

# **QUALITY ASSURANCE PROJECT PLAN FOR BROWNFIELDS ASSESSMENTS**

**Prepared by the  
Missouri Department of Natural Resources  
Division of Environmental Quality  
Hazardous Waste Program  
Brownfields/Voluntary Cleanup Section**

Missouri Department of Natural Resources  
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**A. PROJECT MANAGEMENT ELEMENTS**

**A.1 TITLE AND APPROVAL SHEET**

Brownfield Assessment Quality Assurance Project Plan  
Missouri Department of Natural Resources  
Division of Environmental Quality

Site Name: \_\_\_\_\_

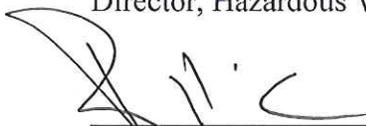
**DEPARTMENT APPROVALS**

  
\_\_\_\_\_  
Division Quality Assurance Manager

September 25, 2013  
\_\_\_\_\_  
Date

  
\_\_\_\_\_  
Director, Hazardous Waste Program (HWP)

9-23-2013  
\_\_\_\_\_  
Date

  
\_\_\_\_\_  
BVCP BA Quality Assurance Project Officer (HWP)

9/17/13  
\_\_\_\_\_  
Date

**STATEWIDE CONTRACTOR APPROVALS**

\_\_\_\_\_  
Director, Statewide Contractor

\_\_\_\_\_  
Date

\_\_\_\_\_  
Project Manager, Statewide Contractor

\_\_\_\_\_  
Date

\_\_\_\_\_  
Project Field Superintendent, Statewide Contractor

\_\_\_\_\_  
Date

\_\_\_\_\_  
QA/QC Manager, Contractor

\_\_\_\_\_  
Date

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### **A.3 DISTRIBUTION LIST**

#### Missouri Department of Natural Resources (MDNR)

Keith Bertels – Quality Assurance Manager, Division of Environmental Quality (DEQ)

#### Hazardous Waste Program (HWP)

David Lamb – Director

Jim Belcher –Brownfields/Voluntary Cleanup Program (BVCP) Section Chief

Scott Huckstep – BVCP Unit Chief

Brian McCurren – BVCP Brownfields Assessment (BA) Quality Assurance Project Officer

Desiree Pigford – BVCP Planner

Project Managers – BVCP

#### Statewide Contractor (contractor)

Director

Project Manager

Project Field Superintendent

Contractor/Consultant/Laboratory – Quality Assurance Project Plan Coordinator

### **A.4 PROJECT/TASK ORGANIZATION**

The following list identifies key individuals and organizations participating in this project, and discusses their specific roles and responsibilities as they pertain to this Quality Assurance Project Plan (QAPP).

#### Brian McCurren – BVCP BA Quality Assurance Project Officer

Responsibilities: Overall management and coordination of site-specific activities as they relate to this QAPP, including correspondence, communication and scheduling. Review plans, reports, and data to ensure that site-specific activities conducted pursuant to this QAPP meet project specific Data Quality Objectives (DQO).

#### Project Managers - BVCP

Responsibilities: Management and coordination of site-specific activities as they relate to this QAPP, including correspondence, communication and scheduling. Review plans, reports, and data to ensure that site-specific activities conducted pursuant to this QAPP meet project specific Data Quality Objectives (DQO).

#### Keith Bertels – Quality Assurance Manager, DEQ

Responsibilities: Monitors the overall Quality Assurance (QA) operations for the division. Develops and maintains the Quality Management Plan (QMP). Reviews and approves all QAPPs for the division.

#### Project Manager – Contractor

Responsibilities: Supervise and schedule field staff conducting sample collection and site assessment activities. Assures that staff are qualified and trained to

perform the work, familiar with the required Standard Operating Procedures (SOP), including those related to Quality Assurance/Quality Control (QA/QC), and have the equipment necessary to perform the work. Reviews reports generated by staff for completeness, clarity and accuracy. Prepare formal reports for Brownfields/Voluntary Cleanup Program (BVCP) staff review and approval.

Project Field Superintendent - Contractor

Responsibilities: Prepare and/or implement site-specific sampling plans to collect environmental samples according to contractor SOPs at potential and/or confirmed hazardous substance sites. Conduct sample collection by appropriate methods to provide data of sufficient quality and quantity to meet projects' DQOs. Prepare and implement health and safety plans for investigations conducted by the contractor at potential and/or confirmed hazardous substance sites. May prepare formal reports of sampling investigations for BVCP staff to evaluate and include in Brownfield Assessment reports.

QA/QC Manager - Contractor

Responsibilities: Reviews site-specific QAPPs and other documents as needed to ensure quality data. Performs field audits of contractor staff who conduct sampling activities in order to verify that staff are following the contractor SOPs for environmental data collection. Prepares audit reports summarizing procedures used and makes recommendations for improvement, if necessary.

Contractor/Consultant/Laboratory – Quality Assurance Project Plan Coordinator

Responsibilities: Ensures that appropriate analytical methods, Laboratory SOPs, QA/QC procedures, documentation, and training are implemented and routinely followed by all supervisory and technical staff of the contractor. Utilizes data review checklists and QC charts for both precision and accuracy data in the data quality review process. Conducts reviews of data files following review and approval by Laboratory supervisory staff.

Director - Contractor

Responsibilities: Ensures overall validation and final approval of data generated by the contractor. Assists as appropriate in the performance auditing of all activities performed by contractor personnel.

## **A.5 PROBLEM DEFINITION/BACKGROUND**

The Small Business Liability Relief and Brownfields Revitalization Act was signed into law on January 11, 2002. The Act amends several sections of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Title II of the Act amends sections 101, 104, 107 and added Section 128. These amendments provide an updated definition of "brownfield", establish several funding programs for assessment and cleanup of brownfield properties, clarify liability protection for innocent landowners, contiguous property owners, and prospective purchasers of brownfield properties, and establish State Response Programs.

Section 128(a) of the Act authorizes a grant program awarded and administered by the United States Environmental Protection Agency (EPA) to establish and enhance state response programs that address the assessment, cleanup and redevelopment of brownfields sites and other contaminated sites as defined by the law. The Missouri Department of Natural Resources has Memoranda of Agreement with EPA and is automatically eligible for state and tribal funding under Section 128(a).

