VOCs including BTEX	EPA Method 8260B	5.0 µg/kg
SVOCs	EPA Method 8270C	Varies
Poly Nuclear Aromatics (PNAs)	EPA Method 8270 or 8310	
Organochlorine Pesticides	EPA Method 8081A	Varies
CAM-17 Metals	EPA Method 6010B and 7470	Varies
Dioxins/furans	EPA Method 8280	Varies
PCBs	EPA Method 8082	20.0 µg/kg
TEL	HMU 900	
Chemical Warfare Agent	EPA Method 8270 Modified	Varies
TPH Carbon Range (C4-C40)	EPA Method 8015B	Varies

Table III
Passive Soil Gas CoCs
Analytical methods and detection limits

Constituents of Concern	Analytical Method	Detection Limits
VOCs	EPA Method 8260B	0.0050 mg/kg
SVOCs	EPA Method 8270C	Varies
Chemical Warfare Agents	EPA Method 8270 Modified	Varies

Table IV
Active soil gas CoCs
Analytical methods and detection limits

Constituents of Concern	Analytical Method	Detection Limits
Explosive Gases including Methane	ASTM 1945	Varies

2.2 Data Use

Decisions to be made will be based on data compiled from the sampling and analysis program. It is intended that data collected through implementation of this QAPP will satisfy federal, state, and local data quality requirements. These data may be used to characterize the nature and extent of any contamination, support risk assessment, support the evaluation of corrective/remedial action, or assist in determination of additional actions.

The presence of environmental contaminants will be determined by the extent of valid detectable concentrations of the constituents discussed above. If the data associated with any CoCs are confirmed, the data will be used to assess risk using accepted methods for determining potential carcinogenic and non-carcinogenic exposures. If results from the risk screening evaluations indicate no risks of exposure with respect to the proposed use of the property, then the data will be used to support No Further Action consent from DTSC. If the evaluation indicates unacceptable risks of exposure, then the data can be used by YCCD for further consideration of action.

3.0 PROJECT ORGANIZATION

This section provides a description of the organizational structure and responsibilities of the individual positions for this project. This description defines the lines of communication and identifies key personnel assigned to various activities for the project.

3.1 Regulatory Agency

The Project Manager from DTSC, identified at this time as Mr. Lance McMahan, will act as the representative for regulatory oversight for the project. The Project Manager's responsibilities are anticipated to include the review and approval of work plans and work activities for the duration of the project. The Project Manager will provide direction of DTSC policy and environmental objectives.

3.2 Yosemite Community College District

Mr. Matthew Kennedy representing YCCD is managing this project. Mr. Kennedy will be responsible for the directional decisions for work conducted on behalf of YCCD, and he or his designee may perform document review of related work plans, reports, and drawings for activities associated with this project.

3.3 Krazan & Associates, Inc

The investigation contractor has responsibility for assigned phases of investigation and reporting. Together the management team (Project Manager, Project Geologist, and Field Manager) will be responsible for the technical planning and implementation of the work prescribed in this plan. The QA staff has responsibility for effective planning, verification, and management of QA activities associated with the assigned project.

Mr. William Cooper is the Krazan Project Manager. Mr. Cooper will serve as the primary contact for Krazan. Mr. Cooper has the authority to commit the necessary resources of Krazan to ensure timely completion of project tasks. His responsibilities include strategy development, budget control, and document review.

Mr. Cooper, of Krazan, is the Project Geologist for the described investigation and is responsible for implementation of the described field program. Mr. Cooper will provide day-to-day management and tracking of the project schedule. Other responsibilities include coordination and preparation of the required reports, and assignment of technical responsibilities to appropriate personnel or subcontractors.

A qualified environmental geologist or scientist will be designated by Krazan as the project's Field Manager and Site Safety Officer for Krazan. This individual will be responsible for the day-to-day coordination of field activities under the direction of the Project Geologist. Other responsibilities include coordination of subcontractors and field crews to ensure that field activities conform to the specifications presented in this plan and the Health and Safety Plan.

