# Quality Assurance Project Plan

## Montana Board of Oil and Gas Conservation

**2535 St. Johns Avenue**
**Billings, Montana 59102**

## Class II Underground Injection Control Program

**Version 2**

**October 20, 2023**

**Effective Date: October 23, 2023**

**October 23, 2023 to October 23, 2028**

## 1.0 TITLE AND APPOVAL SHEET

10/23/23

**Ben Jones, Administrator** Date
**Montana Board of Oil and Gas Conservation**

10/23/23

**Perry Fields, QA Officer** Date
**Montana Board of Oil and Gas Conservation**

LINDA BOWLING Digitally signed by LINDA BOWLING Date: 2023.11.07 16:10:03 -07'00'

**Linda Bowling, Project Officer** Date
**U.S. EPA, Region 8**

VALOIS ROBINSON Digitally signed by VALOIS ROBINSON Date: 2023.11.08 09:52:17 -07'00'

**Valois Robinson, QA Designated Approving Officer** Date
**U.S. EPA, Region 8**

## 2.0 TABLE OF CONTENTS

## 3.0 DISTRIBUTION LIST

In order to maintain an effective Quality Assurance/Quality Control program that is user friendly and reflective of how the Underground Injection Control (UIC) project work is conducted, it is essential that this QAPP be kept current and that all MBOGC personnel involved in the work effort have a current version of this document on hand for reference and guidance. The QA Coordinator shall be responsible for distributing the most current copy of the Quality Assurance Project Plan (QAPP) to the following group.

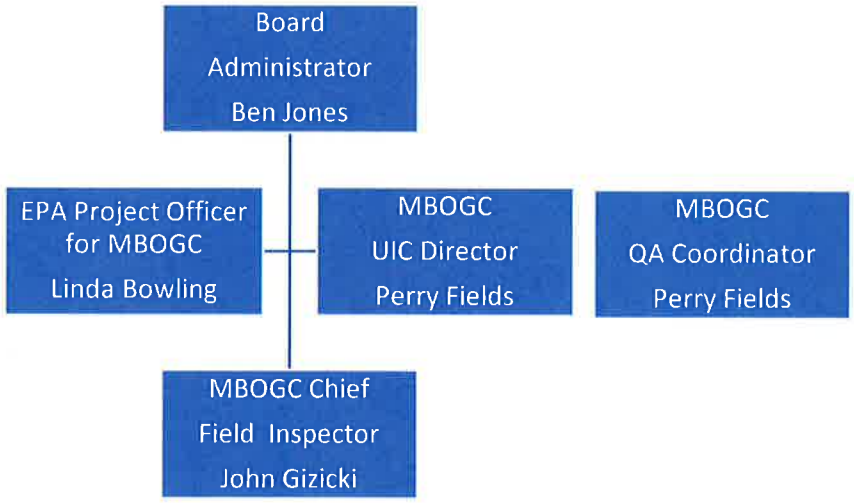
The current MBOGC QAPP is being distributed to the following personnel:

| | |
|---|---|
| Ben Jones | Administrator - Petroleum Engineer<br>MBOGC |
| Perry Fields | UIC Program Director – QA Coordinator<br>MBOGC |
| Linda Bowling | EPA Project Officer<br>EPA Region 8, Denver CO |
| Douglas Minter | UIC Section Supervisor<br>EPA Region 8, Denver CO |

## 4.0 PROJECT TASK/ORGANIZATION

The following depicts the project organization for the Montana Class II UIC Program along with positional responsibilities:

| | |
|---|---|
| Board Administrator | Responsible for setting of policy in UIC matters |
| UIC Director | Responsible for permitting of injection wells and day-to-day program operation and maintains official project plan |
| Secretary | Responsible for preliminary review of all forms received, filing, and typing |
| Chief Field Inspector | Responsible for overseeing all field activities |
| QA Coordinator | Responsible for QA/QC oversight |



## 5.0 PROBLEM DEFINITION/BACKGROUND

The Montana Board of Oil and Gas Conservation (MBOGC or the Board) UIC program regulates Class II injections wells on all lands within the exterior boundaries of the State of Montana except for Indian Lands. Figure 1 shows the extent of Montana State lands and Indian Lands within the State of Montana. Primary enforcement authority (primacy) for MBOGC UIC regulatory program was approved by EPA pursuant to section 1425 of the Safe Drinking Water Act (SDWA) on November 12,1996. Notice of this approval was published in the Federal Register on November 19, 1996; the effective date of this program is November 19, 1996. [40 CFR 147 Subpart BB].

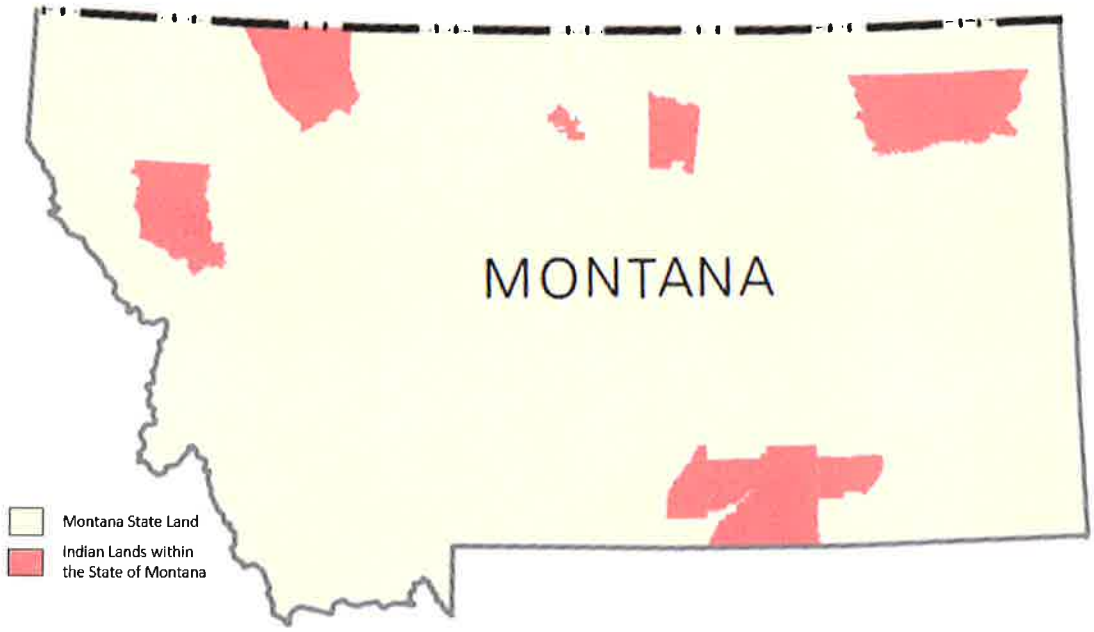



*Figure 1. Map showing the locations of Montana State Land and Indian Lands within the State of Montana.*

The Board currently regulates over 1,200 injection wells. The inventory and location of injection wells is available from the MBOGC's Online Oil and Gas Information System[1].