The Title II amendments clarify that in order to qualify for liability protection under CERCLA, prospective purchasers must perform “all appropriate inquiry” into the history of a property. As of November 1, 2006, parties must comply with the requirements of the All Appropriate Inquiries Final Rule (40 CFR Part 312), or follow the standards set forth in the ASTM E1527-05 Phase I Environmental Site Assessment Process, to satisfy the statutory requirements for conducting all appropriate inquiries. All appropriate inquiries must be conducted in compliance with either of these standards to obtain protection from potential liability under CERCLA as an innocent landowner, a contiguous property owner, or a bona fide prospective purchaser.

Missouri’s state response program, the Brownfields/Voluntary Cleanup Program, is administered by the Department of Natural Resources Hazardous Waste Program’s Brownfields/Voluntary Cleanup Section (BVCP). The BVCP provides voluntary parties with technical assistance and oversight for the investigation and cleanup of properties contaminated with hazardous substances. The goals of the BVCP are to clean up contaminated properties and bring them back into productive use.

Grant funding will be used to cover the costs of a variety of activities at or in direct support of brownfields sites, which are defined under CERCLA 101(39) as real properties the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. One of the activities that grant funding will be used for is to perform Brownfield Assessments (BA). The purpose of a BA is to minimize uncertainties surrounding actual or perceived contamination associated with these properties. In order to achieve this goal, the BA should identify whether petroleum products or hazardous substances have been or could be released on or off site, identify contaminated media, and quantify contaminant concentrations. The BA may also identify human or environmental populations that may be at risk from said releases. The BA may encompass one or both of the following activities:

- A Phase I Environmental Site Assessment (Phase I ESA), including a background and historical investigation of the property as well as a preliminary site inspection;
- A Phase II Environmental Site Assessment (Phase II ESA), including on-site sampling activities to identify the types and concentrations of contaminants.

The BVCP will utilize the services of the consultant/contractor to plan for, conduct, and report on environmental assessments of sites selected by the BVCP for BAs. The Missouri Department of Natural Resources operates under its Quality Management Plan (QMP) when collecting or overseeing the collection of environmental sampling data.

This plan requires that any subgrantees, contractors, or, in some cases, the regulated community, who generate environmental data develop QAPPs or other appropriate quality management tools to provide a clear, concise, and complete plan for the generation of such data, including the identification of data quality objectives and how they will be met. The QMP covers all intramural and extramural monitoring and measurement activities, including BA activities, that generate and process environmental data for use by the department.

This QAPP is generic in that it applies to several site-specific projects. It is ongoing in that projects are conducted continuously. A site-specific work plan detailing site activities will be submitted to the BVCP Project Officer for approval prior to any work conducted. Any deviations from or supplemental activity to the generic QAPP will be documented in a Site-Specific Quality Assurance Project Plan Addendum (SSQA).

## **A.6 PROJECT/TASK DESCRIPTION**

When a site or property has been selected by the BVCP for a BA, the BVCP will select a consultant/contractor based on proposals submitted. The BVCP Project Manager will send a request letter to the selected contractor's Director. The contractor will provide the environmental assessments singly or consecutively as Phase I and/or Phase II ESAs, as specified by BVCP and pursuant to the stated contract specifications. The contractor will conduct environmental assessments which meet or exceed the standards set by the latest edition of ASTM International's "Standard Practice for Environmental Site Assessment: Phase I Environmental Site Assessment Process" and "Standard Guide for Environmental Site Assessments: Phase II Environmental Site Assessment Process." Assessments must also comply with the requirements of the All Appropriate Inquiries Final Rule (40 CFR Part 312), or follow the standards set forth in the ASTM E1527-05 Phase I Environmental Site Assessment Process.

### **A.6.1 Work Plans**

The contractor will submit the written work plan to BVCP at least two (2), but no more than four (4), calendar weeks after BVCP initially requests the plan. The BVCP will evaluate and, if acceptable, approve the written work plan(s) prepared by the contractor for the environmental assessment of the specified property. If the work plan is acceptable, within two calendar weeks of receipt BVCP will provide written authorization to the contractor to proceed with the approved written work plan. BVCP will have the final approval of all individual components of the written work plans revised as specified herein and reserves the right to require modifications, deletions, and or additional elaboration to the written work plans and site assessment reports as BVCP deems necessary.

#### **A.6.1.1 Phase I Environmental Assessment Work Plan**

If a Phase I ESA is requested by BVCP, the contractor will conduct a Phase I ESA to evaluate historical sources of information about the property to determine the likelihood that petroleum products or other hazardous substances have been released on or near the property. The contractor will conduct a visual inspection of the property, including

building interiors, if applicable. To the extent possible through non-sampling means, the contractor will identify the information listed below as part of each Phase I ESA.

- A.6.1.1.a Property site location
- A.6.1.1.b Property site features/current property site condition and use
- A.6.1.1.c History of ownership (title search)
- A.6.1.1.d History of operations (city business directories, etc)
- A.6.1.1.e Past and present on-site activities (manufacturing processes, types, compositions, and volumes of waste streams)
- A.6.1.1.f SARA Title III data
- A.6.1.1.g Toxic release inventory data
- A.6.1.1.h State and federal permit history
- A.6.1.1.i Storage facilities, including underground storage tanks
- A.6.1.1.j Dumps or landfills
- A.6.1.1.k Spills or incidents reported
- A.6.1.1.l Cleanups
- A.6.1.1.m Enforcement actions
- A.6.1.1.n Proximity to human and environmental populations
- A.6.1.1.o Off-site contamination and off-site contamination potential
- A.6.1.1.p Limited visual lead-based paint and asbestos inspection
- A.6.1.1.q Proximity to public and/or private groundwater wells and other environmentally sensitive receptors

#### **A.6.1.2 Phase II Environmental Assessment Work Plan**

If a Phase II ESA is requested by BVCP, the contractor will conduct a Phase II ESA to further evaluate the property and to sample the potential sources of contamination identified in the Phase I ESA. The work plan should include a sampling and analysis plan, a field sampling plan, a health and safety plan, a signature page, and reference to this generic QAPP. A SSQA should also be included, if applicable. The work plan will provide general site information, describe the number, type, and location of samples to be collected (included on a site sketch) as well as analytical parameters and methods for each sample.

