Quality Assurance Project Plan

For

Orbital ATK
~Utah Facilities~

Approvals

Environmental Group

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Orbital ATK

Environmental Group

Analytical Laboratory

State of Utah Department of Environmental Quality

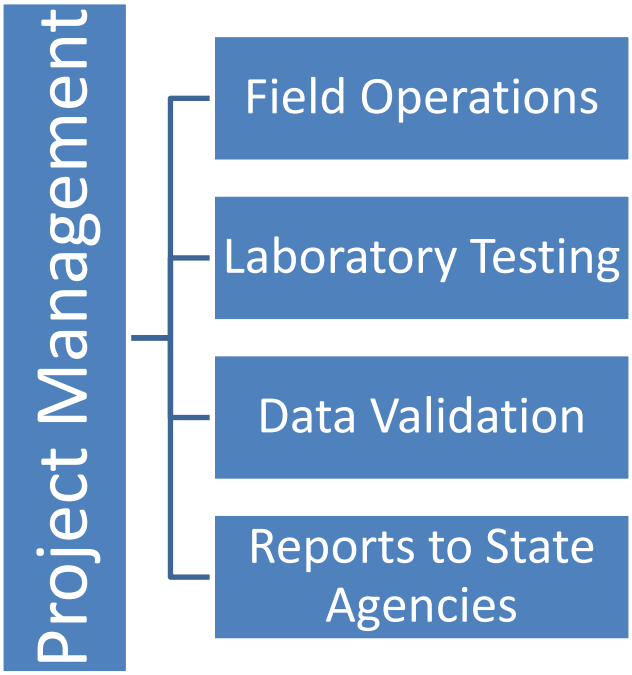
Division of Water Quality

Division of Solid and Hazardous Waste

A4 – Project/Task Management

Project management responsibilities are detailed in this section, and are illustrated in Figure 1. Multiple functions may be performed by one individual.

Figure 1 Project Organization



PROJECT MANAGEMENT

The role of Project Management / Project Manager (PM) is to direct the program with responsibilities which include:

- Ensuring timely resolution of project-related technical, quality, or waste management issues.
- Monitoring and evaluating laboratory performance.
- Coordinating and overseeing work performed by field and office technical staff (including data validation, statistical evaluations, and report preparation).
- Coordinating and overseeing maintenance of all project records.
- Approving the implementation of project corrective action.

Field Operations

Field Operations activities include:

- Function as communications link between field staff members and laboratory personnel.
- Oversee the mobilization and demobilization of all field equipment and subcontractors.
- Coordinate and manage the Field Technical Staff.
- Ensure proper chain of custody protocol.
- Adhere to the work schedules.
- Be responsible for the maintenance of the site field logbook, and field recordkeeping.
- Initiate field task modification requests when necessary.
- Identify and resolve problems in the field; resolve difficulties; implement and document corrective action procedures, and provide communication between the field team and upper management.
- Monitoring QA policies and procedures.
- Conducting systems and performance audits to monitor compliance with environmental regulations, contractual requirements, QAPP requirements, and corporate policies and procedures.
- Auditing project records.
- Monitoring subcontractor quality controls and records.
- Document deviations from approved workplans
- Assisting in the development of corrective action plans; ensuring correction of nonconformance reported in internal or external audits.
- Overseeing the implementation of the QAPP.
- Overseeing and reviewing the development and revision of the QAPP.

Laboratory Testing

The laboratory is responsible for maintaining accreditation with the State of Utah's Environmental Laboratory Certification Program as outlined in Utah Administrative Rule R444. The accreditation requirements include establishing a Quality Management System compliant with *ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories*.

The laboratory will analyze all samples in accordance with the analytical methods and additional requirements specified in this QAPP. It also will be the analytical laboratory's responsibility to properly dispose of unused sample aliquots. Responsibilities of key laboratory personnel are outlined in the following paragraphs.

Laboratory Director

Responsibilities of the Laboratory Director include the following:

- Support the QA program within the laboratory.

- Provide management overview of both production and quality-related laboratory activities.
- Maintain adequate staffing and instrumentation to meet project analytical and quality objectives.
- Approve all laboratory Standard Operating Procedures (SOPs) and QA documents.

Laboratory Quality Assurance Officer

The Laboratory Quality Assurance Officer (QAO) has the overall responsibility for maintaining the Quality Management System of the laboratory. In addition, the Laboratory QAO will:

- Oversee laboratory QA.
- Oversee QA/QC documentation.
- Conduct detailed data reviews.
- Determine whether to implement laboratory corrective actions, if required.
- Define appropriate laboratory QA procedures.
- Approve laboratory SOPs.
- Approve Final Reports

Laboratory Sample Custodian

Responsibilities of the Laboratory Sample Custodian include the following:

- Receive and inspect the incoming sample containers.
- Record the condition of the incoming sample containers.
- Verify and sign COC.
- Assign a unique identification number and customer number, and enter each into the Laboratory Information Management System.
- Control and monitor access/storage of samples

Laboratory Technical Staff

The Laboratory Technical Staff will be responsible for sample analysis and identification of corrective actions. The staff will report directly to the Laboratory Director.

Data Validation

In addition to the data validation steps established within the laboratory as part of normal QA operations, third party validation of data may be required. The PM will coordinate getting the requested data from the laboratory to the data validators and will receive the validation summary report from the data validator. If there are questions that come up during the data validation process, the PM will act to resolve these questions. Third party validators will use this QAPP as a guide.

Reporting to State Agencies

The PM will collect data from the laboratory and any supporting documentation from field

operations and data validation activities and submit a report to the appropriate State Agency at the frequency required by permit or other agreement.

A5 – Problem Definition/Background

The Orbital ATK facilities at the Bacchus and Promontory locations have known legacy environmental concerns which are regulated under corrective action permits. The permits require site characterization, remediation and monitoring activities the goal of which is to protect human health and the environment. To achieve this goal data must be of known and documented accuracy and precision so that sound environmental decisions can be made.

A6 – Project/Task Description

This Quality Assurance Project Plan (QAPP) outlines the organization, objectives, and planned activities for the Quality Assurance/Quality Control (QA/QC) procedures associated with RCRA corrective action conducted at the Orbital ATK Bacchus and Promontory Facilities. These corrective actions include both soil investigations and groundwater monitoring. Corrective action is regulated at each facility by permits. These permits are listed in Table 1

Table 1 - Corrective Action Permits at Bacchus and Promontory

Facility	Soil Corrective Action	Groundwater Corrective Action
Bacchus	HAZARDOUS WASTE STORAGE PERMIT ALLIANT TECHSYSTEMS, INC. ATK LAUNCH SYSTEMS INC. BACCHUS FACILITY - PLANT 1 EPA ID# UTD001705029 MODULE IV – SWMU CORRECTIVE ACTION PROGRAM September 30, 2008	HAZARDOUS WASTE STORAGE PERMIT ALLIANT TECHSYSTEMS, INC. ATK LAUNCH SYSTEMS INC. BACCHUS FACILITY - PLANT 1 EPA ID# UTD001705029 MODULE V – GWMU CORRECTIVE ACTION PROGRAM September 30, 2008
Promontory	Hazardous Waste Post-Closure Permit ATK Launch Systems INC. Promontory EPA ID # UTD009081357 Module VI – Corrective Action For Solid Waste Management Units Reissued September 20, 2007	Hazardous Waste Post-Closure Permit ATK Launch Systems INC. Promontory EPA ID # UTD009081357 Module IV-Groundwater Monitoring Reissued September 20, 2007

Specific protocols for groundwater sample collection, sample handling and storage, chain-of-custody, laboratory and field analyses, data validation, and reporting are found or referenced in the permits listed above. Protocols for other media are addressed in site specific SAPs**.**

A7 – Quality Objectives and Criteria

Data quality objectives (DQOs) are requirements needed to support decisions relative to various stages of the project. The data needs associated with this project have been developed based upon evaluation

of existing site data, requirements in the permits listed above, EPA risk screen and groundwater screen values and subsequent risk assessment needs. Specific data needs include collection of data to define the nature and extent of contamination, development of mean contaminant concentrations across the site and their potential for imparting public health risks and environmental impacts.

In the case of soil investigation activities, the specific concerns of each Solid Waste Management Unit (SWMU) is unique. Thus, it is important to establish Quality Objectives and Criteria that take the specific concerns into account. In the process of establishing a Sample Analysis Plan (SAP) a unique set of DQOs will be developed.

The DQO process is a systematic planning tool based on a logical method for establishing criteria for data quality. Establishing formal DQOs during the development of SAPs allows clear and unambiguous definitions of project objectives and decision criteria so that data of sufficient type, quality, and quantity are generated to meet project objectives. Details such as estimated quantitation limits (EQLs) used by the Laboratory will be provided in SAPs for each SWMU or group of SWMUs. In developing SAPs, the latest version of Guidelines for the Data Quality Objectives Process, US EPA, EPA QA/G-4, August 2000, or other appropriate guidelines will be followed.

The quality of the laboratory data is assessed in terms of **precision**, **accuracy**, **representativeness**, **comparability**, and **completeness**. Definitions of these parameters and the applicable quality control procedures are given below.