Mr. Cooper is the Krazan QA Manager and will be responsible for the QA and QC aspects of the project. It is the responsibility of the QA Manager to ensure that all required QA/QC protocols are met in the field and laboratory. Mr. Cooper will also provide oversight of related data evaluation and validation activities.

3.4 Laboratory

The primary offsite laboratory for soil analysis for the PEA will be Sierra Analytical Laboratories in Laguna Hills, California. The primary offsite laboratory for passive soil gas analysis for the PEA will be W. L. Gore & Associates, Inc. in San Francisco, California. Equivalent laboratories may be substituted for these facilities, based on the availability and costs of the analyses. The laboratory's project manager will report to the Krazan Project Manager on aspects of the sample analysis. In addition, the Krazan QA Manager will be advised of any matters related to data quality during the course of the investigation. The respective laboratories will conform to the QA and QC procedures outlined in the respective laboratory's QA plan.

4.0 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) have been specified for each data collection activity, and the work will be conducted and documented so that the data collected are of sufficient quality for their intended use (USEPA, 1998b). DQOs specify the data type, quality, quantity, and uses needed to make decisions, and are the basis for designing data collection activities. The DQOs have been used to design the data collection activities. The DQOs for the project are discussed in the following sections.

4.1 Data Quality Objective Process

The project DQOs developed specifically for the planned sampling and analysis program have been determined using the USEPA's seven-step DQO process (USEPA, 2000). The Project Manager or Project Geologist will evaluate the project DQOs to determine if the quantitative and qualitative needs of the sampling and analysis program have been met. The project definition associated with each step of the DQO process can be summarized as follows:

State the problem: The purpose of the sampling program is to determine if the site is the source of CoCs preliminarily identified at the site related to past use history and the PEA. The site is scheduled for redevelopment. The proposed development of the site will result in construction of buildings and facilities with asphalt or concrete surfacing over portions of the site used for potential buildings, and physical education activities. Exposed soils will exist potentially in landscaped areas and athletic fields with which occupants could come into contact. A Phase I Environmental Site Assessment (Phase I ESA) was conducted on the site in 2007 and a Preliminary Conceptual Site Model was prepared by Krazan in 2008. The reports identified a past use history for underground storage tanks (USTs). Historical data collected

during the Phase I ESA indicated that HGH formerly occupied the site. The DTSC has requested investigation of potential presence of Heavy Metals, VOCs, SVOCs including PNAs, Pesticides, Dioxins and Furans, PCBs, tetraethyl lead (TEL), Chemical Warfare Agent (CWAs), Perclorate Explosives, and Asbestos. Groundwater samples may be analyzed for VOCs including BTEX; TPH carbon range (C4-C40), Heavy Metals, Pathogens, and CWAs. Soil gas samples may be analyzed for VOCs including BTEX, and Explosive Gases including Methane.

Identify the Decision: The data obtained from the sampling and testing activities will be used to evaluate the extent of hazardous substances from historical uses which have occurred at the site. The data results will be further evaluated to determine to what extent any contamination found will result in risk of exposure. The data results will be compiled and may be used in a screening risk evaluation to assess the relative threat associated with any contamination. The suitability of the property for its intended development will be decided based on the calculation of human health and ecological risks for the site.

Identify Inputs to the Decision: Inputs to the decision will include results of analytical testing of surface and subsurface soil, subsurface soil vapors, and groundwater from selected locations on the site. These samples will be tested for the specified analytes discussed in Section 2.0.

Define the Study Boundaries: The boundaries of the field sampling and analysis program will occur within the site areas.