The work plan prepared by the contractor will include a brief description of all potential environmental concerns, including contamination by hazardous substances, accompanied by a site sketch that illustrates: proposed sampling locations, contaminant sources, migration pathways (e.g., wind, groundwater, sediments, surface water), exposure routes (e.g., ingestion, inhalation, direct contact), and human and ecological receptors.

In conducting a Phase II ESA, the contractor may measure groundwater flow direction. The contractor will sample any of, but not limited to, the following materials, potential sources, environmental media, and receptor populations:

- A.6.1.2.a Hazardous substances stored on site (including above and below ground tanks and conduits)
- A.6.1.2.b Buried drums and other containers
- A.6.1.2.c Debris and building materials
- A.6.1.2.d Spilled materials and residues
- A.6.1.2.e Soils and sediments
- A.6.1.2.f Surface waters
- A.6.1.2.g Groundwater
- A.6.1.2.h Soil gas
- A.6.1.2.i Building and equipment surfaces (wipe samples)

### **A.6.1.3 Modifications to the Work Plan**

Modifications to the written work plan will be permitted under the following conditions:

#### **A.6.1.3.a BVCP requested changes**

If BVCP determines that modifications to the written work plan are necessary or desired, BVCP will document the requested changes to the contractor in writing, including any new instructions for the environmental assessment. Such changes may include additional sampling at the site, changes to the required completion date, or any other change to the original information and instructions. Based on the written instructions provided by BVCP, the contractor will revise the written work plan according to the requirements for the written work plan. The contractor must submit the requested changes to BVCP within 2 weeks, or the timeframe outlined in the written instructions.

#### **A.6.1.3.b Contractor requested changes**

If, after implementation of services, the contractor determines that modifications to the written work plan are necessary, including a request for an extension to the required date of completion, the contractor will submit a written request for such changes to BVCP. The written request will include the reason for the modification and will detail the contractor's proposed changes to the written work plan. BVCP will review the contractor's written request and send written notice of approval or disapproval of the request to the contractor within 5 calendar days of receipt of the contractor's written request. Contractors may not implement changes in the work plan without prior, written approval from BVCP. Any changes which would affect the cost must be approved by the BVCP Planner or Section Chief.

#### **A.6.1.3.c Field Deviations from the Work Plan**

Changes in site conditions between the time of the site reconnaissance and the on-site sampling visit as well as subsurface conditions found at the time of sampling may cause the number of samples actually collected to vary from the number proposed in the work plan. Such deviations or changes to the work plan while in the field will be made and approved by the BVCP Project Officer who approved the work plan. Any changes which would affect the cost must be approved by the BVCP Planner or Section Chief. The deviations or changes will be documented in the final report prepared by the contractor and submitted to the BVCP.

#### **A.6.1.4 Specific Requirements of Work Plan Execution**

##### **A.6.1.4.a Initiation of Assessment Work**

If the contractor receives written notification to proceed from BVCP, the contractor will perform an environmental assessment in accordance with the approved written work plan. The contractor must begin each environmental assessment no later than 10 calendar days after receipt of written notification to proceed from the BVCP. However, in the event that both a Phase I and a Phase II ESA are required for a property, one of the following will apply, as specified by BVCP at the time of the initial notification to proceed:

- The contractor will not proceed with the Phase II environmental assessment, until (1) the Phase I ESA has been completed by the contractor and approved by BVCP, and (2) the contractor has received the BVCP's written notice to proceed with the Phase II ESA; or
- When BVCP determines that its purposes would be best addressed through expedited environmental assessments, BVCP will direct the contractor to proceed with both the Phase I and Phase II ESAs, without waiting for a notice to proceed with the Phase II.

##### **A.6.1.4.b Contractor and BVCP Responsibilities**

The contractor will provide all services for the completion of environmental assessments, as appropriate for the site and approved by BVCP, including, but not limited to, records and title searches, site reconnaissance, interviews, subsurface exploration, sample collection, and chemical testing, and will submit to BVCP any statement of outstanding issues regarding the specific

environmental assessment, as well as the written report of the results as required herein.

The contractor will ensure and provide for the protection of the personal safety and health of all of its on-site workers, including any required medical monitoring and the selection, provision, testing, decontamination, and disposal of all Personal Protective Equipment (PPE). The contractor will comply with all applicable worker safety and health laws and regulations. At all times during performance of services, the contractor will exercise reasonable professional judgement regarding safety and will use professional judgement to make decisions regarding cessation of services for safety reasons.

The BVCP Project Officer will coordinate public contacts. The contractor will coordinate field activity scheduling, utility clearance and site access.

#### **A.6.1.4.c Sampling**

Generally, the scope of each Phase II ESA sampling event will include multiple soil borings, and certain soil borings will be converted to temporary wells for the collection and analysis of groundwater, if present, and determination of the direction of groundwater flow.

The contractor should identify the need to perform limited excavation at sites to obtain samples of buried material or to document other subsurface conditions. The contractor will manage the procurement, selection, and oversight of contractual services for excavation work.

When sampling is conducted, contractor personnel will collect the samples according to applicable Standard Operating Procedures (SOP) for sampling, which will be specified in the site-specific work plan and/or SSQA.

Samples collected for projects under this QAPP will be submitted to the contractor's laboratory for analysis. The contractor will conduct sample analysis using standard EPA testing methods. The analytical parameters will vary by project. On-site field screening analyses may be conducted by the contractor when a variety of unknown materials or media are present on-site, or when field screening analyses could result in significant economies in laboratory analytical work.