Precision - Precision is a measure of the degree to which two or more measurements are in agreement and describe the reproducibility of measurements of the same parameter for samples analyzed under similar conditions. A fundamental tenet of using precision measurements for QC is that precision will be bounded by known limits. Results outside these predetermined limits trigger corrective actions. Because of the inherent and unknown heterogeneity of soil samples, the precision of soil field duplicate samples will be used to gain a perspective on the natural heterogeneity of the soil.

Field precision is assessed by collecting and measuring field duplicates at a rate of 1 duplicate per 20 environmental samples submitted to the laboratory. Acceptance limits for field duplicate samples are:

- 30% relative percent difference for aqueous matrices, and;
- 50% relative percent difference for solid matrices.

This precision estimate encompasses the combined uncertainty associated with sample collection, homogenization, splitting, handling, laboratory and field storage, digestion or extraction, and analysis. In contrast, precision estimates obtained from analyzing duplicate laboratory samples incorporate only homogenization, subsampling, digestion or extraction, laboratory storage, and analysis uncertainties. Consequently, the field precision estimates (i.e., relative percent difference [RPD] values) should equal or exceed the laboratory precision estimates, on average, for each analyte. If field duplicate precision is significantly different from laboratory duplicate precision, the underlying cause will be investigated to

determine whether the observed difference could be artifacts of sampling and analysis. Considerations given to this effort include:

- The scale of subsampling for laboratory precision estimates relative to the scale of field duplicate sample size.
- Analytical measurement precision.
- Precision for repeat analysis of the same solid laboratory control sample (LCS).
- Estimated environmental sample grain size relative to LCS grain size.
- Potential natural soil heterogeneity.

Laboratory precision QC samples (i.e., laboratory duplicates for inorganic chemicals and MSDs for organic chemicals) will be analyzed with a minimum frequency of 5 percent (i.e., 1 QC sample per 20 environmental samples). Laboratory precision is measured by comparing RPD values with precision control limits. Precision limits for matrix spike/matrix spike duplicate and laboratory duplicate samples are displayed in Table 2.

When Precision data falls outside of the listed limits, the laboratory will flag the outlier and provide a comment relating the cause of the outlier and any effect it may have on the usability of the data. In cases where the data is not usable, the laboratory will notify the project manager in order to resolve the issue. In such cases, re-sampling and/or reanalysis may be required in order to obtain usable data for reporting.

Table 2 - Aqueous and Solid Relative Percent Difference Quality Control Limits for Laboratory Control Samples, Matrix Spikes, and Laboratory Duplicates

Analytical Method	**Aqueous**	**Solid**
	RPD	**RPD**
Explosives Method 8330A	30	50
Trace Metals Method 6010C or 6020A	20	50
Mercury Method 7470/7471	20	50
Perchlorate Method 314.0	20	50
Volatiles Method 8260B	20	50
Semivolatiles Method 8270D	30	50
Conductivity Method 9050A	20	50

Accuracy - Accuracy is a measure of the closeness of the measured value to the true value. The accuracy of chemical test results is assessed by "spiking" samples with known standards (surrogate or matrix spike) and establishing the average recovery. Accuracy measurements will be carried out in accordance with Contract Laboratory Program (CLP) Statement of Work (SOW) requirements for organic and inorganic analyses (USEPA CLP OLM04.3 and CLP ILM05.4, respectively) and at a minimum frequency of 1 per analytical batch of up to 20 samples per matrix analyzed (USEPA, 1991).

Accuracy requirements for field measurements are typically ensured through control over the sample collection and handling and through routine instrument calibration. Accuracy is also typically monitored through the use of blanks to detect cross-contamination and by monitoring adherence to procedures that prevent sample contamination or degradation. Accuracy also shall be assured qualitatively through adherence to all sample handling, preservation, and holding time requirements.

Accuracy in the laboratory is measured through the comparison of a spiked sample or LCS result to a known or calculated value and is expressed as a percent recovery (%R). It is also assessed by monitoring the analytical recovery of select surrogate compounds added to samples that are analyzed by organic chromatographic methods. MS and surrogate compound analyses measure the combined accuracy effects of the sample matrix, sample preparation, and sample measurement. LCSs are used to assess the accuracy of laboratory operations with minimal sample matrix effects. Post Digestion spikes (PDSs) are used to assess the accuracy of the analytical measurement on the sample extract or digestate. The parameters to be included in spiking mixes and accuracy limits are presented by analytical fraction and matrix in Table 3. LCS and MS analyses are performed at a frequency no less than 1 per 20 associated samples of like matrix. Laboratory accuracy is assessed via comparison of calculated %R values to accuracy control limits

When Accuracy data falls outside of the listed limits, the laboratory will flag the outlier and provide a comment relating the cause of the outlier and any effect it may have on the usability of the data. In cases where the data is not usable, the laboratory will notify the project manager in order to resolve the issue. In such cases, re-sampling and/or reanalysis may be required in order to obtain usable data for reporting.

Table 3 - Laboratory Control Sample and Matrix Spikes Recovery Quality Control Limits for Aqueous and Solid Samples

Analytical Method	Aqueous	Solid
	% Recovery	% Recovery
Explosives Method 8330A	80-120	80-120
Trace Metals Method 6010C or 6020A	75-125	75-125
Mercury Method 7470/7471	85-115	85-115
Perchlorate Method 314.0	85-115	85-115

Volatiles Method 8260B	80-120	80-120
Semivolatiles Method 8270D	70-130	70-130
Conductivity Method 9050A	90-110	90-110

Representativeness - Representativeness is an expression of the degree to which the data accurately and precisely represent a characteristic of a population or environmental condition existing at the site. Adherence to the project planning documents and use of standardized sampling, handling, preparation, analysis, and reporting procedures ensures that the final data accurately represent the desired populations.

To ensure representativeness of field data depends on the proper design of the sampling program and will be satisfied by ensuring that the project planning documents are followed and that proper sampling techniques are used.

In cases where alternative sampling techniques are employed, such as Multi-Incremental Sampling (MIS), to improve representativeness, it may be appropriate to establish data quality objectives specific to that technique. In such cases, the unique quality control requirements will be included in the sampling and analysis plan.

Representativeness in the laboratory is ensured or evaluated by using the proper analytical procedures, meeting sample holding times, and analyzing and evaluating field duplicate samples relative to laboratory duplicates.

Comparability - Comparability is defined as the confidence with which one data set can be compared with another (e.g., between sampling points and between sampling events). Comparability is achieved by using standardized sampling and analysis methods and data reporting formats (including use of consistent units of measure), and by ensuring that reporting and detection limits are sufficiently low to satisfy project detection and quantitation criteria for the duration of the project.

Comparability depends on the proper design of the sampling program and will be satisfied by ensuring that the project planning documents are followed and that proper sampling techniques are used.

Planned analytical data will be comparable when similar sampling and analytical methods are used and documented. Results will be reported in units that ensure comparability with previous data.

Common sources of data used to assess comparability may include: historical data and data obtained from split samples sent to a second party laboratory. Caution must be used when comparing data where dissimilar sampling and/or analysis techniques are employed. For example, when alternative sampling techniques are used such as Multi-Incremental Sampling (MIS) the data is not directly comparable to data obtained from discrete sampling. Similarly, data from Gas Chromatography using Flame Ionization Detectors is not directly comparable to Gas Chromatography using Mass Spectral

Detectors. While it may be useful to show data from two differing sampling and/or analysis techniques as a general comparison, any comparison needs to clearly indicate that the data sets were obtained using differing techniques and recommend that the end user should use caution when making comparisons.

Completeness - Completeness is defined as the percentage of measurements made which are judged to be valid measurements. Results will be considered valid if all the precision, accuracy, and representativeness objectives are met. The target completeness goal for this work is 90% (combined field and laboratory results) for a given analysis.

A8 – Special Training/Certification

All field personnel will have appropriate training to conduct the field activities to which they are assigned.

The PM and all field staff, including subcontractors that will be performing work at the facility, shall have completed training that meets the requirements in OSHA 29 CFR 1910.120. Documentation and skills certification will be completed as described in OSHA 29 CFR 1910.120. No other certification or special training requirements are requisite for the completion of this project.

While no other formal training is required for the completion of this project, field safety and responsibilities will be reviewed prior to field sampling. The purpose of the review is to assign and review project-specific responsibilities related to field-sampling activities and to discuss any special conditions or problems that are anticipated such as weather, site access, and personal protective equipment (PPE) requirements. In addition, discussions and reviews of specific activities such as sample preservation, sample container requirements, and logbook completion may also be included. These discussions are brief summaries of the requirements contained in the SAPs.

Personnel will participate in the review based on their anticipated activity and responsibilities; for example, a driller would not necessarily be expected to participate in the portion of the review related to filling out a chain of custody form.

The Laboratory will maintain accreditation certificates for the testing involved through the State of Utah's Environmental Laboratory Certification Program.

A9 – Documents and Records

The PM is responsible for initiating any revisions to planning documents and is responsible for making the needed revisions. The QAPP shall be approved by the Director of the Division of Waste Management and Radiation Control by an official letter from the Division. All revisions or modifications related to this QAPP thereafter will be accomplished by specifying a revision or modification to the QAPP in a SAP.