Amendments to the Environmental Protection Agency (EPA) General Grants Regulations (40 CFR · Part 30) Require all State agencies which receive financial assistance to implement a Quality Assurance (QA) Plan. Montana is a primacy State for the UIC Program for Class II wells and as such, Federal regulations 40 CFR 30.503(e), 146.13(b){l) and 146.33(b){l), and Section 1425 of the SDWA are relevant to Montana's UIC QA Plan. Federal regulation 40 CFR 30.503(e) requires that the State prepare a QAPP for environmental measurements.

Although MBOGC collects its own UIC data (e.g., to assess compliance), MBOGC also uses a great deal of data, self-reported by the regulated community, as the basis for its regulatory decisions (e.g., permit issuance). It is required that operators of Class II injection wells in Montana comply with all requirements of this QAPP.

[1] https://bogapps.dnrc.mt.gov/dataminer/UIC/UICWells.aspx

The UIC Program was established to prevent contamination of Underground Sources of Drinking Water (USDWs) that can result from the operation and abandonment of injection wells. Because injection well practices vary considerably, the means by which an USDW can become contaminated may also vary. Listed below are the most common potential routes of USDW contamination for Class II wells.

Class II wells are used primarily for the deep disposal of oil and gas production produced water or for the enhanced recovery of oil and gas. Contamination of USDWs most commonly occurs due to a leak in the well tubing, packer or casing, fracturing of the confining zones that surround the injection zone, inadequate cementation of the casing to the wellbore, or migration of produced water out of the injection formation through abandoned or/or inadequately constructed wells.

The UIC program reviews data submitted by injection well permit applicants and permittees, conducts data gathering and field investigation activities in support of decision-making processes under the rules of the program in support of permitting and enforcement actions. Environmental sampling is completed to obtain the chemical, physical, and/or biological analyses to:

1. Determine baseline and background concentrations and conditions of the formation approved for receiving produced water.
2. Determine the chemical concentrations and physical conditions of produced water approved for injection.
3. Determine compliance of injection well operations with permitted conditions.

This QAPP prescribes the general methodology for addressing the QA/QC elements.

## 6.0 PROJECT/TASK DESCRIPTION

The MBOGC has primacy for the regulation of Class II injection wells within the exterior boundaries of the state of Montana except for tribal lands. These regulations use a wide variety of raw data in its efforts to protect USDWs. Typical data collected for use in the UIC program provides information concerning local geology, water quality of injected formation fluids, operating conditions such as pressure, volume, flow rate, and well construction. Additional information may be found at the following internet locations:

- MBOGC UIC regulations found at:
  Rules and Statutes (mt.gov)

- UIC Program information at:
  https://www.epa.gov/uic

- Information regarding Class II UIC permit requirements at:
  https://www.epa.gov/uic/uic-class-ii-permit-application-completeness-review-checklist

- UIC Regulations and SDWA Provisions is found at:
  https://www.epa.gov/uic/underground-injection-control-regulations-and-safe-drinking-water-act-provisions

Raw data is used by the UIC program for three distinct functions: permitting, compliance, and enforcement. The sources of this information include raw data collected during field inspections, information archived in the MBOGC office, or submitted to the MBOGC by contractor or laboratories. This data is used to determine the geology underlying injection wells, a well's operating conditions, and the chemical nature of the injected formation fluids. Each of these functions is explained in more detail below:

1) PERMITTING

Permitting data is provided via the Application for Permit to Drill (APD) form found in **Appendix A** and the Sundry Notice form found in **Appendix B**. During permitting, technical data is reviewed in order to determine whether an injection facility can be operated in such a way that USDWs are not contaminated. Permitting involves determining the location of all USDWs surrounding the facility, identifying suitable injection and confining formation(s), reviewing analyses of the injected fluid, establishing operating conditions, requiring certain well construction standards, and establishing monitoring and reporting frequency. The permit application also contains water quality information about the injection zone native fluids. If the total dissolved solids concentration of injection zone fluids is less than 10,000 mg/l, the injection zone is a USDW. The injection well may not be authorized for injection unless an aquifer exemption is approved by EPA as a modification to the MBOGC UIC program.

2) COMPLIANCE

Following MBOGC's issuance of authorization for injection well operation, MBOGC conducts inspections to determine whether the facility is operating in compliance with the conditions specified in the permit or regulations. Operators submit reports required in the permit to verify compliance. Typical compliance data collection activities include the following:

a) Well Inspections – are completed annually by MBOGC inspectors, where the focus is on how the well is being operated. Inspectors use equipment present at the facility for field measurements. Typical observations are made regarding injection and annulus pressures, injected volumes and rates, source of injected fluids, monitoring equipment, and the construction, status, and condition of the well. Field inspection forms (included in **Appendix C**) are routinely completed on-site by MBOGC inspectors. Over 1,200 wells, representing the entire MBOGC injection well inventory, are inspected every year. The UIC Supervisor reviews and approves inspection reports and identifies violations.

b) Operator submission and MBOGC review of monthly monitoring reports using the Report of Subsurface Injection form in **Appendix D**. Reporting information includes:
    - Monthly max injection pressure
    - Monthly injection volume
    - Total cumulative injection volume

c) Mechanical Integrity Tests (MITs) – are required for all UIC wells whether the well is for saltwater disposal or enhanced oil recovery (eor). Mechanical integrity tests help to ensure that leaks are not occurring in the annular space between the casing and tubing, which could put USDWs at risk for contamination. Operators report MIT results on the form included in **Appendix E**. UIC permits require the following testing frequency:
    - MIT required every 5 years for active injection wells
    - MIT required every 2 years for Temporarily Abandoned (TA) wells

Information is entered into the UIC Program Risk Based Data Management System (RBDMS) for compliance review of injection pressure and tracking of cumulative injectate volume over time.