- Agricultural Modular Living Units project area (OU1-Ag Housing);
- Allied Health & Life Science Building project area (OU2-Allied Health);
- Agricultural Multi-Purpose Pavilion Facility project area (OU3-Ag Pavilion);
- Softball Complex project area (OU4-Softball Complex);
- Agricultural Beef Unit (OU5-Beef); and
- Alternate Baseball Complex (OU6-Alternate Baseball Complex)

Develop a Decision Rule: Decisions will be based upon laboratory results for the CoCs presented in Table I, II, III and IV. If no valid detectable concentrations of CoC are reported for the given samples, then a decision will be made that the site is fully characterized with respect to the compounds tested and no further sampling will be required as part of this PEA. If CoCs are detected in the samples tested, then the data may be compiled for use in calculating the human health and ecological risk of exposure. The

results of the risk evaluation may be used to request No Further Action consent from DTSC or to support the implementation of additional investigation remediation.

Specify Limits on Decision Error: The results of all analytical testing will be subjected to data evaluation or validation specified in Section 8.3. Data are determined to be valid if the specified limits on precision, accuracy, representativeness, comparability and completeness are achieved. The results of any detected target constituents will be considered in evaluating the need for additional sampling of site soil and groundwater, and assessing the necessity for reducing any risks posed by the potential contamination.

Optimize the Design: The field sampling program has been designed to provide the type and quantity of data needed to satisfy each of the aforementioned objectives. The quality of the data will be assessed through the procedures further described in this QAPP.

4.2 Precision, Accuracy, Representativeness, Comparability and Completeness

The basis for assessing the elements of data quality is discussed in the following subsections. In the absence of laboratory-specific precision and accuracy limits, the QC limits listed in this section must be met.

4.2.1 Precision

Precision measures the reproducibility of repetitive measurements. It is strictly defined as the degree of mutual agreement among independent measurements as the result of repeated application of the sample process under similar conditions.

Analytical precision is a measurement of the variability associated with duplicate or replicate analyses of the same sample in the laboratory, and is determined by analysis of laboratory quality control samples, such as duplicate control samples (LCSD or DCS), matrix spike duplicates (MSD), or sample duplicates. If the recoveries of analytes in the specified control samples are comparable within established control limits, then precision is within limits.

Total precision is a measurement of the variability associated with the entire sampling and analytical process. It is determined by analysis of duplicate or replicate field samples, and measures variability introduced by both the laboratory and field operations. Field duplicate samples are analyzed to assess field and analytical precision.

Duplicate results are assessed using the relative percent difference (RPD) between duplicate measurements. If the RPD for laboratory quality control samples exceeds 30 percent, data will be qualified as described in the applicable validation procedure. If the RPD between primary and duplicate field samples exceeds 100 percent, data will be qualified as described in the applicable validation procedure. The RPD will be calculated as follows:

$$\%RPD = 200 \times \frac{X_1 - X_2}{X_2 + X_1}$$

Where X_1 is the larger of the two observed values and X_2 is the smaller of the two observed values.

4.2.2 Accuracy

Accuracy is a statistical measurement of correctness and includes components of random error (variability due to imprecision) and systematic error. It reflects the total error associated with a measurement. A measurement is accurate when the value reported does not differ from the true value or known concentration of the spike or standard.

Accuracy of laboratory analyses will be assessed by laboratory control samples, surrogate standards, matrix spikes, and initial and continuing calibrations of instruments. Laboratory accuracy is expressed as the percent recovery (%R). Accuracy limits are statistically generated by the laboratory or required by specified EPA methods. Current laboratory limits are provided in laboratory QA documents for laboratory control samples, surrogate recoveries, and matrix spikes. If the percent recovery is determined to be outside of acceptance criteria, data will be qualified as described in the applicable validation procedure. The calculation of percent recovery is provided below:

$$\%R = 100 \times \frac{X_s - X}{T}$$

Where X is the measured value of the spiked sample, X is the measured value of the unspiked sample, and T is the true value of the spike solution added.

Field accuracy will be assessed through the analysis of field and equipment rinsate samples. Analysis of blanks will monitor errors associated with the sampling process, field contamination, sample preservation, and sample handling. The DQO for field accuracy, analyzed as necessary, is that all values are less than

the reporting limit for each target constituent. If contamination is reported in the field equipment blanks, data will be qualified as described in the applicable validation procedure.