B – Data Generation and Acquisition

B1 – Sampling Process Design

For groundwater monitoring activities, the sampling sites and frequencies are established in the groundwater sections of the Bacchus and Promontory permits. For soil investigations, SAPs will be developed based on the unique data needs associated with the SWMUs and soil and soil gas sampling procedures will be addressed in the SAPs.

The primary purpose of the SAPs is to define the data quality objectives for each individual SWMU to be investigated. The SAPs will be developed based upon review of existing analytical data and process knowledge applicable to each SWMU or group of SWMUs. Table 4 is a checklist for consideration in developing specific SAPs. In addition, each SAP will contain a discussion of the components of the sampling strategy, listed below:

1. A methodology for selecting a sampling location and analytical parameters based on the data-quality objectives (DQOs);
2. A basis for selecting duplicate field samples;
3. Basis for selecting random sampling;
4. Locations within a SWMU where judgmental (biased) sampling is used based on process knowledge; and

The rationale for selecting the horizontal and vertical sample densities for each SWMU or group of SWMUs

Table 4 - Checklist for Developing Sampling and Analysis Plans

SAP Component	Specifications
Sampling	**Sampling Plan** · Development of Data Quality Objectives · Sample Design/Strategy · List of Analytes · List of Sampling Locations · Analytical Methods · Analytical Procedures · Analytical Equipment · Standard Operating Procedures (SOPs) For Field-Investigation Activities (such as drilling, sample collection, decon, shipping etc.) **Field Equipment** · Selection of Sampling and Field Analysis Equipment · Operation & Maintenance Procedures · Calibration & Acceptance Criteria · Calibration Frequencies, · Decon Procedures · Investigation and Remediation Derived Waste Generation, Characterization, Management and Disposal · Field Data Sheets · Field Activity Daily Log · Field Instrumentation Log for Calibration and Maintenance · Procedure Variance Log · Photographs · Sample-Handling and Shipping Procedures · Containers & Volumes · Holding Times & Preservation Requirements · Sample Packaging & Shipping · Sample Labels & Sample Identification Number · Analytical Request and Chain of Custody Forms · Transfer of Custody from Field to Laboratory Receipt and Acceptance of Samples
Quality Control	**Field** (as specified in sampling SOPs and SAPs) · Field Duplicates · Trip Blanks · Equipment Blanks · Field Blanks (soil, water) **Laboratory** · See the Laboratory Quality Assurance Plan (on file with the laboratory) · Assess need to add additional Matrix Spikes based on matrix

SAP Component	Specifications
	types
Data Quality Objectives	· Precision Level (as defined in the QAPP or customized limits based on unique SWMU or lab conditions) · Accuracy (as defined in the QAPP or customized limits based on unique SWMU conditions) · Representativeness – representativeness will be specified in each SAP. · Completeness · Comparability · Estimated Quantitation Limits · Clean-up Levels including based on DQOs (e.g., EPA screen values, MCLs)

B2 – Sampling Methods

Standard operating procedures (SOPs) are procedures developed by the PM and field staff for field sampling events. Most field SOPs have been developed for previous sampling and analyses events. The SOPs will be modified, as necessary, to meet data needs and usage requirements that are specified during the DQO development process. The SOPs will describe the process for preparation and decontamination of sampling equipment, including disposal of decontamination by-products; the selection and preparation of sample containers, sample volumes, and preservation methods; and maximum holding times to sample extraction and/or analysis. Procedures for groundwater are in the Bacchus and Promontory permits and Procedures for other media will be addressed are in the SAPs.

B3 – Sample Handling and Custody

Written documentation of sample custody from the time of sample collection through the generation of data is recognized as a vital aspect of an environmental study. The Chain-of-Custody (COC) of the physical sample and its corresponding documentation will be maintained throughout the handling of the sample. All samples will be identified, labeled, and logged onto a COC or Request for Analysis form, as a part of the procedure designed to assure the integrity of the resulting data. The record of the physical sample, including the location and time of sampling, will be joined with the analytical results through accurate accounting of the sample custody. Sample custody applies to both field and laboratory operations. All laboratories completing chemical analyses will be required to maintain samples in a secure location with limited access from the time of sample receipt through sample disposal.

Samples collected will be either shipped to the laboratory via a commercial carrier or will be hand-delivered to the analytical laboratory when possible. All packaging materials and samples will be reviewed for compliance with changes in air shipment regulations when shipping by commercial carrier. If the samples are shipped via a commercial carrier, the following procedure will be used for packaging:

1. Inert cushioning material will be utilized when needed;

2. Sample containers will be sealed in re-sealable plastic bags and placed upright in the cooler;

3. Blue ice or wet ice and additional packaging materials will be placed around the containers;

4. Pertinent paperwork such as the COC/Request for Analysis form will accompany shipping papers;

5. When using a commercial provider a shipping label will be affixed to the outside of the cooler.

Upon arrival at the laboratory the Chain-of-Custody documents will be signed to relinquish/receive the samples. The sample packaging and sample integrity will be inspected by the laboratory personnel and the condition including temperature of samples will be documented. Any problem that may affect the outcome of the testing will be communicated to the customer at that time in order to determine if the samples will be tested or if a re-sample is needed. The communication and final decision with regard to testing will be documented.

B4 – Analytical Methods

Chemical analyses of samples will be completed by using specific laboratory methods in accordance with turn-around time for the completion of analyses and laboratory data reporting specified in SAPs. These methods may include analysis of explosives, volatile organic compounds (VOCs), semivolatile compounds, metals, and perchlorate. Samples will be collected and preserved as described in specific SAPs. Sample holding times are specific to each group of analytes and analytical methods. Holding times for specific samples shall be based on the date and the time of sample collection.

If holding times are exceeded, the laboratory will contact the project manager for direction on whether to analyze the samples out of holding time, (in which case a comment will appear on the final data report regarding the missed holding time), or whether resampling will be done to obtain data analyzed within the recommended holding time.

All laboratories involved will be required to read and comply with the QAPP and SAPs before analyzing samples.

The laboratories chosen to complete the analyses shall not subcontract any portion of the work without prior written approval from the PM. The laboratory shall use analytical equipment and procedures to produce data that will meet the DQOs and requirements as specified in SAPs.

If non-standard analytical methods are proposed for use, the method must be approved by the Division in writing. Detailed descriptions of the analytical method shall be reviewed to ensure that data generated by the method will meet the minimum data quality objectives and requirements as specified in SAPs for a SWMU or a group of SWMUs. The review will focus on the method as supplied by the analytical lab including scope, requirements, applicable documents, materials and equipment, operations, QC limits, detection limits, QA/QC measures, safety, sample preparation and analysis. The data validation process for data generated by the method shall follow the protocol specified in this QAPP and in the pertinent SAP.

B5 – Quality Control

Quality Control checks of both the field sampling procedures and laboratory sample analyses will be used to assess and document data quality and to identify discrepancies in the measurement process that need correction. The minimum analytical laboratory QC samples to be considered for inclusion in the SAPs is provided in Table 4.

Quality control samples will be used to assess various data quality parameters such as representativeness of the environmental samples, the precision of sample collection and handling procedures, the thoroughness of the field equipment decontamination procedures, and the accuracy of laboratory analyses. To evaluate bias and contamination from field-collection procedures, appropriate soil or water blanks will be prepared. In addition, all sample containers, preservation methods, and holding times will be in accordance with QC requirements, as specified in SAPs.

The analytical laboratory will use a series of QC samples as identified in the laboratory QAP and specified in the standard analytical methods. The types of samples include method blanks, surrogate spikes, laboratory control samples, laboratory control sample duplicates, matrix spikes, and matrix spike duplicates. Analyses of QC samples will be performed for samples of similar matrix type and concentration and for each sample batch.

For QC purposes, the laboratory generally categorizes samples into two matrix types: aqueous and solids; which often encompasses a wide variety of matrix types. If for any reason a narrower definition of a matrix is desired (e.g. Clay vs Silty samples being separated), the laboratory may be instructed to spike discrete samples. This should be clearly communicated to the laboratory as it will most likely be different from the standard protocol.

Field Quality Control

Field Quality Control Checks

Field equipment, if used, will be calibrated as frequently as recommended in the manufacturer's specifications. Each calibration including the results will be documented in the field logbook or on a data sheet developed for calibration and signed by the PM. Additionally, quality control samples will be collected during environmental sampling activities. Each type of field quality control sample is defined below.

Field Duplicate Samples

A field duplicate sample is a second sample collected at the same location as the sample designated for collection. Field duplicate sample results are used to assess precision, including variability, associated with both the laboratory analysis and the sample collection process. Field duplicate and regular samples will be collected simultaneously at a rate of 5% or at least one per project, from the same sample interval, providing sufficient material exists, and treated in an identical manner during storage,

transportation, and analysis. When recovery of soil from sampling operations is sufficient, field duplicate samples will be collected at a frequency to be specified in specific SAPs.

Trip Blanks

A trip blank is a sample of distilled and/or deionized, organic-free water preserved with 0.2 ml of HCl provided in three VOC bottles (and may vary in the specific SAPs). Trip blanks will be prepared only for the analysis of VOCs and will be subjected to the same handling as the other samples. The trip blanks will serve to identify contamination from sample containers or transportation and storage procedures. A trip blank will accompany each cooler of samples sent to the laboratory for the analysis of VOCs. If the travel time is brief (e.g. less than 2 hours) this may not be required.