3) ENFORCEMENT

In those cases where an operator is not in compliance with one or more conditions of the permit or regulations, MBOGC will seek to ensure the operator returns to compliance through compliance assistance and/or enforcement actions. First, MBOGC provides compliance assistance to the operator. If the operator does not come into compliance in a timely manner, MBOGC will establish a deadline compliance. If compliance is not achieved by the deadline, then MBOGC will issue an enforcement action.

All information gathered during permitting and compliance activities may be used for enforcement actions. Sources of this information may include data collected by MBOGC or MBOGC contract personnel, data submitted by the operator, data gathered from other Federal, State or local government agencies, or data submitted by third-party contractors and laboratories.

Depending on the type and use of the data needed, information may be collected as a one-time event, or on a regularly scheduled basis. Also, the timeframe for a regularly scheduled event may vary, for example:

- Information relating to the injection formation water quality may be provided only once during the permit review.
- Mechanical integrity testing is performed at least once every five years.
- MBOGC performs field inspections at an approximate frequency of once every year for each well.
- Class II wells require the operator to observe and record wellhead operating conditions every month for enhanced recovery wells and for saltwater disposal wells.

Records reviews are conducted during inspections. Criteria for conducting records reviews are:

- When there has been a reporting non-compliance.
- When it has been as least 5 years since a records review has been conducted.

## 7.0 DATA QUALITY OBJECTIVES FOR MEASUREMENT DATA

All data collection activities for permit applications and compliance evaluations are subject to the general Data Quality Objective (DQO) of demonstrating that no injection activities allow the contamination of any USDW. Compliance evaluation data must be of sufficient quality to identify a violation of permit or regulatory requirements and support an enforcement action when a violation has been discovered. All sampling activities must be representative of media being characterized including geologic characterization of the injection zone and confining units, injection zone groundwater quality and injectate characteristics. It is the operator's responsibility to determine the number and location of samples required for any analytical determination of contaminants within an injection facility to satisfy requirements of MBOGC regulations. However, MBOGC will determine if the sampling information meets the DQOs for data completeness.

The Board intends to use this QAPP as a standard for the collection, handling, and analysis of all environmental data submitted to the Board in relation to its Class II UIC Program. As specified in Section 5.0 (above), federal regulations require that the Board prepare a QAPP for all environmental measurements. This QAPP provides guidance for operators of oil and gas exploration and production

facilities within the State of Montana to assist them in formulating effective sampling programs and procedures for developing permit applications and collection compliance data when necessary or required by the MBOGC. Therefore, this QAPP must be followed by all Class II injection well operators and laboratories involved in handling and analyzing environmental data relating to the Board's Class II program.

The MBOGC adopts this QAPP in conjunction with UIC primacy delegation. Copies of the QAPP will be sent to each operator of record and to each laboratory located or doing business in the State of Montana within thirty days after the MBOGC adopts the UIC program. All MBOGC staff and Board members will also be provided with the QAPP at that time. The names and addresses of laboratories will be obtained from the Montana Department of Health and Environmental Sciences' records of certified laboratories.

Copies of this QAPP can be obtained from the MBOGC office. This QAPP is current as of the date appearing at the bottom of this page. It is the operator's and laboratory's responsibility to obtain current copies of QAPP's issued by the MBOGC.

There are no starting or ending dates specific to the UIC Program because it is an on-going program. Because the UIC Program is very dynamic, the MBOGC may amend this plan at any time. The operator should consult with an environmental contractor or laboratory for the latest information pertaining to acceptable QA/QC procedures.

Data Quality Objectives for the UIC program include:

- Permit applications of sufficient completeness and quality to enable MBOGC to determine if an injection facility can be operated in compliance with UIC regulations and USDWs will be protected from contamination.
- Permit applications must also be of sufficient completeness and quality to enable MBOGC to establish protection permit requirements such as well construction standards, operating conditions, types and frequency of monitoring and reporting.
- Compliance review data from facility inspections, operator reports, inspection of records maintained at the operator's facility of sufficient completeness and quality to allow MBOGC to determine that injection wells are operating in compliance with permit and regulatory requirements.
- If a non-compliance is discovered, compliance review data of sufficient quality to support the resulting enforcement action.
- Analytical results from injectate sampling of sufficient quality to determine that to allow MBOGC to determine that injection wells are operating in compliance with permit and regulatory requirements and if a non-compliance is discovered, of sufficient quality to support the resulting enforcement action.
- Summary data quality indicator statistics are discussed below for each type of matrix to be sampled, where applicable.

MBOGC uses the permit application review checklist in **Appendix F** for this purpose to ensure completeness and quality of permit application data. MBOGC uses the inspection form in **Appendix C** and the inspection SOP in **Appendix G** to ensure completeness and quality of data collection during

inspections. MBOGC refers to monitoring and reporting permit requirements to ensure completeness of operator monitoring reports and records maintained at the operator's facility. Sampling and analytical techniques that are consistent with SOPs will be used to ensure that representativeness and comparability are addressed to the maximum extent possible, given the constraints of the type of project being conducted. Precision, bias, accuracy, and measurement range are to be addressed according to the guidelines discussed in the Section 13.0 Quality Control Requirements.

**Standard Analytical Methods**

For all environmental data submitted to the Board, all analyses must be done in conformance with standard United States Environmental Protection Agency (EPA) standard methods as specified in 40 CFR 136 (if applicable). Results of analyses submitted to the Board that are not performed in accordance with standard EPA methods or equivalent methods may not be accepted by the Board. Analytical methods are included in lists of regulated drinking water contaminants of concern in **Appendix H**. References for Analytical Procedures are included in **Appendix I**. Equivalent methods have the same or lower detection and reporting limits for analytes of concern. It is the responsibility of the operator to verify whether non-standard laboratory analytical methods will be acceptable to the Board prior to sampling and analysis. Failure by the operator to gain prior approval from the Board for using non-standard methods may result in the Board's unwillingness to accept that data.