#### **A.6.1.5 Reporting**

The contractor will prepare and submit a full-color, complete written report of the results of the Phase I and/or Phase II ESA to BVCP. The contractor will complete each environmental assessment in accordance with the approved project schedule. The environmental assessment will not be considered complete until the written report is submitted to and received by BVCP. The written report must, at a minimum, contain the following information and results of the environmental assessment:

- A.6.1.5.a** Property(s) assessed
- A.6.1.5.b** Maps and photographs of site(s)
- A.6.1.5.c** Site History (current and past owners and operators and property use)
- A.6.1.5.d** Overview of investigation
- A.6.1.5.e** General Site Features (including topography and hydrogeology)
- A.6.1.5.f** Hazardous substances and hazardous wastes present (descriptions, contaminants, quantities, locations)
- A.6.1.5.g** Receptor populations, both human and environmental (descriptions, numbers, locations)
- A.6.1.5.h** Soil investigations
- A.6.1.5.i** Surface water investigations
- A.6.1.5.j** Groundwater investigations
- A.6.1.5.k** Air investigations
- A.6.1.5.l** Sampling methods, field logs, chain of custody, analytical data, and QA/QC documentation for field and laboratory (if Phase II environmental assessment was performed)
- A.6.1.5.m** Map depicting sample locations (drawn to scale) and contaminant concentrations at each location
- A.6.1.5.n** Sampling data summary table including appropriate target levels for comparison
- A.6.1.5.o** Other information as may be requested by BVCP
- A.6.1.5.p** Identity and quantity of investigation derived wastes as well as documentation of the disposal of any waste or hazardous substances generated during the assessment.
- A.6.1.5.q** Summary and Conclusions. May include recommendations for proper handling of the various contaminants, materials, and conditions discovered that represent an imminent threat or hazard.

#### **A.7 DATA QUALITY OBJECTIVES AND CRITERIA**

Data Quality Objectives (DQOs) are qualitative and quantitative statements derived from the Systematic Planning and DQO processes developed by EPA and further described in *Guidance for the Data Quality Objectives Process* (U.S. EPA, 2006), *Data Quality Objectives Process for Hazardous Waste Investigations* (U.S. EPA, 2006a), and

*Guidance on Systematic Planning Using the Data Quality Objectives Process* (U.S. EPA, 2006b). Data quality indicators as discussed in Section B.5 will be used to ensure quality data for sampling conducted pursuant to this QAPP.

#### **A.7.1 Problem Statement**

Current and historical uses of many properties in Missouri include a variety of industrial and commercial uses that may have resulted in the presence of hazardous substances or petroleum products on the property. The presence of these contaminants may hinder redevelopment or sale of the property. Before redevelopment or sale can take place, more information is needed regarding potential environmental impacts from previous operations.

#### **A.7.2 Decision Statement**

The decision to be made is to determine if soil, surface water, groundwater, and/or structures on the property have been impacted by hazardous contaminants. If they have been impacted, BVCP will need to determine what actions may be needed to facilitate safe redevelopment.

#### **A.7.3 Inputs into the Decision**

The inputs into the decision will be any reports, as required in Section A.6.1.5, of Phase I and Phase II ESA activities, as discussed in Sections A.6.1.1 and A.6.1.2. Results of sampling conducted as part of a Phase II ESA will be compared to Missouri Risk-based Corrective Action (MRBCA) target levels.

#### **A.7.4 Study Boundaries**

The study boundary is the legal property boundary of the site that has been selected by BVCP for a BA.

#### **A.7.5 Decision Rules**

- If the Phase I ESA finds no Recognized Environmental Conditions (RECs) and there is no indication of the presence of asbestos-containing material (ACM) or lead-based paint (LBP), then no further action will be recommended.
- If the Phase I ESA finds no RECs but ACM or LBP is discovered or suspected, a Phase II ESA will be recommended.
- If the Phase I ESA finds one or more RECs but no ACM or LBP is discovered or suspected, a Phase II ESA will be recommended.
- If the Phase I ESA finds one or more RECS and ACM or LBP is discovered or suspected, a Phase II ESA will be recommended.
- If the Phase II ESA finds no contaminants at concentrations above the MRBCA Default Target Levels (DTLs) and no ACM or LBP, then no further action will be recommended.
- If the Phase II ESA finds no contaminants at concentrations above the DTLs but the presence of ACM or LBP is confirmed, further investigation, risk assessment, and possibly remediation will be recommended.

- If the Phase II ESA finds contaminants at concentrations above the DTLs but no ACM or LBP, further investigation, risk assessment, and possibly remediation will be recommended.
- If the Phase II ESA finds contaminants at concentrations above the DTLs and the presence of ACM or LBP is confirmed, further investigation, risk assessment, and possibly remediation will be recommended.

#### **A.7.6 Limits on Decision Error**

Due to the limited nature of Phase II ESA sampling, a judgemental sampling approach will be used. RECs will be identified in the Phase I, and decision error will be limited by using judgemental sampling to target the worst-case contaminant locations by sampling RECs where the largest contaminant release would have occurred. When contaminants are detected, decision error will also be limited by comparing contaminant concentrations to the conservatively-derived target levels in the MRBCA guidance.

#### **A.7.7 Design Optimization**

In BVCP, the contractor who performs a particular BA is selected by a bid process. Design of the BA is optimized because BVCP has up to four bids to select from, and the bid selected is the one with the lowest cost that also meets minimum sampling requirements.

### **A.8 SPECIAL TRAINING/CERTIFICATION**

Sample collectors are required to successfully complete a 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) site safety course in accordance with 40 CFR Part 311, which references 29 CFR 1910.120. Staff are also expected to be trained on sampling for hazardous materials as well as read and be familiar with applicable SOPs, the generic QAPP, the site-specific work plan and the SSQA prior to performing actual sample collection. Some sample collectors may need to be licensed inspectors for ACM or LBP.

Specific training requirements may be necessary for personnel operating field analytical or sampling equipment or specialized equipment, such as an X-ray Fluorescence (XRF) analyzer or geophysical instruments. Manufacturer's requirements and recommendations shall be followed.

The contractor will ensure and provide for the protection of the personal safety and health of all its workers on site, including any required medical monitoring and the selection, provision, testing, decontamination, and disposal of all Personal Protective Equipment

(PPE). The contractor will comply with all applicable worker safety and health laws and regulations. At all times during performance of services, the contractor will exercise reasonable professional judgement regarding safety and will use professional judgement to make decisions regarding the cessation of services for safety reasons.

## **A.9 DOCUMENTS AND RECORDS**

Work plans and final reports will be generated and submitted to BVCP for review and approval.

Field QA/QC documentation for site characterization reports and/or remedial action/risk management reports shall be developed in consideration of the following details:

- Calibration and maintenance records for field instrumentation
- Documentation of sample collection procedures
- Reporting of any variances made in the field to sampling plans, SOPs or other applicable guidance documents
- Reporting of all field analysis results
- Documentation of sample custody (provide copies of completed chain-of-custody documents)
- Documentation of sample preservation, handling and transportation procedures
- Documentation of field decontamination procedures (and if applicable, collection and analysis of equipment rinsate blanks)
- Collection and analysis of all required duplicate, replicate, background and trip blank samples, and
- Documentation of disposal of investigation-derived wastes.