Equipment Blanks

Equipment blanks are collected and analyzed to determine any level of contamination potentially introduced into samples due to the equipment cleaning technique. Equipment blanks will be collected if required in the SAP. General procedures for collecting equipment blanks are as follows (and may vary in the specific SAPs):

Following the collection of a designated sample, the sample collection device will be cleaned using a phosphate-free detergent and rinsed with water. The device will be inspected to ensure it has been thoroughly cleaned and rinsed.

When detailed by specific SAPs, a sample of the equipment sample device rinse water will be collected using the following additional steps:

(1) Collect a sample from the final rinse. Collect the water off the equipment being rinsed into the required sample bottle(s);

(2) Submit the equipment blank for analysis of all waste constituents sampled at the site. This equipment blank will be used to help quantify the potential for cross-contamination between samples due to improperly cleaned sampling devices;

(3) Drum all wash and rinse water generated at the site for characterization and probable permitted discharge to a sanitary sewer; and

(4) Obtain fresh wash water and rinse water from for cleaning operations at different site.

At the completion of sampling operations, all sampling equipment (augers, drill rods, sampling devices, tools, etc.) will be pressure washed. Any additional requirements for equipment blanks will be specified in SAPs.

Field Blanks

Field blanks consist of empty, clean sample containers to be opened in the field and filled with reagent grade water prior to collection of a field sample. Upon collection of the sample, the field blank container is sealed and carried through the same handling, shipping, and analytical procedures as the field sample. Since the frequency of field blanks is project-specific, field blanks will be specified in the SAP. Field blanks may also be collected as needed based on field conditions (i.e., heavy exhaust from a drill rig, etc.).

Laboratory Quality Control

Laboratory analyses will be conducted in accordance with the appropriate analytical methods. Internal laboratory quality control checks will include:

- surrogate spikes for the respective methods;
- method blank (reagent blank) that is carried through the same analytical process as native samples;
- matrix spike/matrix spike duplicates with known concentration in accordance with the laboratory SOPs;
- laboratory control samples/laboratory control sample duplicates that are spiked in accordance with analytical method and laboratory SOPs for each respective method of analysis.

The Laboratory will document continuing calibration check standards, Laboratory Control Samples, surrogates, matrix spike and matrix spike duplicate recoveries, and relative percent differences (RPDs) on statistical control charts.

The laboratory will address all data outliers and add comments in the laboratory database regarding the effect the outlier may have on the usability of the data. If the QC data indicates a systematic problem that makes the data unusable, corrective action will be implemented to resolve the problem and any affected data will be re-analyzed to obtain usable data for reporting.

In order to maintain accreditation the laboratory will participate in a Proficiency Testing program on a semiannual basis. The laboratory will analyze blind samples provided by a 3rd party vendor and must receive acceptable results on two of the most recent 3 Proficiency Testing Studies. The laboratory will report the results to the State of Utah Environmental Laboratory Certification Program office. Corrective Action Investigations will be performed for analytes that do not pass the study criteria.

B6 – Instrument/Equipment Testing, Inspection and Maintenance

Instruments and Equipment will be tested, inspected and maintained as required by the manufacturer for optimal performance. Information about the actions taken and the status of the instrument and Equipment will be recorded in a logbook that is traceable to the specific instrument or Equipment. In the case where a problem is identified, the instrument or Equipment will be taken out of service until

the problem is resolved. The actions taken to resolve the problem and the outcome those actions will also be recorded in the logbook.

Balances –The calibration of Analytical balances will be verified daily or before each use and will be calibrated by a qualified Metrologist annually. The daily verification will be conducted using two calibrated weights that bracket the expected balance use range. Balance calibrations checks will be documented on logsheets.

Refrigerators/Freezers - All refrigerator and freezer temperatures will be monitored. Thermometers used (either continuous or minimum/maximum) for measurement of refrigerator and freezer temperatures will be calibrated at a frequency defined by the manufacturer.

Water Supply System - The laboratory will maintain a water supply system which is capable of furnishing reagent water that is free from target analytes or interfering elements. Such water may be generated from a system that uses deionization, distillation or some combination thereof and may incorporate filtration through carbon filters and/or particle filtration. The water system is considered adequate when reagent blank quality control samples show no positive detections for target analytes or interfering elements.

B7 – Instrument/Equipment Calibration and Frequency

Calibration at a specified Frequency for Instruments and Equipment will be performed as required by the manufacturer or per the analytical methodology in use. Documentation of the calibration will be maintained in a logbook or via the raw data. Acceptance of the calibration will be verified prior to proceeding with testing.

All laboratory instruments will be calibrated with the appropriate standard solution. All reported analytes are to be bracketed by an established calibration curve. Because standard methods allow the lowest standard to be up to ten times the concentration of the MDL, any positive values below this low-level standard and above the project PQL would be classified as estimated. To avoid quantifications of data based on this requirement, the contract laboratory is required to analyze an additional low standard at or near the project PQL. Analytical guidelines and manufacturer specifications determine the frequency of laboratory instrument calibration necessary. All batches of samples analyzed will be bracketed by appropriate calibration verification standards. Corrective actions will be taken if the calibration checks do not meet established criteria.

B8 – Inspection/Acceptance of Supplies and Consumables

Upon receipt of Supplies and consumables the items will be inspected to ensure that they are of the type and quality required by the methodology in use. Items received that do not meet the criteria established will be segregated to prevent inadvertent use.

For Analytical Standards, a Certificate of Analysis that is traceable to a NIST standard will be maintained on file as part of the quality records for the testing activities.

All standards and standard solutions will be catalogued to identify the supplier, lot number, purity/concentration, receipt/preparation date, preparer's name, method of preparation, expiration date, and any other pertinent information. Stock and working standard solutions will be validated before use and checked regularly for signs of deterioration. Standard solutions will be properly stored and handled, and all containers will be labeled to identify the chemical(s), concentration, solvent, expiration date, initials of preparer, and date of preparation. Reagents will be examined for purity by subjecting an aliquot or subsample to the analytical method in which it will be used. The contract laboratory will not use a standard or reagent if its expiration date has passed. Expiration date extension is allowed if it can be documented that the quality is still acceptable for the intended use. Complete documentation will be maintained for all standards and reagents used

B9 – Non-Direct Measurements

Because many of the activities at the Bacchus and Promontory facilities have taken place for many years there is a wealth of historical information available. When this type of information is used to establish the actions taken, the information will be included in a SAP or a report as part of the quality record.

B10 – Data Management

All analytical data produced by Laboratory and the field operations will be stored at each data producer's location.

Data transfer and communications must ensure that only validated data are stored in the project database. The transfer of data from generation, through validation, database entry, and final delivery to the Division can be summarized as follows:

- All field data will be maintained on file.
- The laboratory generates laboratory validated data and sends the reports to the PM.
- The PM reviews laboratory validated data to ensure it complies with project objectives.
- The PM coordinates third party validation of a percentage of the laboratory-validated data.
- The report from the third party validators are maintained in the project database.

The PM forwards copies of validated data as required in the permit.

Validation of Laboratory Data

The Laboratory will provide a QC review of their respective data in accordance with the relevant laboratory QAP. The laboratory will enter validated data into the laboratory information management system.

The PM may request third party validation of a percentage of the data. The percentage will be dependent on the DQOs specified in the SAPs.

Validation of Field-Generated Data

All field generated data will be validated by the PM prior to incorporation into the project database. The PM will validate data generated by the field instrumentation in accordance with instructions supplied with the instruments.

Use and Storage of Data

Electronic data and documents shall be backed up to avoid loss. Retrieval of project documents is limited to project personnel who have been granted access to the appropriate electronic files. Sensitive or final electronic documents may be password protected to prevent unauthorized access or inadvertent changes. At project closure, these electronic documents will be copied and electronically stored on a disc or CD. When required an archived hardcopy will be maintained on file.

C – Assessment and Oversight

C1 – Assessments and Response Actions

To provide data having quality measures consistent with the project data quality objectives, the data shall be reviewed against established criteria for precision, accuracy, representativeness, completeness, and comparability. Limits are outlined in this QAPP and the individual SAP. Any data failing to meet the stated limits will be indicated by including data qualifiers on all affected data.

To meet SAP requirements for data quality, periodic assessments may be conducted to assure adherence to SOP requirements for field sampling, sample custody, equipment operation and calibration, laboratory sample analysis, and data reporting. Further, the PM will assess the quality of data generated once sampling and analysis of each project has been accomplished to assure that all data are scientifically valid and of known and documented quality as specified in the project SAP.

If any information found during data assessments calls into question the usability of the data, the PM will investigate the impact and corrective action will be taken to address any concerns. Corrective action may include the need to re-sample and/or re-analyze samples to obtain usable data.

The assessment process is also intended to ensure that there is an acceptable level of confidence in the decisions that are made from the data. Data that fail to meet the QC criteria may still be used for informational purposes, but will be flagged to indicate that the data has limited usability in meeting project objectives.

Data assessments will be conducted by the PM after each sampling event to assure that the QAPP, SOPs, and SAPs have been properly implemented. The PM will ensure that corrective actions are executed for any nonconformance.