4.2.3 Representativeness

Representativeness is the degree to which data accurately and precisely represent selected characteristics of the media sampled. Representativeness of data collection is addressed by careful preparation of sampling and analysis programs. This QAPP addresses representativeness by specifying sufficient and proper numbers and locations of samples; incorporating appropriate sampling methodologies; specifying proper sample collection techniques and decontamination procedures; selecting appropriate laboratory methods to prepare and analyze soil; and establishing proper field and laboratory QA/QC procedures.

4.2.4 Completeness

Completeness is the amount of valid data obtained compared to the amount that was expected under ideal conditions. The number of valid results divided by the number of possible results, expressed as a percentage, determines the completeness of the data set. The objective for completeness is to recover at least 90 percent of the planned data to support field efforts. Specifically for background samples, no less than 100 percent completeness of the planned data set will be acceptable. The formula for calculation of completeness is presented, as follows:

$$\% \text{ Completeness } 100 \times \frac{\text{number of valid results}}{\text{number of expected results}}$$

4.2.5 Comparability

Comparability is an expression of confidence with which one data set can be compared to another. The objective of comparability is to ensure that data developed during the investigation are comparable to site knowledge and adequately address applicable criteria or standards established by the USEPA and DHS. This QAPP addresses comparability by specifying laboratory methods that are consistent with the current standards of practice as approved by the USEPA and DHS.

5.0 QUALITY CONTROL ELEMENTS

This section presents QC requirements relevant to analysis of environmental samples that will be followed during all project analytical activities. The purpose of the QC program is to produce data of

known quality that satisfy the project objectives and that meet or exceed the requirements of the standard methods of analysis. This program provides a mechanism for ongoing control and evaluation of data quality measurements through the use of QC materials.

5.1 Quality Control Procedures

The chemical data to be collected for this effort will be used to determine that the extent of contamination is properly evaluated. As such, it is critical that the chemical data be of the highest confidence and quality. Consequently, strict QA/QC procedures will be adhered to. These procedures include:

- Adherence to strict protocols for field sampling and decontamination procedures;
- Collection and laboratory analysis of appropriate field equipment blanks to monitor for contamination of samples in the field or the laboratory;
- Collection and laboratory analysis of matrix spike, matrix spike duplicate, and blind split samples to evaluate analytical precision and accuracy
- Attainment of completeness goals.

5.1.1 Equipment Decontamination

Non-dedicated equipment will be decontaminated before and after each sample is collected. The equipment will be washed in a non-phosphate detergent such as LiquinoxTM and potable water, rinsed in potable water, and then double rinsed in deionized water. A description of the specific methodologies to be followed to maximize proper decontamination of non-dedicated sampling equipment is provided in Krazan procedures.

5.1.2 Standards

Standards used for calibration or to prepare samples will be certified by the National Institute of Standards and Technology (NIST), USEPA, or other equivalent source. The standards will be current. The expiration date will be established by the manufacturer, or based on chemical stability, the possibility of contamination, and environmental and storage conditions. Standards will be labeled with expiration dates, and will reference primary standard sources if applicable. Expired standards will be discarded.

5.1.3 Supplies

All supplies will be inspected prior to their use in the field or laboratory. The descriptions for sample collection and analysis contained in the methods will be used as a guideline for establishing the acceptance criteria for supplies. A current inventory and appropriate storage system for these materials

will assure their integrity prior to use. Efficiency and purity of supplies will be monitored through the use of standards and blank samples.

5.1.4 Holding Time Compliance

Sample preparation and analysis will be completed within the required method holding time. Holding time begins at the time of sample collection. If holding times are exceeded, and the analyses are performed, the associated results will be qualified as described in the applicable validation procedure. The following definitions of extraction and analysis compliance are used to assess holding times:

- Preparation or extraction completion - completion of the sample preparation process as described in the applicable method, prior to any necessary extract cleanup.
- Analysis completion - completion of all analytical runs, including dilutions, second- column confirmations, and any required re-analyses.