Laboratory QA/QC documentation for site characterization reports and/or remedial action/risk management reports shall be developed in consideration of the following details:

- If the published analytical method used specifies QA/QC requirements within the method, those requirements must be met and the QA/QC data reported with the sample results;
- At a minimum, QA/QC samples must consist of the following (where applicable): method/instrument blank, extraction/digestion blank, initial calibration information, initial calibration verification, continuing calibration verification, laboratory fortified blanks/laboratory control samples, duplicate, and matrix spikes/matrix spike duplicates. The site characterization and/or remedial action/risk management reports must include a discussion of data quality.
- Documentation of appropriate instrument performance data such as internal standards and surrogate recovery.

## **B: DATA GENERATION AND ACQUISITION**

### **B.1 SAMPLING PROCESS DESIGN**

The types of information inputs required to design the Phase II ESA work plan may be gathered from numerous sources, including: Phase I ESA, site reconnaissance, interviews

of site owners or operators, published reference books and other resources, databases, and internet resources.

The goal of each BA is to identify areas of contamination in surface and subsurface soil, groundwater, and buildings, not necessarily to fully delineate the extent of contamination or to locate all contaminant sources. BA projects primarily are limited screening investigations, the results of which will be used by the BA recipient to evaluate potential future use and/or development of the property. The projects usually have very limited budgets and involve a limited number of samples, both of which may preclude implementing a statistical sampling design. Based on these factors, the sampling designs for BAs will primarily use the judgemental sampling technique. When developing a plan for a judgemental sampling design, the following site information should be considered: potential contaminant(s) and locations based on past property uses, soil properties that affect contaminant migration, physical and chemical nature of potential contaminant(s), the manner in which contaminant(s) may have been released, and the timing, duration and amount of potential release(s). The sampling process design will be described in detail in the site-specific work plan and/or SSQA.

All QC samples will be collected in accordance with EPA guidance and described in the site-specific work plan. All QC samples will be documented in the sampling report. See Section B.5 for more information on QC samples.

## **B.2 SAMPLING METHODS**

The field investigations and sample collection activities under the project will adhere to applicable SOPs and available EPA and MDNR guidance and will be described in the site-specific work plan and/or SSQA.

For specific field analytical equipment, geophysical equipment, surveying instruments, etc., for which no SOPs or EPA guidance exist, manufacturer's specifications and operational instructions, other agency SOPs, other methods and instructions, including professional or scientific technical standards, may also be used upon approval of the BVCP Project Officer. The site-specific work plan will specify sampling methodologies and procedures used.

## **B.3 SAMPLE HANDLING AND CUSTODY**

Sample handling and custody will be accomplished according to SOPs and using standard forms developed by contractor's laboratories. Sample container selection will be according to appropriate method guidance and/or SOPs. The site-specific work plan will specify sample handling procedures, sample containers, preservation methods, holding times, chain-of-custody and field documentation, handling of samples in the field, and transport of samples to the laboratory. All laboratory analyses will be conducted within the holding time specified for the analytical method used. Any data obtained from analyses conducted on samples after the specified holding time limit will be qualified by the laboratory in sample result documentation and discussed in the sampling report.

#### **B.4 ANALYTICAL METHODS**

Field analytical measurements will be according to SOPs and manufacturer's operational instructions, such as immunoassay kit instructions, photoionization detector (PID) instructions, XRF manual, etc. Calibration and other QA/QC actions will be accomplished according to SOPs, manufacturer's minimum recommendations/requirements, and other appropriate scientific and technical standards. Appropriate EPA guidance, SOPs, best professional judgement, and accepted industry and scientific practices will be used when correlating field analytical data to laboratory data.

Laboratory measurements will be performed by the selected laboratory according to the method requested, and generally shall be in accordance with EPA Solid Waste Methods (SW)-846-specified container, preparation and analytical methods. The QC procedures specified in these methods must be followed.

The detection limits of the selected analytical methods shall be equal to or less than the concentrations of interest needed for BAs. Analytical parameters will vary by project; therefore, the analytical methods used for the parameters of concern will be specified in the site-specific work plan and/or SSQA.

Analytical results obtained for projects conducted under this QAPP will be compared to specific risk-based target levels in the department's MRBCA Guidance. Ideally, the laboratory reporting limits would be at or below the MRBCA media and pathway-specific risk-based target levels. However, these risk-based values do not take into account analytical feasibility; even using the best available measurement technology, laboratory-reporting limits will exceed the MRBCA benchmarks for some analytes in some environmental media. There may be special circumstances where a higher level of sensitivity for some analytes will be required. Data that do not meet the laboratory reporting limits will be qualified as described in the applicable verification/validation procedure, and documented in the project report.

Any non-standard analytical methods, along with associated validation procedures, should be specified in the site-specific work plan and/or SSQA, and will need prior approval by the BVCP. An explanation as to why non-standard methods are being proposed should also be included in the site-specific work plan and/or SSQA.

All QC documentation must be provided with each analytical deliverable package. The contractor will be responsible for ensuring all analytical data provided by the contractor's laboratory for the project meets the contract requirements and the requirements of this QAPP. If the analytical data do not meet contract requirements, the issue will be handled as described in Section D.3 Reconciliation With User Requirements.

#### **B.5 QUALITY CONTROL**

##### **B.5.1 Principal Quality Attributes**

A number of field and laboratory QC checks will be required to ensure data meet the project DQOs. The principal quality attributes important to site assessment projects

are precision, accuracy, comparability, representativeness, and completeness. Criteria for these attributes are discussed below.

### 1. Data Precision

Data Precision is a measure of the reproducibility of analytical results and is typically expressed in terms of the standard deviation among a set of data or as the relative percent difference (RPD) between two measurements. Overall precision will be measured using the RPD between duplicate or replicate split samples.

$$RPD = 100 \left[ \frac{x_1 - x_2}{\bar{x}} \right]$$

- The criterion for RPD between primary and duplicate aqueous samples for each contaminant measured above the laboratory reporting level is  $\leq 30\%$ .
- The criterion for RPD between primary and replicate split non-aqueous samples and for duplicate non-aqueous VOC samples will be  $\leq 50\%$ .
- The criterion for RPD between primary and duplicate air samples will be  $25\%$ .