Audits may be conducted as a means to determine compliance with this QAPP and SAPs. Specifically, audits may be conducted for both field and laboratory operations to assess performance to project requirements. Several factors will be taken into consideration for determining the scope and frequency for audits as follows:

1. Complexity of the activity;
2. Duration and scope of activity;
3. Degree of QC specified in the SAP;
4. Criteria to achieve quality assurance objectives;
5. Requirements for deliverables;
6. Participation of contractors;
7. Criticality of data collection; and
8. Potential for or frequency of nonconformance.

Addressing Nonconformance: The PM has the authority to stop all or part of the project activities if a nonconformance occurs and the authority to assure appropriate development and implementation of the required corrective actions.

Documentation: All auditing processes and results shall be documented.

C2 – Reports to Management

The PM will keep Environmental Services management apprised project performance assessments and corrective actions. This will be communicated verbally in project progress meetings.

D – Data Validation and Usability

D1 – Data Review, Verification and Validation

Laboratory Data Reduction and Review

Data reduction is the process of transforming raw data measurements obtained during analysis to final reported data. This usually involves various calculations, application of dilution or preparation factors, as well as the use of rounding data values to the appropriate number of significant figures. Reduction of laboratory analytical data will be completed in accordance with the laboratory's quality assurance program and standard operating procedures.

The laboratory will perform the in-house analytical data reduction and QA review under the direction of the laboratory manager or designee. The laboratory is responsible for assessing data quality and indicating in the analytical reports any problems with the data that may affect usability. Any QC outlier will be addressed and a comment in the laboratory database will be made to state any affect the outlier may have had on the usability of the data. The laboratory will take corrective action were appropriate to ensure data generated meets method and project objectives. Data reduction, QA review, and reporting by the laboratory may include the any number of the following QC tasks:

1. The data reviewer will check that preliminary data produced by the analyst are processed and reviewed for attainment of quality control criteria as outlined in the laboratory QAP.

2. The data reviewer will check all manually entered sample data for entry errors and will check for transfer errors for all data electronically uploaded from the instrument output into the software packages used for calculations and generation of report forms and will decide whether any sample re-analysis is required.

3. The data reviewer will review initial and continuing calibration data, and calculation of response factors, surrogate recoveries, matrix spike/matrix spike duplicate recoveries, internal standard recoveries, laboratory control sample recoveries, sample results, and other relevant QC measures.

4. Upon acceptance of the preliminary reports by the laboratory data reviewer, the Laboratory QA Officer will review and approve the data packages prior to report submittal to the PM.

The signing of the Certified Analytical Data Report by the QA Officer indicates that the QC review tasks have been accomplished.

Laboratory Data Package Delivery Requirements

Data deliverables will be provided in a tiered approached as indicated in the SAPs for the individual projects. The tiers, ranging from the simplest data reporting level to the more complex deliverable, are described below:

Certificate of Analysis: A certified report listing all analytical and preparation methods used, sampling dates/times, EQLs, MDLs, dilutions, analysis dates/times, analyst, and results with units of measure, dry weight reporting. Also attached will be any sample receiving documents including Chain-of-custody forms. The final report will include comments indicating any problems with sample receipt, data analysis, or quality control issues that may affect the usability of the data, including explanation of what qualified and flagged data us acceptable for use.

Certificate of Analysis with Quality Control Summary: the next level of complexity in data deliverables would be to include with the Certificate of Analysis a Quality Control Summary report. This report shows the results analysis batch quality control samples, such as blanks, laboratory control samples, matrix spikes, duplicates, initial and continuing calibration verification standards and any other method specific quality control samples. The report will indicated the expected range of acceptability for the quality control samples and flag any data that fall outside of acceptance limits. Where outlier data exists, a comment by the laboratory as to the effect on the usability of the data will be included in the analytical report.

Additional Data on File : The laboratory will maintain on file a full record of the analytical testing and include the following types of information:

1. Calibration/Standardization plots and equations.
2. Initial and continuing calibration verification summary sheets with results of true values compared to found values.
3. Copies of laboratory notebook pages showing data not otherwise recorded and calculations.
4. Digestion and preparation logs
5. Chromatograms
6. Enhanced or background subtracted mass spectra.
7. ICP interference check sample summary.
8. Internal standard area (or recovery) and retention time summary information.
9. Analysis data (including printer tapes, strip charts, etc.) for analysis/reanalysis, calibrations, diluted/undiluted samples, and QC samples.
10. Quantitation and integration reports.

11. Surrogate recovery information.

12. When used: Laboratory generated library standard spectra. For tentatively identified compounds provide the reference mass spectrum or spectra from the software-spectra library.

Electronic Data Deliverable: Any of the above deliverables may be provided in electronic format. The complexity of the electronic deliverable may vary as the needs of the project require.

Field Data Reduction and Review

The PM is responsible for recording data generated by field instruments including but not limited to PIDs, thermometers, barometers, and field analytical test kits in accordance with SOPs provided by the manufacturer or in the SAPs. Data shall be reported in a format to be provided in SAPs and shall include, at a minimum the following QC checks:

1. The PM will check that data produced by the instrument are within the calibration range of the instrumentation and other QC measures relevant to the field instruments. The degree to which the data meet DQOs will be provided in the data report.

2. The PM will check field logs and cross check field sampling locations and procedures with the field data for representativeness.

3. The PM will check all manually entered field data for entry errors and will check for transfer errors for all data electronically uploaded from an instrument output where appropriate.

D2 – Verification and Validation Methods

Laboratory Data Validation

The first level of review will be conducted by the Laboratory. Laboratories have the initial responsibility for the correctness and completeness of the data they generate. The laboratory data reviewer will evaluate the quality of the analytical data based on an established set of laboratory guidelines (laboratory QAP and SOPs). This person will review the data deliverables to confirm at a minimum, the following:

1. Sample preparation information is correct and complete;

2. Analysis information is correct and complete;

3. The appropriate SOPs have been followed;

4. Analytical results are correct and complete;

5. QC sample results are within established control limits and if not, why data is useable;
6. Blank results are within appropriate QC limits;
7. Analytical results for QC sample spikes, sample duplicates, initial and continuing calibration verifications of standards and blanks, standard procedural blanks, and laboratory control samples are correct and complete;
8. Tabulation of reporting limits related to the sample is correct and complete; and
9. Documentation is complete (all anomalies in the preparation and analysis have been documented; holding times are documented).

The second level of review will include data validation conducted on a minimum of ten percent of the certificates of analysis by a third party. The sample-specific requirement review conducted by the third party validator shall include the following:

1) Blanks Analyses
2) Organic Analyses
    a) Holding Times
    b) Surrogate Spike Results
    b) Matrix Spike/Matrix Spike Duplicate (MS/MSD) Sample Analysis
    c) When required: Tentatively Identified Compound Identification
    d) Field Duplicate Agreement
    e) Comparison of EQLs and MDLs with project DQOs (RSL, MCL etc.)
3) Metals and Inorganic Analyses
    a) Holding Times
    b) Duplicate Sample Analysis
    c) Matrix Spike Sample Analysis
    d) Matrix spike duplicate or laboratory duplicate precision
    g) Field Duplicate Agreement
    e) Comparison of EQLs and MDLs with project DQOs (RSL, MCL etc.)

The data package delivery requirements as specified in this QAPP and SAPs will be reviewed for completeness. Data determined to be outside acceptance criteria, using professional judgement, and any conclusions reached concerning usability of the suspect data will be described in the third party data validation reports.

Field Data Validation

The purpose of the validation process is to evaluate the usability of field data that are collected or documented in accordance with specified protocols outlined in the SAPs. Field data will be reviewed for data usability and adherence the project objectives outlined in the SAPs and this QAPP

D3 – Reconciliation with User Requirements

Once the data verification and validation procedures have been completed, the PM will evaluate the results to determine if project DQOs have been met for field operations and laboratory analyses, respectively. The calculations specified in other sections of this QAPP and in SAPs will be used to determine if numeric acceptance criteria have been met. Data, which do not meet the requirements for their intended use, will be flagged accordingly and the flags entered into the project database, so that all data reports used for decision making are clearly noted

ATK LAUNCH SYSTEMS (ATK) PROMONTORY FACILITY
POST-CLOSURE PERMIT

GROUNDWATER SAMPLING AND ANALYSIS PLAN

CONTENTS

FIGURES

TABLES

ATK LAUNCH SYSTEMS
GROUND WATER SAMPLING AND ANALYSIS PLAN
FOR POST-CLOSURE PERMIT MONITORING

1.0 PURPOSE AND SCOPE

ATK Launch Systems (ATK) has developed this plan to satisfy the requirements for a ground water sampling and analysis plan as referenced in R315-264-97 of the Utah Administrative Code and this Permit.

The plan specifically addresses the sampling of ground water monitoring wells at ATK Launch systems Promontory, Utah-based Operations. The location, number, and description of each well have been submitted previously to the Utah DWMRC. The plan addresses all procedures for taking ground water samples, shipping the samples for analysis, and methods for analyzing samples.

The goal of this plan is to collect groundwater samples that are representative of in-situ groundwater conditions and to minimize changes in groundwater chemistry during sample collection and handling. DNAPL's are not known to be present in any screened interval of any well. If DNAPL's are discovered to be present in a well, this document is not sufficient, and protocol for sampling will be developed prior to sample collection.