5.1.5 Preventive Maintenance

The Field Manager for Krazan is responsible for documenting the maintenance of all field equipment as prescribed in the manufacturer's specifications. Scheduled maintenance will be performed by trained personnel. The analytical laboratory is responsible for all analytical equipment calibration and maintenance as described in their laboratory QA plan. Subcontractors are responsible for maintenance of all equipment needed to carry out subcontracted duties.

5.2 Quality Assurance and Quality Control (QA/QC) Samples

The purpose of this QA/QC program is to produce data of known quality that satisfy the project objectives and that meet or exceed the requirements of the standard methods of analysis. This program provides a mechanism for ongoing control and evaluation of data quality measurements through the use of QC materials. Quality assurance and quality control samples will be collected as part of the overall QA/QC program.

5.2.1 Laboratory Reagent Blanks

A laboratory reagent blank is deionized, distilled water that is extracted by the laboratory and analyzed as a sample. Analysis of the reagent blank indicates potential sources of contamination from laboratory procedures (e.g., contaminated reagents, improperly cleaned laboratory equipment, or persistent contamination due to presence of certain compounds in the ambient laboratory air). A reagent blank will be analyzed at least once each day for each method utilized by the laboratory for that day.

5.2.2 Field Equipment Rinsate Blanks

A field equipment rinsate blank is a sample that is prepared in the field by pouring deionized, distilled water into cleaned sampling equipment. The water is then collected and analyzed as a sample. Field equipment rinsate blanks are typically blind (given a fictitious name so that the laboratory will not recognize it as a blank). The field equipment blank gives an indication of contamination from field procedures (e.g., improperly cleaned sampling equipment, cross- contamination). Field equipment blanks will be collected at a minimum frequency of one per day when non-dedicated equipment is utilized. The field equipment blanks and associated primary sample should be analyzed using the same methods.

5.2.3 Trip Blanks

The primary purpose of trip blanks is to detect potential additional sources of contamination that could potentially influence contaminant values reported in field samples for volatile compounds, both quantitatively and qualitatively. Trip blanks serve as a mechanism of control for sample bottle preparation, blank water quality and sample handling. They are generally submitted to the laboratory for analysis of VOCs and/or purgeable petroleum hydrocarbons in soil and groundwater.

5.2.4 Matrix Spike Samples

Matrix spikes are performed by the analytical laboratory to evaluate the efficiency of the sample extraction and analysis procedures. They are necessary because matrix interference (that is, interference from the sample matrix, water or soil) may have a widely varying impact on the accuracy and precision of the extraction analysis. The matrix spike is prepared by the addition of known quantities of target compounds to a sample. The sample is extracted and analyzed. The results of the analysis are compared with the known additions and a matrix spike recovery is calculated giving an evaluation of the accuracy of the extraction and analysis procedures. Matrix spike recoveries are reviewed to check that they are within acceptable range. However, the acceptable ranges vary widely with both sample matrix and analytical method. Matrix spikes and matrix spike duplicates will be analyzed by the laboratory at a frequency of at least one per twenty, or 5 percent of the primary field samples. Typically, matrix spikes are performed in duplicate in order to evaluate the precision of the procedures as well as the accuracy. Precision objectives (represented by agreement between matrix spike and matrix spike duplicate recoveries) and accuracy objectives (represented by matrix spike recovery results) are based on statistically generated limits established annually by the analytical laboratory. It is important to note that these objectives are to be viewed as goals, not as criteria. If matrix bias is suspected, the associated data will be qualified and the direction of the bias indicated in the PEA report.