If data fall within these limits, then the overall precision of the sampling and analytical process is adequate to meet the project DQOs. Data that do not meet these precision criteria will be qualified as described in the applicable validation procedure (Section D), and discussed in the project report.

### 2. Laboratory Precision

Precision of laboratory analyses is assessed by the analysis of Matrix Spike/Spike Duplicates (MS/MSD), laboratory duplicate samples, and blind performance evaluation samples. The frequency with which laboratory precision is assessed and the performance criteria vary by analyte, analytical method, and environmental media. The criteria and methods for assessment of laboratory precision are specified in the analytical methods.

### 3. Accuracy

Accuracy is a measure of the bias that exists in a measurement system. The accuracy of laboratory analyses will be assessed by analysis of preparation/method blanks, laboratory control samples, surrogates, internal standards, matrix spikes, and blind performance samples. The frequency with which laboratory accuracy is assessed and the performance criteria vary by analyte, analytical method, and environmental media. Criteria for laboratory accuracy are specified in the analytical methods.

Field accuracy will be assessed through the analysis of trip blanks and field equipment rinse blanks. Contaminants should not be detected above the

laboratory reporting level in trip blanks and equipment rinse blanks. Any data that do not meet these accuracy criteria will be qualified as described in the applicable validation procedure. The BVCP Project Manager and applicant's contractor will evaluate all qualified data on a project-specific basis, and determine how/whether to use the data.

#### 4. Data Comparability

Comparability is the degree of confidence with which one data set can be compared to another. The objective of comparability for this QAPP is to ensure that sampling data developed during the project investigation may be readily compared to each other and to the appropriate screening benchmarks. All data will be reported as degrees Celsius (flash point); pH units;  $\mu\text{g/l}$  or  $\text{mg/l}$  for water, liquids or Toxicity Characteristic Leachate Procedure (TCLP);  $\mu\text{g/kg}$  or  $\text{mg/kg}$  for soil, sediment or other solids;  $\mu\text{g/m}^3$  for air;  $\text{mg/cm}^2$  or % by weight for LBP; and % by weight for ACM. Comparability is further addressed by using appropriate field and laboratory methods that are consistent with current standards of practice as approved by EPA.

#### 5. Data Representativeness

Representativeness is the degree to which sampling data accurately and precisely depicts selected characteristics such as parameter variations at a sampling point or an environmental condition and is ensured for projects under this QAPP in several specific ways that are further discussed in other sections of this QAPP:

- a. Use of correct sampling procedures and equipment
- b. Adherence to QA and QC requirements for ensuring sample integrity
- c. Collection of an adequate amount of sampled material
- d. Selection and implementation of an appropriate analytical measurement method, including sample preparation.

#### 6. Data Completeness

Completeness is the measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under "normal" conditions and is expressed as a percentage of the amount of valid data obtained compared to the amount that was planned. One hundred percent of data completeness is desired for the collection of field samples for all project investigations. If less than 100 percent is received, the BVCP Project Manager will decide if the valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions is sufficient to meet the project DQOs. If not, additional sampling may be required.

### **B.5.2. QC Samples**

QC samples will be required to verify the validity of analytical results and to assess whether the samples were contaminated from sources not directly attributable to releases at the site (such as improper decontamination, cross-contamination, laboratory contamination, etc.). The field QC samples proposed for collection will be specified in the site-specific work plan, and shall include the following, as appropriate.

- Trip blanks to determine if samples were contaminated during transport.
- Field blanks to determine if contaminants were introduced into samples by sample containers, preservatives, sampling procedures, etc.
- Rinsate samples to verify adequate decontamination of sampling equipment.
- Replicate samples (split samples) are obtained by dividing or splitting one sample that has been mixed or homogenized into two samples for separate analysis. Replicate samples primarily assess precision associated with analytical procedures, and to a lesser extent, sample handling procedures. Replicate split samples of soils or other non-aqueous materials are not recommended if volatile organics analyses are requested due to the potential loss of the volatiles during the mixing process. If soil samples will be analyzed for volatile organic compounds (VOCs), duplicate samples should be collected prior to mixing. However, note that there may be a greater potential for inconsistency due to the heterogeneous nature of soils or other non-aqueous media
- Duplicate water samples to assess precision associated with sampling methodology, and to a lesser extent sample heterogeneity and analytical procedures.
- Duplicate soil samples to determine the variability or heterogeneity of the sampled media.

For all projects involving the collection of aqueous samples, a trip blank will be included at a frequency of one per cooler if the proposed analysis includes VOCs or semi-volatile organic compounds (SVOCs). An equipment rinsate blank will be collected for projects where the sampling equipment is decontaminated in the field for reuse. Equipment rinsate blanks will be collected at a frequency of one per field sampling event (mobilization) for each different combination of sampling equipment, decontamination method, and analytical parameter. Aqueous samples, air samples, and non-aqueous samples for VOC analysis will be collected as duplicates. Other non-aqueous samples will be collected as replicate splits. Duplicate or replicate split samples for each media (groundwater, surface water, soil/sediment, air, ACM, LBP) should be collected at a frequency of 10% of the total number of samples (for all events with <10 samples, at least one duplicate or replicate is required).

Contaminants should not be detected above the laboratory reporting level in trip blanks, field blanks, and equipment rinse blanks. Any data that do not meet these accuracy criteria will be qualified on sample results. The BVCP Project Manager and contractor personnel will evaluate all qualified data on a project-specific basis, and determine how/whether to use the data.

All QC samples will be documented in the sampling report.

Laboratory QC samples include duplicates, spikes, laboratory blanks, and performance evaluation samples, and are performed by the fixed laboratory according to the approved laboratory QA/QC plans.

#### **B.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE**

Field analytical instruments used during this project will be maintained and calibrated according to instructions provided by the instrument manufacturer, and other appropriate scientific and technical guidance and standards pertinent to the specific instrument in use. The contractor will be responsible for performing operational checks on all field equipment prior to use in the field. An operational problem with any field instrumentation will be noted by the contractor in the field notebook. Daily or regular calibration of field instrumentation will be according to applicable SOPs and manufacturer's instructions and indicated or referenced in the site-specific work plan.