**Measurement Methods**

Environmental data collection, handling, and analysis should be basic and straightforward in most cases. Typically, operators will provide the Board with groundwater and/or injectate analyses that may be limited to pH, concentrations of total dissolved solids, chlorides, total petroleum hydrocarbons, and/or other types of analytes required by the Board to meet Class II program requirements. (See **Appendix F**) More sophisticated measurements methods may be required in cases of suspected or alleged contamination and will be handled on a case-by-case basis.

The purpose of this QAPP is to ensure accurate data is obtained in complying with the MBOGC Class II UIC regulatory program, and to verify the presence or absence of pollution causing events associated with the construction, operation, and abandonment of Class II injection wells. Section 82-11-127 specifies that "No person may cause pollution of any state waters or place or cause where the substance is liquid, gaseous, solid, or other substance in a location where the substance is likely to cause pollution of any state waters." For the purposes of the Board's Class II UIC program, the Board must assure that Class II injection well operations do not cause pollution to any state waters, which include groundwater.

The following represents the Board's data quality indicators for data collected are listed below:

**Precision** - MBOGC has established a goal of plus or minus 20 percent is established for sampling precision. Duplicate field measurements will be taken and recorded in field reports. Sampling precision will be evaluated using duplicate field samples. Duplicate field samples will help establish precision among different samples collected from the same site. Splits of the same samples will provide a measure of precision within that sample (sample homogeneity). Laboratory data for sample analysis and QC samples will be reported with analytical results.

**Bias** – Bias is systematic error. A variety of QC samples can be used to determine the degree of bias, such as analysis of samples with a known concentration of the contaminant of concern. These are

known as standards, matrix spike samples, and matrix-specific QC samples. For example, calibration drift is a nonrandom change in a measurement system over time and is often detectable by periodic re-measurement of calibration check standards or samples. The laboratory will report matrix spike recovery results and calibration information with analytical results.

**Accuracy** - Accuracy limits specified for each of the analytical measurement parameters are specified in various EPA methods and procedures. The laboratory will report calibration results and percent recovery of matrix spike samples of known concentration of analyte standard for each analytical method.

**Completeness** - A measure of the amount of valid data obtained compared to that which was expected. A goal of 90 percent completeness is established for results obtained under this plan.

**Representativeness** - The field and laboratory sampling techniques and procedures are designed to ensure that a representative sample or portion thereof was used to generate the analytical data.

**Comparability** - Data comparability is improved by using standardized sampling protocol, analytical methods, and units of reporting. The data reported from the laboratory will be in units consistent with other reporting organizations. All data in a particular data set must be obtained by the same methods to insure comparability of results.

**Method Sensitivity** – Appendix H includes analytical methods and requirement detection limits for each analyte of interest to ensure the analytical method is sensitive enough to support decisions regarding compliance with permitting conditions.

## 8.0 SPECIAL TRAINING REQUIREMENTS/CERTIFICATION

Two distinct categories of personnel generate data: private industry personnel or representatives and MBOGC personnel or representatives. Special training or certification is required for MBOGC personnel specifically for field inspectors. The Board Director and Chief Field Inspector assure that training/certifications are satisfied. Records are maintained in the personnel files.

Required Field Inspector Training and Certification

All MBOGC Compliance Inspectors/Field Investigators are required to complete the following training courses:

- In-person "Basic Inspector Training" before they are qualified to lead inspections
- MBOGC Inspectors also are required to complete the "UIC Inspector Certification Course". This training is provided by the US EPA either virtual meeting or in-person training in locations determined by EPA.
- Montana DRIVE Workshop, Montana DRIVE Summer Workshops (mt.gov)
- $H_2S$ Training Course with CS Consulting

## 9.0 DOCUMENTATION AND RECORDS

Data submitted by operators to the UIC program are categorized into two types: permit application/review data and well operation data for compliance determination. Permitting data is provided via the APD in Appendix A and Sundry Notice Form found in **Appendix B**. Permitting data is kept in the permit files in the MBGOC file room. At this point in time, MBOGC keeps all records in house

indefinitely. Even when injection wells are plugged and abandoned, we retain the records so we can review them for Area of Review for any new injection wells.

Well operation data is collected via three forms including: well inspection form in **Appendix C**, the monthly injection report in **Appendix D,** and the MIT/mechanical integrity test form in **Appendix E**. Data from these reports are captured in the RBDMS and in hardcopy form in the permit files. The RBDMS is backed up twice each week.

Data collected for routine field measurements during inspections include:

1. Pressure - Type of gauge and serial number (if available), location of measurement (pump, tubing, annulus, downhole, etc.
2. Temperature – Type of gauge, location of measurement.
3. Volume – Type of meter, location of measurement.
4. Flowrate – Type of meter, location of measurement.
5. Latitude/Longitude – Method of obtaining data, location of measurement.
6. Fluid Analysis – Description of actual sampling procedures and chain of custody.

Inspection reports are stored in the well files and inspection dates and report information are entered into the RBDMS.

## 10.0 SAMPLING PROCESS DESIGN/SAMPLING METHODS REQUIREMENTS

Although MBOGC and the regulated community perform many types of analyses using raw data, the raw data collected is very limited in scope. All data and information that will be collected is critical to the program. Data elements include injection pressure, temperature, volume of fluids injected, injection rate, and injectate sampling for measurement of pH and analysis of total dissolved solids concentrations. Fluid samples collected of injection zone groundwater are analyzed for concentrations of total dissolved solids. When contamination of a USDW is suspected, fluid sample may be collected for analysis of constituents listed in **Appendix H**. Annual inspections of all the existing injection wells regulated by MBOGC UIC program are conducted year-round. According to UIC permit requirements, operators must perform routine mechanical integrity tests (MITs) on active injection wells every 5 years and on temporarily abandoned injection wells every two years. Operators notify MBOGC staff of the time frame for when MITs will be performed in order to provide opportunity for MBOGC staff to be present on site to observe MITs being conducted. MBOGC tracks the MIT schedule for each well using the UIC program RBDMS database to identify which wells require testing for a given year and to record MIT results.