2.0 QUALITY OBJECTIVES AND CRITERIA FOR MEASURMENT DATA

This section presents the DQOs for the project and the performance criteria necessary to meet these DQOs. Included are discussions of the project DQOs, quantitative DQOs (precision, accuracy, and completeness), and qualitative DQOs (comparability and representativeness). The overall QC objective is to generate data that are of known, documented, and defensible quality.

2.1 DATA QUALITY OBJECTIVES

DQOs are statements that specify the quantity and quality of the data required to support project decisions. DQOs were developed for this project using the seven-step process listed in *Data Quality Objectives Process for Hazardous Waste Site Investigations* (U.S. EPA, 2000). The QC procedures as well as the associated sampling procedures for this project will be focused on achieving these DQOs in a timely, cost-effective, and safe manner. Deviations from the DQOs will require defining the cause or causes for noncompliance and will initiate the process of determining whether additional sampling and analyses will be required to attain project goals.

2.1.1 Statement of Problem

Groundwater monitoring at the ATK facility has shown that, due to waste management practices of the past, contaminants have been released to the groundwater. Some of the contaminants have

routinely been detected at concentrations exceeding the Groundwater Protection Standard (GWPS) established in Module IV of this Permit. Pursuant to R315-264-90, and this Permit, ATK is required to establish a corrective action program when the GWPS is exceeded. Groundwater monitoring data collected in accordance with this SAP will be used for assessing the human health and ecological risk associated with the contaminated groundwater in order to determine the appropriate corrective action. Monitoring data will also be used to update groundwater flow and transport models that are used to predict the migration of contaminants and how points of exposure may be affected. Therefore, the goal of this plan is to outline the methodologies for collection of groundwater samples that are representative of in-situ groundwater conditions and to minimize changes in groundwater chemistry during sample collection and handling.

2.1.2 Decision Statement

Decision statements identify the key questions that the study should address and alternative actions that may be taken, depending on the answer to the study questions. The key questions associated with groundwater sampling at the Promontory facility are:

- Where do the contaminant concentrations exceed the GWPS? and;
- Does the site contamination pose an unacceptable risk to human health and the environment?

The decision statement for this program is to determine where contaminant concentrations exceed the GWPS site-wide and what response is appropriate for those areas. The appropriate response (e.g. removal or treatment of contaminants, site management, or continued monitoring) will be based on the results of groundwater models, human health and ecological risk assessments and a corrective measures study.

2.1.3 Decision Inputs

The most appropriate resolution of the decision statement will require the collection of groundwater samples and potentiometric surface data on a regular schedule. These samples will be analyzed for the constituents shown in Table 1 of this SAP. The analytical methods that will be used are also shown in the table. These data along with historic groundwater data, will be used as inputs to groundwater models and human health and ecological risk assessments. All of this information will be considered and appropriate corrective measures will be proposed in a Corrective Measures Study.

2.1.4 Study Boundaries

Groundwater contamination at the facility exists in at least three separate plumes and in two different aquifers. The boundary of the study is defined by the extent of groundwater contamination and is not limited to the ATK property. The Area of Compliance is defined as all monitoring wells, piezometers and springs located within impacted aquifers and displaying

concentrations that exceed the Groundwater Protection Standard as defined in section IV.C. of Module IV.

The monitoring wells and springs that may be sampled are listed in Table 4-A of Attachment 4. Wells are selected for sampling on an annual basis. Shotgun and Pipe Springs are sampled semiannually, once in the Spring and once in the Fall. Well and spring locations are shown on Plates 1(a) and 1(b), Attachment 4.

2.1.5 Decision Rule

As stated above, groundwater monitoring at the site has shown that the GWPS has been exceeded for a number of constituents. The GWPS for constituents that have been detected at the site are listed in Table IV-1 of the Permit. Based on the requirements of R315-264-90 and this Permit, if the GWPS is exceeded then a corrective action program shall be initiated.

In accordance with Module V, Section A, ATK is currently conducting human health and ecological risk assessments, as part of the corrective action program, using the Director approved groundwater flow and contaminant transport models. The risk assessments are being conducted in accordance with the State of Utah R315-101 Cleanup Action and Risk-Based Closure Standards. The characterization and evaluation of risk is based on developing concentration terms for contaminants (generally the 95% upper confidence limit of the mean) and calculating the reasonable maximum exposure for all exposure pathways. The appropriate response action that will be taken at the site will be dependent on the results of the risk assessments.

2.1.6 Tolerable Limits on Decision Errors

Tolerable error limits assist in the development of sampling designs to ensure that the spatial variability and sampling frequency are within specified limits. However, the location, number, and frequency of sampling at the Promontory facility has been previously determined by the requirements of the Post Closure Permit and compliance monitoring downgradient of identified Solid Waste Management Units. The selection of the well locations was based on professional judgment rather than statistics. Therefore, error limits are not used to determine sampling locations or frequency. There is no need to define the “gray region” or the tolerable limits on the decision error, since these only apply to statistical designs.

In general, the steps necessary to minimize errors and produce good quality data will be incorporated into quality assurance/quality control (QA/QC) protocols in this plan.

2.1.7 Selected Sampling Design

The proposed sampling locations (monitoring wells) were drilled in areas based on best professional judgment, site history, aerial photos, and results of previous environmental investigations. A statistical design for collecting groundwater samples will not be used. The Post-Closure care period began in 1992 for the M-136 impoundments. The location of contaminant plumes have been identified based on this collection of data. In addition, due to the large number of wells that exist, plans are submitted annually for which wells will be sampled.

The selection of wells to sample is based on an evaluation of what data is the most pertinent at the time the sampling plan is generated.

2.2 QUANTITATIVE OBJECTIVES

Precision quantifies the repeatability of a given measurement. Precision is estimated by calculating the relative percent difference (RPD) of field duplicates, as shown in the following equation:

$$(\%)\mathbf{RPD} = \frac{\mathbf{Result} - \mathbf{Duplicate\ Result}}{\mathbf{(Result} + \mathbf{Duplicate\ Result)/2}} \mathbf{x100}$$

The laboratory will review the QC samples to ensure that internal QC data lies within the limits of acceptability. Any suspect trends will be investigated and corrective actions taken. The laboratory will document the calculation for %RPD or other statistical treatment used. The results will be compared to the acceptance criteria as published in the mandated test method. Where there are no established criteria, the laboratory will determine internal criteria and document the method used to establish the limits

Accuracy refers to the percentage of a known amount of analyte recovered from a given matrix. Percent recoveries are estimated using the following equation and can be calculated for the project-specific matrix (i.e., water).

Recovery Laboratory Control Standard (LCS) and Surrogate Internal Standard

$$\mathbf{(SIS)\ (\%)} = \frac{\mathbf{(Amount\ Spike\ Recovered)}}{\mathbf{Added\ Spike\ Amount}} \mathbf{x100}$$

Recovery Matrix Spike/Matrix Spike Duplicate

$$\mathbf{(MS/MSD)(\%)} = \frac{\mathbf{(Spiked\ Sample\ Result)} - \mathbf{(Sample\ Result)}}{\mathbf{Spike\ Added}} \mathbf{x100}$$

The recovery of most spiked organic compounds is expected to fall within a range of 70 to 130%.

Completeness refers to the percentage of valid data received from actual testing done in the laboratory. Completeness is calculated as shown in the following equation. The target completeness goal for all compounds is 100%. However, where data are not complete, decisions regarding re-sampling and/or reanalysis will be made by a collaborative process involving ATK Environmental personnel, laboratory personnel, and regulatory personnel. The completeness goal for holding times will be 100%.

$$\text{Completeness \%} = \frac{\text{Number of Measurements Judged Valid}}{\text{Total Number of Measurements}} \text{x100}$$

2.3 QUALITATIVE OBJECTIVES

Comparability is the degree to which one data set can be compared to another. To ensure comparability, samples will be collected at specified intervals and in a similar manner, and will be analyzed within the required holding times by accepted and comparable methods. Comparability will be obtained through the use of standard sampling procedures and trained personnel, and through standard analytical methods used by the laboratory. Additionally, adherence to the procedures and QC approach contained in the QAPP will provide for comparable data throughout the sampling events. All data and units used in reporting for this project will be consistent with accepted conventions for environmental matrix analyses. This approach will ensure direct comparability between the results from one sampling event to the next sampling event using the methods presented in this SAP.

Representativeness is the degree to which a sample or group of samples is indicative of the population being studied. Over the course of a project, samples will be collected in a manner such that they are representative of both the chemical composition and the physical state of the sample at the time of sampling.

2.4 AUDITS AND REPORTING

A Performance Audit will be conducted during a sampling round at least once in a five year period. The performance audit will be used to determine the status and effectiveness of field and laboratory measurement systems.

For the laboratory, this will involve the use of PE samples with known concentrations of constituents that will be analyzed as unknowns in the laboratory. Results of the laboratory analysis will be calculated for accuracy against the known concentration and acceptance limits provided by the supplier or manufacturer.

Field performance will be evaluated using field blanks, trip blanks, field duplicates, and equipment blanks as described in Section B5 of the QAPP.

A Data Quality Audit will be conducted following the procedures specified in Section C2 of the QAPP to assess the effectiveness and documentation of the data collection and generation processes. Data-quality audits will be conducted by the DVSM at least once during a five year period.