Fixed laboratory equipment used by contract laboratories for quantitative sample analysis will be tested, inspected, calibrated and maintained according to the specific analytical equipment requirements as stated in the SOPs of the laboratory, in accordance with manufacturer-specified procedures or method-specified procedures, as appropriate.

#### **B.7 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY**

Maintenance and calibration procedures will be conducted in accordance with manufacturers' instrument manuals, method-specified procedures and the laboratory SOPs, as appropriate.

#### **B.8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES**

Inspection and acceptance of supplies and consumables will be conducted according to laboratory SOPs. Any supplies and consumables used in the sample collection or instrument calibration processes, such as sample bottles, bailers, dedicated tubing, deionized water, calibration gases, etc., will be inspected upon receipt and prior to use.

#### **B.9 NON-DIRECT MEASUREMENTS**

Non-direct measurement data is the basis for Phase I and II ESAs and is accepted by industry and EPA in accordance with ASTM Standards. Several types of data and information may be obtained from non-measurement sources for use in projects conducted under this QAPP. The primary types and sources of non-measurement data are listed in Section B.1 Sampling Process Design, first paragraph. These data may be used to design sampling plans and may be used with the directly measured data collected during each project to evaluate the need for further site characterization, risk assessment, remediation, and/or suitability for development. Non-direct measurement data will be documented and referenced in any document for which they are used.

## **B.10 DATA MANAGEMENT**

Data management, including chain-of-custody review and correction, data review, reduction and transfer to data management systems, quality control charts, quality control procedures, and sample receipt, storage and disposal, will be in accordance with applicable SOPs and accepted industry practices.

Data management documentation will be in accordance with applicable SOPs and accepted industry practices, and will include sampling reports, copies of completed chain-of-custody forms, and field notes or other supporting documentation with the analytical results. Data reduction will occur in accordance with contractor analytical SOPs for each parameter. If difficulties are encountered during sample collection or sample analyses, a brief description of the problem will be provided in the sampling report prepared by the contractor. Data reporting will be in accordance with applicable SOPs and will include, at a minimum:

- Sample documentation (location, date and time of collection, collection method, and analysis, etc.)
- Chain-of-custody forms
- Initial and continuing calibration
- Determination and documentation of detection limits
- Analyte(s) identification
- Analyte(s) quantitation
- Quality Control sample results

Adequate precautions will be taken during the reduction, manipulation, and storage of data in order to prevent the introduction of errors or the loss or misinterpretation of data.

## **C: ASSESSMENT AND OVERSIGHT**

### **C.1 ASSESSMENTS AND RESPONSE ACTIONS**

This section describes the internal and external checks necessary to ensure that all elements of the QAPP are correctly implemented as prescribed, that the quality of the data generated by implementation of the QAPP is adequate, and that any necessary corrective actions are implemented in a timely manner.

#### **C.1.1 Laboratory Performance Assessment**

Laboratories will comply with all of the EPA and the National Environmental Laboratory Accreditation Conference (NELAC) requirements for laboratory QA programs. Data resulting from participation in the NELAC program shall be reviewed by the laboratory Quality Assurance Manager and any problems shall be documented and addressed.

#### **C.1.2 Field Performance Assessment**

The auditor in charge of field QA will conduct audits of field activities according to contractor QA field auditing procedures. The process of choosing when field

audits are conducted is not based on a particular project or site-sampling event, but rather on assuring that each person involved in sample collection is audited at least once per year. The contractor's field QA auditor will be responsible for initiating and implementing response actions associated with findings identified during the field audit.

### **C.1.3 Overall Quality Assessment**

EPA Region VII conducts periodic QA Audits of Missouri's environmental programs. These audits normally include some type of review of the program's quality system, and may include review of QAPPs.

### **C.1.4 Data Validation**

All field and laboratory data will be subject to validation to review for accuracy, precision, completeness, representativeness, and comparability, and is discussed in more detail in Section D. The acceptance criteria for measurement data are discussed in Section B.5.

### **C.1.5 Overall Project Performance Assessment**

If deficiencies or areas that need improvement are found with the overall performance of the tasks described herein, the BVCP BA Quality Assurance Project Officer will evaluate and report on the overall performance, and provide the evaluation to the BVCP Section Chief. The Section Chief will communicate deficiencies and areas that need improvement to the contractor's Director.

Specifically, the following items will be evaluated to determine how well the performance of tasks met the specification of this QAPP and the goals of the BVCP's BA program: data quality; data completeness; report completeness; usability and clarity of report narrative, figures and maps; and timeliness of report completion.

## **C.2 REPORTS TO MANAGEMENT**

Data from the contractor's laboratory will be submitted to the BVCP Project Officer as an appendix to the final report using the laboratory analytical report sheets. The report sheets will include documentation of the sampling location, sample description, date of collection, collector, analysis performed and results, date of analysis, and analytical method used. A copy of the chain-of-custody and the lab results should also be attached to the final report. In addition, an explanation of any deficiencies in data quality should be provided with the sampling report.

Field performance assessment audits will be documented by the contractor's field QA auditor in a written report that will be kept on file at the contractor's office. Results from the laboratory's audit studies will be kept on file at the contractor's office.

Comments and recommendations from the EPA Region VII periodic QA audits of state environmental programs are provided to the Department QA manager and used by Department management and staff to take any corrective actions which may be needed.

## **D: DATA VALIDATION AND USABILITY**

### **D.1 DATA REVIEW, VERIFICATION AND VALIDATION**

To ensure that measurement data generated when performing BAs are of an appropriate quality, all data will be validated. Data validation is a systematic procedure for reviewing a body of data against a set of established criteria to provide a specified level of assurance of its validity prior to its intended use. The techniques used must be applied to the body of the data in a systematic and uniform manner. The process of data validation must be objective and independent of the data production process. All data, as applicable, from BAs will be validated in accordance with EPA guidance on *Environmental Data Verification and Data Validation, Data Quality Assessment: A Reviewers Guide* and *Data Quality Assessment: Statistical Methods*. Any deviations will be documented and provided with the analytical data report.