Non routine mechanical integrity tests will be inspected as needed at the request of the operator. The following discussion includes acceptable data collection methods used by MBOGC.

Well inspections are conducted according to a standard operating procedure (SOP) which is attached in **Appendix G**. Information collected during the inspections is recorded on the Inspection form in **Appendix C**.

**WELLHEAD PRESSURES**

The measurement of injection pressure at the wellhead is the most frequent measurement type in the UIC program. Injection pressure measurements help to confirm that the well is operating in a way that

will not threaten USDWs specifically by exceeding the Maximum Allowable Injection Pressure, (MAIP). In addition, monthly maximum injection pressures and average injection pressures must be provided in an monthly report to the UIC program. These measurements are usually made with a standard pressure gauge attached to the tubing or annulus at the wellhead.

Since the well may be operating (injecting) or shut-in at the time a pressure reading is taken, the location of the pressure measurement is very important. Injection wells are usually constructed with one-way valves installed on the injection line. These valves allow fluid to flow only in one direction (into the well), and they close automatically when fluid begins to flow in the undesired direction (back toward the pumps). One-way valves usually are easy to identify on the injection line. They have a slightly larger diameter than the injection line and are placed in the injection line near the wellhead. They are manufactured with a large arrow (pointing into the well) indicating the direction that fluid is allowed to flow through the valve.

If a well is injecting during a pressure measurement, these one-way valves will not greatly affect the pressure readings **(FIGURE 1 - INJECTING)**. A pressure reading may be taken at any point between the pumps and the wellhead. However, a point closest to the wellhead provides the most representative measurement.

If the well is shut-in during a pressure measurement, the point of measurement is very important. Since the one-way valves automatically close preventing fluid from "backflowing" to the pumps, any pressure reading made between the one-way valves and the pumps will indicate a pressure of 0 psi since the pumps are not operating **(FIGURE 1 - SHUT-IN)**. To get representative tubing pressures at the wellhead, the measurements must be made at a point between the one-way valve and the wellhead.

As with any pressure measurement, all valve(s) shall be open if they are located between the pressure gauge and the point of measurement. On an injection well, valves usually exist on the tubing at the wellhead, and on the annulus. If a well is injecting, the tubing valve will be open. If a well is not injecting, check each valve to make sure that the pressure gauge is not isolated from the desired point of measurement. Also, pressure gauges are usually mounted on small "needle valves." These "needle valves" shall be in the open position (with the gauge in place) in order to read the desired pressure.

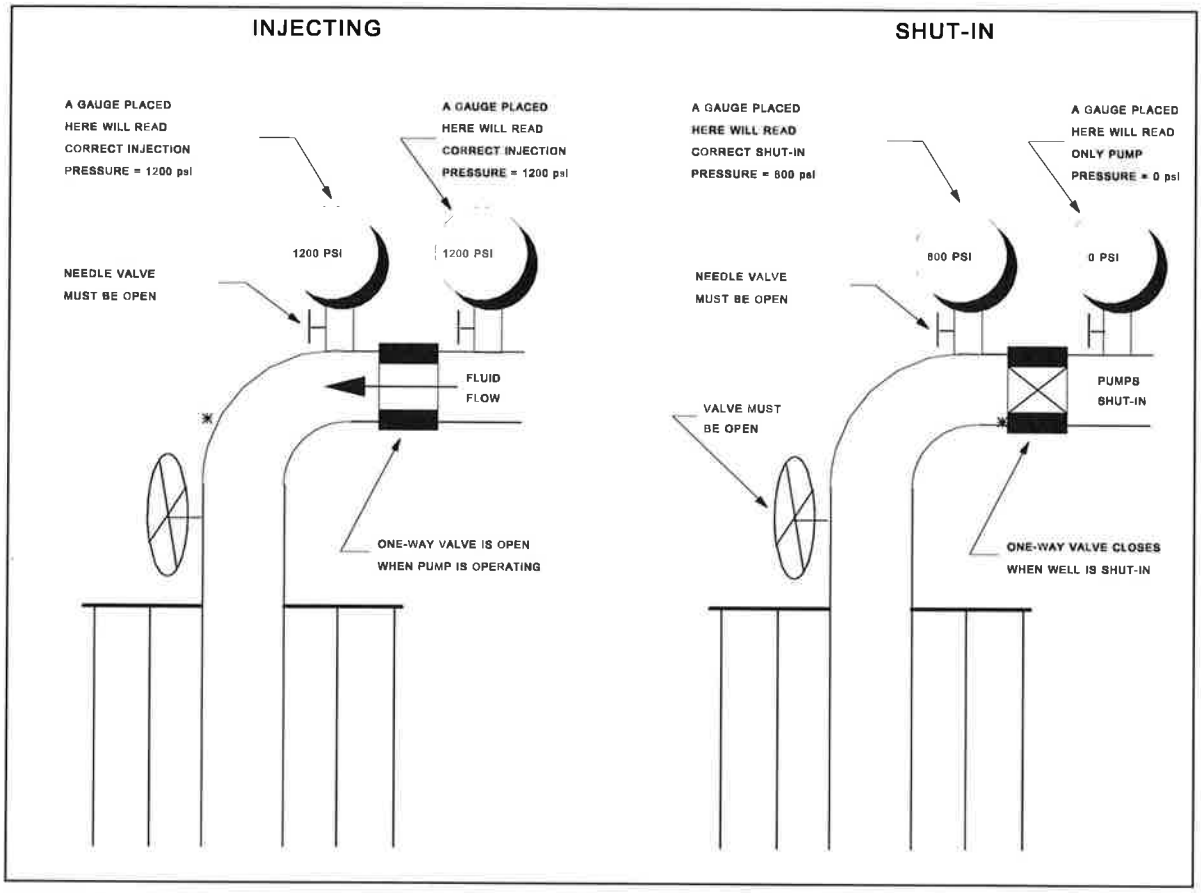



**FIGURE 1 - PRESSURE MEASUREMENTS**

Other devices may be used to measure wellhead pressures. Among these devices are Murphy Switches, flow totalizers, and chart recorders. These devices are typically mounted to support structures separate from the wellhead (either in a pumphouse, or on a stand-alone structure). Pressure measurements are transmitted to the gauge either through small diameter pressure lines connected the well, or via electrical signals sent to the meter from a sensor mounted to the wellhead. When reading pressures from these devices, make sure that the point of measurement (either where the pressure line is connected, or the sensor is attached) is in a suitable location on the well. If the measurement point is isolated by a closed valve, it may be impossible to obtain a meaningful pressure measurement.