5.2.5 Field Duplicate Samples

Field duplicate samples will be collected and analyzed to evaluate sampling and analytical precision. Field duplicates are collected and analyzed in the same manner as the primary samples. Agreement between duplicate sample results will indicate good sampling and analytical precision. Specific locations will be designated for collection of field duplicates prior to the start of field activities. Field duplicates will be collected at a frequency of 10 percent of the primary samples collected. The duplicate sample will be analyzed for all laboratory analyses requested for the primary sample collected. The precision goal for field duplicate analyses will be plus or minus 50 percent RPD for aqueous samples and plus or minus 100 percent RPD for soil and soil gas samples.

5.2.6 Performance Evaluation Samples

Double blind performance evaluation (PE) samples may be submitted to the analytical laboratory during any site investigation. These samples may be of water or soil matrix, and are used to assess the accuracy of analytical procedures employed for a given sample set. PE samples may be used if questionable data quality is suspected as determined during laboratory audits or data validation.

If used, double blind PE samples will be prepared by Environmental Resources Standards, or similar supplier, in similar sample containers as the project field samples and shipped from the field to the laboratory for analysis.

Double blind PE samples will be prepared using NIST and/or A2LA certified standards. The project-specific PE samples will contain known concentrations of the analytes of interest. Laboratory results will be evaluated against the original certificates of analyses for precision and accuracy. PE samples may be submitted for analysis as part of the laboratory pre-qualification process, or as part of a given sampling event. Results will be reported to the laboratory and presented with associated field sample results.

6.0 SAMPLING PROCEDURES

The defensibility of data is dependent on the use of well defined, accepted sampling procedures. This section describes the sampling and handling procedures that will be followed for each sampling event.

6.1 Field Procedures

Collection of environmental samples of high integrity is important to the quality of chemical data to be generated. To this end, strict field procedures have been developed as general descriptions of field

methods that will be employed during the field investigation. These methods are contained in Krazan corporate-approved procedures.

6.2 Sample Containers, Preservation, and Holding Times

Sample containers provided by the laboratory will be purchased commercially from 1-Chem, Eagle Pitcher, or other equivalent source. Samples will be analyzed within the maximum holding time.

6.3 Sample Handling and Storage

In the field, each sample container will be marked with the sample identification number, requested analyses and methods, and date and time of sample collection. All sample containers for soil and water will be wiped with paper towels and securely packed, in a cooler on ice, in preparation for delivery to the laboratory. All soil gas containers will be transported by hand immediately to the onsite laboratory for analysis.

Upon receipt of the samples, the laboratory will immediately notify the Field Manager if conditions or problems are identified which require immediate resolution. Such conditions include container breakage, missing or improper chain-of-custody, exceeded holding times, missing or illegible sample labeling, or temperature excursions.

6.4 Sample Custody

For each sample that is submitted to the laboratory for analysis, an entry will be made on a chain-of-custody form from either Krazan or supplied by the laboratory. The information to be recorded includes the sampling date and time, sample identification number, matrix type, requested analyses and methods, preservatives, and the sampler's name. Sampling team members will maintain custody of the samples until they are relinquished to laboratory personnel or a professional courier service. The chain-of-custody form will accompany the samples from the time of collection until received by the laboratory. Each party in possession of the samples (except the professional courier service) will sign the chain-of-custody form signifying receipt.

The chain-of-custody form will be placed in a plastic bag and shipped with samples inside the cooler. After the samples, ice, and chain-of-custody forms are packed in the coolers. The cooler will be appropriately sealed before it is relinquished to the courier. A copy of the original completed form will be provided by the laboratory along with the report of results. Upon receipt, the laboratory will inspect the condition of the sample containers and report the information on chain-of-custody or similar form.

7.0 ANALYTICAL PROCEDURES

The analytical methods used for this project are USEPA-approved methods and are listed in Table 1. Specific analytical method procedures are detailed in the laboratory QA Plan and standard operating procedures of the selected laboratory. These documents may be reviewed by Krazan quality assurance staff during laboratory audits to ensure that project specifications are met. Laboratory audits are discussed in Section 9.2.

7.1 Internal Standards

Internal standards are measured amounts of method-specified compounds added after preparation, or extraction, of a sample. Internal standards are added to samples, controls, and blanks in accordance with method requirements to identify column injection losses, purging losses, or viscosity effects.