A Technical System Audit (TSA) will be performed once each five years. A TSA is a thorough and systematic qualitative onsite audit where equipment, personnel, training, procedures, and

record keeping are examined for conformance with requirements of the QAPP. The TSA will encompass field sampling activities, data validation, and data management. All findings will be documented in writing to the OPM and communicated to the PM when the assessment is complete. A copy of the TSA report will be provided to the Division for review, together with a discussion of all proposed corrective actions and corrective actions taken as a result of the audit.

The TSA will include a field audit to check on sample collection and sample handling procedures. The field audit will include:

- A review of compliance with requirements of the QAPP and Sampling Plans
- On-site visits, which will include observation of field personnel as they perform all aspects of the sampling programs: field equipment calibration, equipment decontamination, sample collection, sample packaging, and documentation. The on-site visits will also include a review of data collection forms, COC forms, calibration procedures, etc. The auditor will also talk individually with field personnel to determine consistency of sampling procedures and adherence to the approved sampling plan.

3.0 SAMPLE COLLECTION

As of March, 2012, 102 groundwater monitoring wells have been installed at the ATK-Promontory facility. The first series of wells was installed in 1985. The RCRA Groundwater Monitoring Technical Enforcement Guidance Document (TEGD) was used as a guide for the installation of monitoring wells once the document was published in 1986. Wells have been completed in both bedrock and unconsolidated sediments and from depths ranging from 25 feet to over 600 feet deep. 20 foot well screens and dedicated pumps were used in the earlier wells that were installed. More recent wells that have been installed utilize 10 foot well screens without dedicated pumps.

ATK collects groundwater samples, in accordance with the November 1992 TEGD, using the pumps described in Section 3.2.3 below or HydraSleeve, no purge groundwater samplers, as described in Section 3.3.1 below. Occasionally, bailers may be used for collecting samples from the deepest wells at the facility. In general, if the well still has an operating, dedicated pump the sample will be collected with the pump using the well purging and sampling methods described below.

In the Spring of 2006, ATK began a study to evaluate the use of the HydraSleeve, no purge sampling method. A plan to evaluate the accuracy of the collection method was submitted to the Division of Solid and Hazardous Waste (the Division) in April of 2006. The study showed that samples collected with the HydraSleeve compared very well with samples collected using the conventional method. The Division approved the use of the HydraSleeve sampler on June 20, 2008. This SAP includes the use of the HydraSleeve sampler as an option for collecting groundwater samples.

The HydraSleeve sampler will be used in all applicable wells, unless the wells have a functioning dedicated pump system.

3.1 WATER LEVEL MEASUREMENT

Before sampling any ground water monitoring wells, a water level measurement will be recorded using an electronic water level indicator to the nearest 0.01 feet. The water level will be recorded in the field book before each monitoring well is sampled. The total depth of all monitoring wells that are completed in unconsolidated sediments will be measured every three years beginning in 2008 and will be recorded to the nearest 0.1 feet in the field book. The northern edge of the (inner) PVC casing shall be used as the reference point. Table 2 contains a list of all wells at the facility that were completed in unconsolidated sediments.

3.2 PURGING THE MONITORING WELLS

The ground water monitoring wells will be purged before sampling begins, unless the well will be sampled using the HydraSleeve sampling method. Monitoring wells shall be purged so that stagnant waters, which are not representative of the waters in the aquifer, can be removed before sampling. The amount of water to be removed from the well will be dependant upon the ground water yield for the formation in which the well is located. Although specific purge and sample systems are described below, other methods may be employed if they meet guidelines approved by the USEPA and Utah DSHW.

3.2.1 Purging High-Yield Formations

A. For high-yield formations (which produce greater than 1 gpm), three casing volumes of water will be removed from the well or until the pH, temperature, and conductance has stabilized within approximately 10% over at least two measurements. A casing volume is defined as the volume of water between the water level measured and the total depth of the monitoring well. The casing volume will be calculated during each sampling period, so that a consistent volume of standing water can be removed prior to each sampling.

B. Low-flow Purging (consistently yields the highest level of data quality), <1 L/min (.26 gpm), Low-flow Sampling < 300 ml/min (0.3 L/min or 0.1 gpm). During purging, the water level in the well should not decrease significantly and should stabilize after purging for a few minutes. Purge the well until the pH, temperature, and conductance have stabilized within approximately 10% over at least two measurements. The pump intake will be positioned within the lower screened interval.

3.2.2 Purging Low Yield Formations

For low-yield formations (which produce less than approximately 1 gpm), wells should be purged at or below their recovery rate so that migration of water in the formation above the well screen does not occur. A low purge rate also will reduce the possibility of stripping VOCs from the water, and will reduce the likelihood of mobilizing colloids in the subsurface that are immobile under natural flow conditions. Make sure that purging does not cause formation water to cascade down the sides of the well screen. At no time should a well be purged to dryness if recharge caused the formation water to cascade down the sides of the screen, as this will cause an accelerated loss of volatiles. Water should be purged from the well at a rate that does not cause recharge water to be excessively agitated until the pH, temperature and conductance has stabilized within approximately 10% over at least two measurements. The pump intake will be positioned within the lower screened interval.

3.2.3 Purging and Sampling Equipment

Wells less than 250 feet deep may be purged and sampled with a variable frequency pump or a bladder pump. Wells greater than 250 feet deep may be purged and sampled using a pneumatic-operated tubing-vented piston pump or a bladder pump. Wells greater than 250 feet with a dedicated system may use a submersible pump for purging and a bladder pump for collection of volatile organic samples or a variable frequency 4" diameter Pump or a bladder pump. Wells greater than 500 feet deep may be purged using a submersible pump and sampled with a bailer or a bladder pump may be used. Variable speed low rate centrifugal pumps and bladder pumps may also be used for both purging and sampling. When dedicated equipment is not used for sampling it should be cleaned in the following manner: Wash the equipment with a non-phosphate detergent. Rinse the equipment with tap water. Rinse the equipment with reagent water. Decontamination fluids should be put in the waste water collection tank and disposed of with the collected well water. Equipment blanks will be taken on approximately 10% of all wells sampled not using dedicated equipment.

The HydraSleeve groundwater sampler can be used in wells that do not have a functioning, dedicated sampling system.

3.2.4 Nested Multi-Screened Well

Wells B-2 and F-2 consist of three two inch inside-diameter well casings nested within an eight-inch diameter borehole. Each casing is screened at a different depth in the aquifer. These wells are also sampled using a HydraSleeve. If a pump is used, purging and sampling is accomplished by using a pneumatic-operated tubing-vented piston pump or a centrifugal, variable speed, low-rate pump. Each casing shall be purged of three casing volumes prior to sampling, or until parameters stabilize.

3.3 SAMPLING PROCEDURE FOR MONITORING WELLS

Each well will be sampled using the following procedure. These procedures will describe specifically the following steps for sampling the wells.

(1) Each well will be purged before removing a sample unless the well will be sampled using the HydraSleeve sampling method as described below.

(2) If purging is required, the sampling pump will be operated to produce a stream of ground water. Before taking a sample, the pH, specific conductance, and temperature will be measured using portable meters. Samples will be taken when the pH, conductance, and temperature have stabilized to within approximately 10% over at least two readings, or after three casing volumes of water have been purged. A sample from the pump will be put into an appropriate container.

(3) For volatile organic compounds, the flow rate will be restricted to less than 100ml/minute while taking the samples. To minimize the possibility of volatilization of organic constituents, no headspace should exist in the containers of samples containing volatile organics.

(4) The samples will be taken in the following order:

1) Volatiles
2) Anions
3) TDS
4) Metals
5) Other Constituents

(5) The number, size and type of sample containers required for the constituents that will be sampled are given in Table 1.

(6) If samples are being split, the samples will be taken directly from the ground water monitoring well. This process will be done in order to minimize volatilization of sensitive organics.

3.3.1 HydraSleeve

The HydraSleeve is a discrete interval, no-purge groundwater sampler. A representative sample is collected by the sampler when it is raised through the water column in the screened interval of the well. A new, clean HydraSleeve sampler is used each time a sample is collected by this method.

One or more HydraSleeves are weighted and placed within the screened interval of the monitoring well. Typically a dedicated pre-measured line allows for the required depth to

be achieved during each sampling event. It is typically left in the well for a period of time to allow the well to re-equilibrate following sampler deployment. To activate, the sampler is pulled up a distance equal to 1 to 2 times the sampler length. The HydraSleeve collects a sample with no drawdown and minimal agitation or displacement of the water column. Once the sampler is full, the one-way reed valve closes, which prohibits any more water from entering the sampler. An alternate approach to activating the sampler is to raise and lower it multiple times over a distance equal to the sampler length. This approach is less attractive because the raising and lowering of the sampler can result in increased agitation of the water in the well and higher turbidity levels in the sample.

The best way to remove a sample from the HydraSleeve with the least amount of aeration and agitation is with the short plastic discharge tube included with each sampler. First, squeeze the full sampler just below the tip to expel water resting above the flexible check valve. Then, push the pointed discharge tube through the outer polyethylene sleeve about 3-4 inches below the white reinforcing strips. Discharge the sampler into the desired containers (per sampling protocol). Raising and lowering the bottom of the sampler or pinching the sample sleeve just below the discharge tube will control the flow of the sampler. The sample sleeve can also be squeezed, forcing fluid up through the discharge tube, similar to squeezing a tube of toothpaste.