Annulus pressure measurements are used to evaluate the mechanical integrity of the tubing, packer, and casing. These measurements may be made during routine field inspections, or during mechanical integrity tests. Pressure measurements shall be made in a manner like tubing pressure measurements, checking to ensure that all valves between the pressure gauge and the annulus are open.

**DOWN-HOLE PRESSURES**

Several well tests (such as step-rate tests and pressure fall-off tests) require measurement of down-hole pressures. These pressure tests help determine Maximum Allowable Injection Pressures (MAIP). One method used to measure down-hole pressures involves lowering a wire-line pressure sensor into the well and recording the pressures that are signaled back to the logging truck. Another method involves

running a small pressure recorder (bomb) into the well with the pressures recorded within the bomb. When the "bomb" is retrieved, the pressure records are then retrieved from the bomb. When obtaining pressures from the wireline tool, or from the "bomb", the logging engineer must provide you with tool calibration checks and standard QC logging procedures. Inspect the tool calibration before and after the logging run and make sure that the appropriate QA/QC methods are followed. File the tool calibration records and QC logging procedures as appropriate.

**MECHANICAL INTEGRITY TESTING**

In addition, a well must demonstrate Mechanical Integrity (MI) routinely to ensure that the well construction as constructed and operated does not allow injected fluids to go anywhere except the intended injection zone thereby protecting USDWs. Any determination that the fluids are not injecting into the intended injection zone is a violation. Two types of Mechanical Integrity Testing (MIT) must be met: internal and external. Internal mechanical integrity testing requires that pressure is applied to the well at either the Maximum Allowable Injection Pressure (MAIP) or 1000 pounds per square inch gauge (psig) whichever is lower. External mechanical integrity is achieved through well design and is checked using cement bond logs, radioactive tracer surveys and temperature logs.

**TEMPERATURES**

Some types of well analyses (for example temperature surveys) require downhole temperature measurements. Temperature surveys can be used to assist in determining external mechanical integrity as well confinement of the injection into the approved injection zone.

The most common method of measuring down-hole temperatures involves running a wire-line temperature probe into the well and recording the temperature data that is signaled back to the logging truck. When obtaining temperatures during a logging run, the logging engineer must provide tool calibration checks and standard QC logging procedures. The MBOGC inspector should confirm that the company performing the work performs the tool calibration before and after the logging run and make sure that the appropriate QA/QC methods are followed.

**VOLUMES OF INJECTED FLUIDS**

Operators are required to include injection volume measurements in the monthly report as well as tracking volume limits to ensure the injectate does not extend past the aquifer exemption boundary. There are several methods commonly used to obtain volume measurements. These include volume indicators, flow totalizers, and pump stroke counters.

Volume indicators (sometimes called barrel counters) may be installed as part of the injection line. These counters look much like automobile odometers. They indicate the volume of fluid that has passed through them.

Flow totalizers are devices with LED display devices and are typically mounted on support structures separate from the wellhead (either in a pumphouse, or on a stand-alone structure). They measure volumes via electronic signals sent from a sensor that is connected to the injection line. When reading volumes from these devices, make sure that the sensor is connected to the injection line at a point which reads the desired volume.

Sometimes an operator may not have a volume meter at the well location. The operator may measure injected volumes via a pump counter. This is like the barrel counter, except that it is installed near the pumps, and the device counts pump strokes. Since each stroke of the pump delivers a known volume, the pump counter can be used as a volume indicator.

**FLOWRATE**

There are several methods commonly used to obtain flowrate measurements. Rate indicators may be installed as part of the injection line. Rate indicators look much like automobile speedometer dials. They show the rate at which fluid is passing through the indicator. Flow totalizers (refer to "Volumes" section) also measure flowrates via electronic signals sent from a turbine sensor connected to the injection line. When reading from these devices, make sure that the sensor is connected to the injection line at a point which reads the desired flowrate.

**LAT/LONG**

Navigation System with Timing and Ranging Global Positioning Systems (NAVSTAR GPS) is a system of satellites, ground stations, and receivers designed to provide 24-hour global, three-dimensional position information in real-time. Portable GPS receivers compare coded time and position data broadcasts from the satellites to calculate locations. Signals must be received from at least three satellites simultaneously to unambiguously calculate location. In order to gain the highest accuracy from hand-held GPS equipment, lat/long data can be corrected with computer software. Corrections of this nature result in an accuracy in the range of a few centimeters. Since MBOGC policy specifies accuracy goals within 25 meters, most GPS measurements for the UIC program are acceptable without this correction. For UIC applications, the GPS instrument shall be placed as close as possible to the point to be measured (wellhead, pump, sump, center of drainfield, etc.).

**SAMPLING PROCESS**

The sampling process for any Class II UIC program is generally limited to an individual Class II injection well, except in instances of suspected, alleged, or confirmed pollution to state waters. Rarely will sample collection include anything other than injectate or groundwater from the subject well. Injectate samples are typically used to verify that only authorized fluids are being injected as specified in Board statutes, rules, orders, or permits. Groundwater samples may be taken to establish the groundwater quality of a subject water producing aquifer or evaluate whether contamination has occurred, which is rare. Sampling requirements will be set by Board permits and orders.

**SAMPLING AND ANALYSIS PLAN**

When sampling will be conducted to evaluate the presence of contamination, MBGOC will develop a Sampling and Analysis Plan using the template found at https://www.epa.gov/quality/sampling-and-analysis-plan-guidance-and-template-v4-general-projects-042014.