Acceptance limits for internal standard recoveries are set forth in the applicable method. If the internal standard recovery falls outside of acceptance criteria, the instrument will be checked for malfunction, and reanalysis of the sample will be performed after any problems are resolved.

7.2 Retention Time Windows

Retention time windows will be established as described in SW-846 Method 8000A and other applicable sources for applicable analyses of organic compounds. Retention time windows are used for qualitative identification of analytes and are calculated based on multiple, replicated analyses of a respective standard.

Retention times will be checked on a daily basis. Acceptance criteria for retention time windows are established in the referenced method. If the retention time falls outside the respective window, actions will be taken to correct the problem. The instrument must be re-calibrated after any retention time window failure and the affected samples must be reanalyzed.

7.3 Method Detection Limits

The method detection limit (MDL) is the minimum concentration of an analyte, or compound, that can be measured and reported with 99 percent confidence that the concentration is greater than zero. MDLs are established for each method, matrix, and analyte, and for each instrument used to analyze project samples. MDLs are derived using the procedures described in 4OCFR 136 Appendix B (USEPA, 1990a). USEPA requires that MDLs be established on an annual basis. MDLs must be less than applicable PRG or other limits for each target analyte.

7.4 Instrument Calibration

Analytical instruments will be calibrated in accordance with the procedures specified in the applicable method. All analytes that are reported shall be present in the initial and continuing calibrations, and these calibrations must meet the acceptance criteria specified in the reference method. Records of standard preparation and instrument calibration will be maintained. Records shall unambiguously trace the preparation of standards and their use in calibration and quantification of sample results. Calibration records will be traceable to standard materials as described in Section 5.1.2.

At the onset of analysis, instrument calibrations will be checked using all of the analytes of interest. This applies equally to multi-response analytes. At a minimum, calibration criteria will satisfy method requirements. Analyte concentrations can be determined with either calibration curves or response factors, as defined in the method. Guidance provided in SW-846 should be considered to determine appropriate evaluation procedures.

8.0 DATA REPORTING

This section presents reporting requirements relevant to the data produced during all project analytical activities.

8.1 Field Data

Data measured by field instruments will be recorded in field notebooks, laptops, and/or on required field forms. Units of measure for field analyses are identified on the field forms. The field data will be reviewed by the Project Geologist or Field Manager to evaluate completeness of the field records and appropriateness of the field methods employed. All field records will be retained in the project files.

8.2 Laboratory Data

Analytical data will contain the necessary sample results and quality control data to evaluate the data quality objectives defined for the project. Documentation requirements for laboratory data are defined in USEPA Region 9 Laboratory Documentation Requirements for Data Validation (USEPA, 1997). The laboratory reports will he consistent with USEPA Level IV documentation, will be retained in the laboratory files, and include the following data and summary forms:

- Narrative, cross-reference, chain of custody, and method references*
- Analytical results*

- Surrogate recoveries (as applicable)*
- Calibration summary
- Blank results *Laboratory control sample recoveries*
- Duplicate sample results or duplicate spike recoveries*
- Sample spike recoveries*
- Instrument tuning summary
- Associated raw data
- Magnetic tape or equivalent.
- Information indicated by an "*"above will be transmitted in the initial summary analytical report. The remaining information must be provided upon request.
- The laboratory data will be reviewed for compliance with the applicable method and the quality of the data reported. The following summarizes the areas of data evaluation.
- Data Completeness
- Holding Times
- Blanks
- Laboratory Control Samples
- Matrix Spike/Matrix Spike Duplicates
- Surrogates/Internal Standards (as applicable);
- Field Quality Control Samples
- Compound Identification and Quantification.

Should data evaluation indicate that analytical data quality might be inadequate, data validation may be initiated by the QA/QC or project manager. Data validation criteria are derived from the USEPA Contract Laboratory Program National Functional Guidelines for Organic and Inorganic Data Review (USEPA, 1999 and 2002, respectively). The Functional Guidelines provide specific data validation criteria that can be applied to data generated for this investigation.