### **D.2 VERIFICATION AND VALIDATION METHODS**

#### **D.2.1 Documentation, Data Reduction and Reporting**

Documentation will include the sampling reports, copy of the completed chain-of-custody, and field notes or other supporting documentation with the analytical results. Data reduction will occur in accordance with the laboratory's analytical SOPs for each parameter, consistent with EPA or other established methods. If difficulties are encountered during sample analyses, a brief description of the problem will be provided.

Data derived from sampling events undertaken for this project will be reported to the BVCP Project Officer as discussed in Section C.2. Reports to Management.

#### **D.2.2 Data Validation**

Data validation will occur as described in the analytical SOPs for each parameter and the laboratory SOPs for data review. Data validation is accomplished using control charts and data review checklists. Discrepancies are noted in the analytical file and appropriate data flags are used. If data is determined to be outside of control limits, the data is flagged on the report of analysis.

Laboratory personnel will review matrix spikes/matrix spike duplicates, lab blanks, and lab duplicates to ensure they are acceptable. The sample collector will compare the sample descriptions with the field sheets for consistency and ensure that any anomalies in the data are documented. The contractor will perform a final review and approval to ensure that the data meets the quality objectives of this QAPP and, if applicable, the SSQA. The contractor's review and approval is a check on the reviews conducted by the laboratory to ensure consistency of all field and analytical data that is generated by the contractor.

### **D.3 RECONCILIATION WITH USER REQUIREMENTS**

Once the final report is submitted, the BVCP Project Officer will review the field duplicates to determine if they appear to indicate a problem with meeting quality objectives. If problems are indicated, the BVCP Project Officer will contact the contractor to discuss and attempt to reconcile the issue. Completeness will also be evaluated to determine if the completeness goal for this project has been met. If data quality indicators do not meet the project's requirements as outlined in this QAPP and applicable SSQA, the data may be discarded and re-sampling may occur. The BVCP Project Officer will determine the cause of the failure (if possible) and make the decision whether to discard the data and re-sample. If the failure is tied to the analyses, calibration and maintenance techniques will be reassessed as identified by the appropriate lab personnel. If the failure is associated with the sample collection and re-sampling is needed, the sampling methods and procedures will be reassessed as identified by the field audit process.

Corrective action will be undertaken by all parties to address specific problems as they arise. Corrective actions required will be identified through the use of control charts for chemical analyses, precision and accuracy data, through performance auditing, and through systems audits.

## REFERENCES

- EPA Guidance on Environmental Data Verification and Data Validation EPA/240/R-02/004 November 2002.
- EPA Guidance Data Quality Assessment : A Reviewer's Guide EPA/240/B-06/002 February 2006.
- EPA Guidance Data Quality Assessment: Statistical Methods for Practitioners EPA/240/B-06/003 February 2006.
- EPA Guidance on Systematic Planning Using the Data Quality Objective Process EPA/240/B-06/001 February 2006.
- EPA Guidance for Quality Assurance Project Plans (G-5), U.S. EPA, December 2002.
- EPA Requirements for Quality Assurance Project Plans (R-5), U.S. EPA, March 2001DNR-ESP-210-Quality Assurance/Quality Control for Environmental Data Collection

## APPENDIX A: LISTING OF ACRONYMS & TERMS

ACM	Asbestos-Containing Material
BA	Brownfield Assessment
BVCP	Brownfields/Voluntary Cleanup Program
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
DEQ	Division of Environmental Quality
DTL	Default Target Level
DQO	Data Quality Objectives
EPA	United States Environmental Protection Agency
HAZWOPER	Hazardous Waste Operations and Emergency Response
LBP	Lead-Based Paint
MCL	Maximum Contaminant Level
MRBCA	Missouri Risk-based Corrective Action Process
NELAC	National Environmental Laboratory Accreditation Conference
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
REC	Recognized Environmental Condition
RFP	Request for Proposal
SOP	Standard Operating Procedure
SSQA	Site-Specific Quality Assurance Project Plan Addendum
SVOC	Semi-Volatile Organic Compound
VOA	Volatile Organic Analysis
VOC	Volatile Organic Compound

**Duplicate or co-located sample** is a sample obtained from the same location, at the same time, and of the same material as the original sample. Duplicate water samples are used primarily to assess precision associated with sampling methodology, and to a lesser extent sample heterogeneity and analytical procedures. Duplicate soil samples are used primarily to determine the variability or heterogeneity of the sampled media. Due to the heterogeneity of soils, caution must be used if attempting to assess precision associated with sampling methodology or analytical procedures.

**Hazardous Substance** means a substance defined as hazardous pursuant to federal rule 40 CFR 302.4, which includes asbestos and Polychlorinated Biphenyls (PCBs); any substance designated pursuant to Section 311(b)(2)(A) of the federal Water Pollution Control Act; any toxic pollutant listed under Section 307(a) of the federal Water Pollution Control Act; any hazardous air pollutant listed under Section 112 of the Clean Air Act; any imminently hazardous chemical substance or mixture with respect to which the Administration of EPA has taken action pursuant to Section 7 of the Toxic Substances Control Act; any hazardous waste; any hazardous material designated by the Secretary of the U.S. Department of Transportation under the Hazardous Materials Transportation Act; any radioactive materials; or any petroleum product.

**Hazardous waste** means waste defined to be hazardous pursuant to the Missouri Hazardous Waste Management Law Section 260.350 to Section 260.430 or pursuant to federal rule 40 CFR 261.

**Replicate split** sample is obtained by dividing or splitting one sample that has been mixed or homogenized into two samples for separate analysis. A replicate split is collected primarily to assess precision associated with analytical procedures and to a lesser extent sample handling procedures. Replicate split samples of soils or other non-aqueous materials are not recommended if volatile organics analyses are requested due to the potential loss of the volatiles during the mixing process. Duplicate samples for volatile organics analyses are sometimes collected prior to mixing, however, there may be a greater potential for inconsistency due to the heterogeneous nature of soils or other non-aqueous media.

**APPENDIX B: ANALYTICAL REQUIREMENTS**

The detection limits, as specified in 40 CFR 136 Appendix A and the EPA SW-846 Methods, are sufficient for BAs. The accuracy and precision of each analytical method are determined by using spikes and spike duplicate analyses, as specified in the EPA SW-846 methods.