A sampling and analysis plan will be developed which includes the following information and procedures:

1. Sample containers
2. Sample collection
3. Sample preservation and handling

4. Holding times and analyses
5. Chain of custody protocol and control
6. Analytical procedures
7. Field and laboratory quality assurance and quality control (QA/QC)

Also, the following records shall be kept for each sampling program:

1. Analyses to be performed
2. Example containers required
3. Shipping forms and other information needed to deliver a proper sample to the laboratory
4. Calculations and statistical analyses
5. Historical sampling data, and other pertinent information

Chemical parameters to be sampled depend on the purpose of the sampling program and shall include those listed in either the Board Regulations or other sections of this document. In addition, site specific parameters shall be chosen based upon the chemical composition of E&P waste at each facility.

Note: It is the operator's responsibility to assure that adequate sampling procedures at E&P facilities are followed. This responsibility includes:

- Determining the constituents to be analyzed depending on the specific conditions of reporting, remediation or disposal as may be required by the Board Regulations.
- Determining sampling procedures within the field to satisfy the objectives set in Section 7.0.
- Determining and assuring that health and safety plans, and procedures for all sampling operations, are in accordance with all federal, state, or local statutes and regulations.

The sampling and analysis plan shall describe a program for ensuring proper calibration of field equipment, decontamination procedures and chain-of-custody procedures.

Any sampling, analysis and reporting program will be executed in a sound and uniform manner in order to fulfill the operator's QA responsibilities. The operator will keep accurate and complete records of all analyses and field work.

**SAMPLING METHODS REQUIREMENT**

Environmental water samples collected for the Board's Class II UIC program will be collected using U.S. Geological Survey National Field Manual for the Collection of Water-Quality Data (NFM) appropriate for the type of sample being taken. Non-EPA approved methods must be approved by the Board prior to sample collection. Because of the diversity of sampling conditions, a sampling work plan will need to be formulated on a case-by-case basis. Most water samples will come from drill stem testing, swab testing, or directly from injection lines or storage tanks. Common accepted methods for taking these samples can be found in the references listed in Section 21.0. The minimum standards specified in the "API Recommended Practice for Analyses of Oil Field Waters," API Report 45, must be met.

Review all existing information including inspection files, laboratory studies, correspondence, the nature of the product or contaminants, and the history of sampling results. The appropriate ASTM sampling method will determine the number and location of samples, the sample parameters, and the necessary equipment for the sampling work plan.

Coordinate with the Board staff to maximize the reliability of the results, avoid duplication of work and maintain good communications.

Visually inspect the sampling locations and analyze media with field instruments (pH and conductivity meters, thermometer, resistivity meter, etc.) prior to sampling in order to verify previous formulated sampling strategy.

The above guidelines are utilized to varying degrees depending on the sampling situation.

**Sampling Strategies for Various Receptacles**

**Wellhead Sampling**

Wellhead sampling such as swab testing, must be done in a manner to assure that the source has been sufficiently flushed of foreign waters prior to taking the sample.

**Tanks and Pits**

Sampling considerations. If stratifications are known or suspected, samples will be taken in a distribution proportionate to the layered volumes. If access to the tank is restricted, samples taken will not be considered representative unless the contents are known to be homogeneous, or unless samples are taken in a distribution proportionate to layer volumes while the tank is being emptied. The typical stratification in pits is generally in a configuration of:

1. Surface fluids, i.e., less dense fluids floating or accumulated on the surface of more dense fluids such as oil, grease or emulsions on water:
2. An intermediate layer of more dense fluids such as produced water,
3. Pit bottom sludges including mixtures of oil and chemical emulsions and soils.

A representative sample of the fluids will be taken using one of the following pieces of equipment. Samples of the pit bottom sludges shall be taken and analyzed separately from liquid portions of the pit contents.

Equipment used for sampling tanks and pits includes weighted bottles or pond dippers.

**FLUID SAMPLING**

Sampling procedures for fluid or sludge that are performed on a routine basis, such as routine Class II annual fluid sampling for Total Dissolved Solids, Specific Gravity, pH, and Specific Conductance are included. Any non-routine sampling procedures required for a specific purpose should be documented in the site-specific field report. The field report should be included the purpose of the sampling event, the sampling method, sample handling procedures, analytical procedures, and the QA/QC aspects of sampling. Since the field report addresses QA/QC concerns in a very site-specific manner, this generalized SOP is meant to be used only as a reference for sampling procedures. More specific SOPs are available on the USGS National Field Manual for the Collection of Water-Quality Data website.

The UIC program uses fluid sample analyses for two primary purposes: 1) to characterize injectate, and 2) to identify quality of the water held within geologic formations. Routine sampling events required by permit or rule shall follow the procedures described below. Each proposed sampling scheme must be evaluated on an individual basis to assure that the best approach is followed and that the samples

obtained are a true representation of the existing conditions. If field conditions call for significant deviations from these procedures, such deviations shall be documented in field notes as appropriate. The identification of all sampling methods, required equipment, decontamination procedures, and performance requirements must be specified in the field report.

**INJECTATE SAMPLING**

When sampling injectate, the goal of sampling investigations is to characterize injectate as close to the point of injection (the point of discharge to the subsurface) as possible. Practically, this point is usually at the wellhead. Potential sampling points become less preferable farther upstream.

When obtaining injectate samples, the following set of procedures shall be followed:

- Include the procedures below to serve as a reference for the field team providing an overview of the specific samples to take and the sampling procedures.
- Upon arrival at the sampling site, conduct a brief survey of the area. The purpose of this survey is to document any irregularities or inconsistencies and to locate and visually inspect the sampling points. Any field modifications shall be noted (see "Fluid Sampling" paragraph in the section for further discussion).
- Prior to taking samples, assemble all sample data sheets for the field log, sample tags, sample labels, chain-of-custody forms, and sample seals. The sample data sheets include the location of the sampling point, sample identification number, matrix, analyses required, preservation technique, and containers used. Sample bottle labels adhere directly to the bottles and include the facility, well, and sample identification number, time of sample collection, and analyses to be performed. The sample tags include a unique tag number to be used on the Chain-of-Custody form, time, date, site identification information, analyses and preservation, and signature of sampler.
- If sampling equipment is to be reused, set up a decontamination area and triple rinse all equipment with deionized water. Collect all rinsate and dispose back into tanks or line at the site for reinjection as directed by owner/operator.
- Transfer the samples from the collection device (if any) into the sorted, pre-labeled containers.
- Log all activities in ink in a bound field notebook whose pages are consecutively numbered. This notebook shall note the author, the personnel on-site, photograph log, facility name and address, facility contact, date and time of sampling, planned sample transport/delivery information, and field measurements and observations. Each page shall be dated and signed as it is completed. Any mistakes shall be crossed out with a single line. The author shall then initial the change.