The application of data evaluation/validation criteria is a function of project-specific DQOs. The QA/QC Manager will determine if the data quality objectives for the analytical data have been met. Results of the data validation review will be documented and summarized in the PEA report.

8.3 Data Qualifiers

The data evaluation and validation procedures were designed to review each data set and identify biases inherent to the data and determine its usefulness. Data validation flags are applied to those sample results that fall outside of specified tolerance limits and, therefore, did not meet the program's quality assurance objectives described in Section 4.2. Data validation flags to be used for this project are defined in the National Functional Guidelines. Data validation flags will indicate if results are considered anomalous, estimated, or rejected. Only rejected data are considered unusable for decision-making purposes; however, other qualified data may require further verification.

9.0 PERFORMANCE AND SYSTEM AUDITS

Audit programs are established and directed by the Krazan quality assurance staff to ensure that field and laboratory activities are performed in compliance with project controlling documents. This section describes responsibilities, requirements, and methods for scheduling, conducting and documenting audits of field and laboratory activities.

9.1 Field Audits

Field audits focus on appropriateness of personnel assignments and expertise, availability of field equipment, adherence to project controlling documents for sample collection and identification, sample handling and transport, use of QA samples, chain-of-custody procedures, equipment decontamination, and documentation. Field audits are not required, but may be performed in the event significant discrepancies are identified that warrant evaluation of field practices.

9.2 Laboratory Audits

Laboratory audits include reviews of sample handling procedures, internal sample tracking, standard operating procedures, analytical data documentation, QA/QC protocols, and data reporting. Any selected laboratory will be licensed by the State of California as a certified testing laboratory, and will participate in the WP/WS Performance Program for hazardous waste, wastewater, and drinking water analyses. If no previous audit has been conducted by Krazan, a scheduled audit will be conducted by the quality assurance staff during the course of this project to ensure the integrity of sample handling and processing by the laboratory.

9.3 Data Audits

Data audits will be performed on analytical results received from the laboratories. These audits will be accomplished through the process of data validation as described in Section 8.3, or may involve a more detailed review of laboratory analytical results. Data audits require the laboratory to submit complete raw data files to Krazan for validation. Krazan personnel will perform a review of the data consistent with the level of effort described in the National Functional Guidelines. This level of validation consists of a detailed review of sample data, including verification of data calculations for calibration and quality control samples to assess if these data are consistent with method requirements. Upon request, the laboratory will make available all supporting documentation in a timely fashion.

9.4 Scheduling

Audits will be scheduled such that field and laboratory activities are adequately monitored, or in the event discrepancies are identified. The overall frequency of audits conducted for these activities will be based on the importance and duration of work, as well as significant changes in project scope or personnel.

9.5 Reports to Management and Responsibilities

Upon completion of any audit, the auditor will submit to the Project Geologist and Field Manager a report or memorandum describing any problems or deficiencies identified during the audit. It is the responsibility of the Project Geologist and Director to determine if the deviations will result in any adverse effect on the project conclusions. If it is determined that corrective action is necessary, procedures outlined in Section 9.6 will be followed.

9.6 Corrective Action

Corrective actions will be initiated whenever data quality indicators suggest that DQOs have not been met. Corrective actions will begin with identifying the source of the problem. Potential problem sources include failure to adhere to method procedures, improper data reduction, equipment malfunctions, or systemic contamination. The first level of responsibility for identifying the problems and initiating corrective action lies with the analyst/field personnel. The second level of responsibility lies with any person reviewing the data. Corrective actions may include more intensive staff training, equipment repair followed by a more intensive preventive maintenance program, or removal of the source of systemic contamination. Once resolved, the corrective action procedure will be fully documented, and if DQOs were not met, the samples in question must be recollected and/or reanalyzed utilizing a properly functioning system.

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