3.4 FIELD QUALITY ASSURANCE AND CONTROL PROGRAM

The field QA/QC program is described in the Post-Closure Permit Quality Assurance Project Plan. A general description is given below.

A QA/QC officer has been appointed to oversee the Ground Water QA/QC Plan, implement all phases of the Field Quality Assurance and Control Program, and to periodically audit the laboratory's QA/QC Program. The QA/QC officer will work with the sampling staff and the laboratory's QA/QC officer to assure that the data collected from the ground water is accurate. The QA/QC officer duties include:

1. Making sure that the Ground Water Sampling Plan is followed.

2. Making sure the laboratory follows their QA/QC plan.

3. Send spiked samples periodically to the laboratory to audit the QA/QC program.

3.4.1 Trip Blanks, Field Blanks and Field Duplicates

Trip blanks, when collecting VOC's, will consist of not less than ten percent of the total of samples, and will be made of deionized water, prepared at the laboratory immediately before leaving on a sampling run. The trip blanks are then placed in a cooler which will be filled by

other samples: the trip blanks are handled in the same manner as other samples. Holding times for a trip blank begins when groundwater samples are being collected.

Field Blanks (field rinsate blank, decontamination blank, equipment blank)

Collect one field blank for every 10 samples collected. Decontaminate the sampling equipment for the field blank the same way you do when collecting other samples. After decontaminating the sampling device (e.g., bailer or pump), fill it with laboratory reagent grade water, then collect a sample of the reagent grade water, this is your field blank. The field blank should be analyzed for the same parameters as the samples. Field blanks are not required if you used dedicated sampling equipment (permanently left in the well) or disposable sampling equipment.

Field duplicates, consisting of not less than ten percent of the total samples, will be collected and stored with the water samples. The field duplicates are collected and handled at the same time and in the same manner as a regular sample. The results of these samples are compared against those of the appropriate regular sample.

3.4.2 Blind Controls and Spiking Samples

Annually, the QA/QC officers will send a spiked sample or a blind control to the laboratory to audit the laboratory's QA/QC program. A blind control and a spiked sample both are samples with a known amount of solute in a solvent. The difference between a blind control and a spiked sample is the following:

1) Blind Control – An unannounced spiked sample sent to the laboratory.

2) Spiked Sample – An announced spiked sample sent to the laboratory.

The level of contamination in either case is not divulged to the laboratory.

The QA/QC officer will review the spike or blind control recovery. If the spike or blind control recovery is out of line with the laboratory's surrogate spike and matrix spike recoveries, the laboratory's QA/QC officer will be contacted to resolve the problem.

3.4.3 Sample Handling

Sampling equipment and techniques have been designed so that the ground water sample is not contaminated or altered. A critical part of obtaining samples is proper sample handling. All of these procedures will be followed for handling ground water samples.

All samples requiring refrigeration will be stored in a secured refrigerator or ice chest with ice. Sample preservation requirements and maximum holding times for the constituents that will be collected are shown in Table 1. All samples will be labeled and accompanied by a laboratory request and chain of custody sheets.

3.4.4 Labeling Samples

All sample containers will be labeled with the following information:

1) Sampling date and time
2) Sample number
3) Name of person taking samples
4) Parameters to be analyzed in sample
5) Location of sampling point
6) Preservative added (if applicable)

3.4.5 Field Book

During each sampling period, the person sampling the ground water wells will keep a field book into which all relevant information regarding sampling will be recorded. The data must be entered in the book using permanent ink. The following information will be entered into the field book as applicable to the sampling method:

1) Signature and date of person(s) conducting the sampling.

2) General weather conditions.

3) Date and time each well is sampled.

4) Sample number and location of sample (i.e., well number).

5) Static water level in well.

6) Volume of a casing of well (if applicable).

7) Well depth

8) Flow rate, and purge start and stop times.

9) Well purging procedure and equipment

10) Well yield (high or low) and well recovery after purging (slow, fast)

11) PH, specific conductance, and temperature measured during stabilization of well.

12) Sample withdrawal procedure and equipment

13) Internal temperature of field and shipping containers

14) Conductance and pH meter calibration date.

15) Any irregularities in the sampling procedures or in the conditions of the wells.

16) Any other information the sampler deems necessary or important during sampling.

3.4.6 Chain-of-Custody Control Procedures

All samples will be controlled by chain-of-custody procedures. All samples shall be accompanied by a chain-of-custody form. This form must be completely filled out, signed, and dated by the sampler. An example of the form is found on Figure 1.

The containers will be placed in a lockable cold storage box, or refrigerator. This box will be in the possession of the person charged with the custody of the samples or the box will be locked and placed in a secure place. Under no circumstances will the box with the samples be left unlocked or unattended. A copy of all the Chain-of-Custody forms will be reviewed for accuracy and filed by the QA/QC officer.

3.4.7 Field Equipment Calibration Procedure

The pH and conductivity meters will be calibrated with a standardized solution in accordance with the manufacturer's specification each day they are used when collecting samples. Record of these calibrations will be kept in the Field Log Book.

3.5 SAMPLE COLLECTION SCHEDULE

The ground water monitoring wells will be sampled annually in accordance with Module IV. Shotgun and Pipe Springs are sampled semiannually, once in the Spring and once in the Fall.

4.0 ANALYSIS OF GROUND WATER SAMPLES

Wells will be sampled for constituents specified in the post-closure permit. Samples will also be analyzed for the field water quality parameters pH, temperature, and conductance as applicable.

4.1 ANALYTICAL LABORATORY

All samples will be analyzed by a state certified laboratory using EPA or State approved analytical methods. If there is not an established EPA or State approved analytical method, the Utah Director of DWMRC will be notified for approval of the proposed analytical method.

If the laboratory is not State certified to do a specific analysis, the laboratory will subcontract a State certified laboratory to do the analysis. Table 1, contains a listing of analytes, methods, containers, and holding times.

5.0 REPORTS

Reports submitted annually to the Utah DEQ will include raw analytical data and analysis of data as described in Section D of the QAPP.

5.1 PRESENTATION OF ANALYTICAL RESULTS

The analytical results received from the laboratory will be placed on a computer for easy data manipulation and presented in the following manner:

5.1.1 Listing of Data

All the collected monitoring data will be presented in a list. This list will be presented according to monitoring well and will include all of the data produced from sampling the monitoring well. The list will include the following data:

- Ground water contaminant constituents
- Monitoring well number
- Date sample was taken
- Concentration of constituents
- Units
- Laboratory detection limits (including the method detection limit and estimated quantitation limit)

FIGURE 1

CHAIN OF CUSTODY

Page ____ of _____

ATK Launch Systems, Promontory Utah

Collected by:	Project:
Contact:	Collection Location:
Telephone:	Work Order:

Turn Around Time: _____

SAMPLE NUMBER	LAB	DATE SAMPLED	TIME SAMPLED	NUMBER OF BOTTLES	ANALYSIS REQUESTED

Relinquished by:	Received by:	Date/Time

TABLE 1. SAMPLING AND ANALYTICAL METHODS REQUIREMENTS

Parameter	Matrix	Analytical Method	Containers per sample (number, size, and type)	Preservation Requirements (temperature, chemical)	Maximum Holding Time (to extraction)	Lab Holding Time (after extraction)
Volatile Organic Compounds	Water	USEPA Method 8260B - ATK SOP 401	3-40 ml glassTeflon cap	Cool 4^{o} C HCl to pH<2	14 Days	40 days
Perchlorate	Water	USEPA Method 314-ATK SOP 314	250 ml nalgene	Cool 4^{o} C	28 days	28 days
Metals: As, Ba, Be, Co, Cr, Mo	Water	USEPA Method 6010B-ATK SOP 364 USEPA Method 7471A-ATK SOP 373	500 ml nalgene	Cool 4^{o} C HNO_3 to pH<2	28 days (Hg); 6 months (other)	40 days
RDX	Water					
HMX	Water					
Nitrate	Water					

Table 2 – Groundwater Monitoring Wells Completed in Unconsolidated Material

Well	Total Depth	Well	Total Depth	Well	Total Depth
A-7	242.00	G-1	97.70	LF-2	154.75
B-5	178.20	G-2	98.60	LF-3	153.80
B-6	127.00	G-3	26.00	M-508-1	203.00
B-7	97.00	G-4	76.35	M-508-2	199.40
B-8	112.95	H-1	47.00	M-508-3	202.29
C-7	108.30	H-2	58.30	M-508-4	200.68
E-1	126.25	H-3	81.30	M-508-B1	182.00
E-2	120.00	H-5	48.30	P-1	257.00
E-4	132.90	H-6	53.58	P-2	178.48
E-5	122.00	H-8	143.70	P-5	127.00
E-8	228.00	H-9	12.85	P-6	93.25
E-9	234.00	H-10	30.0	P-7	90.58
F-1	107.00	J-1	145.00	P-8	179.20
F-2A	151.75	J-3	147.70	P-9	193.00
F-2B	217.20	J-7	146.25	P-10	105.00
F-2C	319.15	J-8	166.35		
F-3	108.00	LF-1	136.95		