When collecting samples for specific analyses, samples shall be collected in the following order, and by the following sampling procedures:

1) **VOLATILE ORGANIC COMPOUND (VOC)** - VOC samples are to be taken first in order to limit disturbance and prevent possible loss of volatile components. Sampling for injectate is usually performed near the wellhead. Typical sampling points are sample taps or needle valves on or near

the wellhead. During sampling, take great care to limit turbulence to the grab sample. VOC vials may be used to collect samples directly from the sampling tap or needle valve. In this case, open the sampling valve slowly to better control the amount of fluid flow. VOC Sample Container and Handling - The fluid shall be transferred from any sampling container into pre-chilled, pre-labeled 40-ml VOC vials with Teflon septa. Two 40-ml vials shall be obtained for each sample. Each vial shall be filled to produce a meniscus over the lip of the vial. The screw-top lid with the Teflon septum is then tightened onto the vial which may be turned upside down and tapped to check for air bubbles. The sample must be repoured or retaken if any head space is present. If preservative is present in the VOC vial, then add a few more drops of the injectate to the sample bottle to create the meniscus. VOC vials shall not be filled near a running engine exhaust which could cause contamination through vapor absorption. The samples must then be stored in an ice-filled cooler for shipment to the laboratory. If quality control samples are taken at the site, replicate VOC samples (two pre-chilled, pre-labeled vials) shall be collected and preserved in an identical manner (see "Quality Control Requirements..." Section 13.0 of this QAPP).

If there is chlorine in the injectate, then the sample must be preserved with ascorbic acid or sodium thiosulfate to bind up the chlorine, so it does not interfere with the VOC analysis. If the sample is to be analyzed using the Gas Chromatograph/ Mass Spectroscopy, then ascorbic acid should be used to preserve the VOC sample. Sodium thiosulfate creates interference for GC/MS analyses.

2) **SEMI-VOLATILE ORGANICS** - If the decision is made to analyze for semi-volatiles, these samples shall be collected next. Use the same procedures and preservation described for VOCs above. The approved sample container is a pre-labeled one-liter glass bottle with a Teflon cap. The samples must then be stored in an ice-filled cooler for shipment to the laboratory. A replicate semi-volatile sample shall be obtained as appropriate.

3) **METALS** - Samples for metals analyses may be collected next. All metals samples are collected in the same manner as volatiles and subsequently transferred to certified metals-free containers. Since different metals analyses require different field sampling procedures, a decision must be made prior to sample collection regarding which type of metals data is desired. The most frequent method of metals analysis is for total metals. For this analytical method, an unfiltered sample shall be acidified with 1:1 redistilled $HNO_3$ to a pH of less than 2 at the time of collection. Suitable preservatives may be provided in the sample container by the laboratory. If not added by the laboratory, preservatives must be added to the sample container by field personnel (see note, below). A volume of sample appropriate for the expected level of metals shall be collected. If much suspended material is present, as little as 50-100 ml of well-mixed sample is sufficient. The sample volume required also may vary proportionally with the number of metals to be determined. Consult with the laboratory to determine the appropriate volume.

   (NOTE: If acid preservatives present a field or transportation hazard, the samples may be stored in an ice-filled cooler for shipment to the laboratory. Following acidification in the lab, the samples shall be mixed, held for sixteen hours, and verified to pH < 2 prior to analysis. This procedure is applicable only for Total Metals analysis.)

4) **pH, TEMPERATURE, AND SPECIFIC CONDUCTANCE** - Samples for pH, temperature and specific conductance shall be made as quickly as possible after sampling, preferably in the field. The pH, temperature, and conductivity measurements may be obtained in the field with a temperature-

compensated pH/conductivity meter and/or a thermometer. Measured values for pH, temperature, and conductivity must be noted in the field notebook. Samplers also shall note if the recorded measurements for pH and conductivity were obtained using a temperature compensated instrument.

a. **pH** - Each pH measurement instrument shall be calibrated at a minimum of 2 points approximately 3 pH units (or more) apart, bracketing the expected pH. During calibration, readings shall be brought to within 0.05 pH units of the buffer solution values used. Samples must be collected in an appropriate sampling device and transferred to a container for measurement. If the measured sample pH is above or below the buffer solution values used for instrument calibration, the instrument shall be recalibrated to bracket the measured value. Sample pH and temperature shall be recorded for several successive volumes of fresh, unfiltered sample until pH values obtained differ by less than 0.1 pH units. Instrument electrodes must be rinsed with distilled water between successive samples. If the field measurement indicates corrosivity in the sample, it shall be sent to a lab for further analysis. The laboratory shall be instructed to perform Method 9040 on the sample in order to obtain further data which may be useful for enforcement proceedings. EPA method 1110 from SW-846 (Corrosivity Toward Steel) also may be requested if measured field pH indicates a characteristically hazardous corrosive waste is being discharged.

b. **Specific Conductance** - If analysis is not to be completed within 24 hours of sample collection, the sample shall be filtered through a 0.45-micron filter and be stored in an ice-filled cooler for shipment to the laboratory. Filter and apparatus must be washed with high quality distilled water and pre-rinsed with sample before use. Specific conductance shall be obtained using a temperature compensated conductivity meter.

5) **TOTAL DISSOLVED SOLIDS (TDS) AND SPECIFIC GRAVITY (SG)** - Samples must be collected in a similar manner as VOCs, then transferred directly to sterile glass containers for transport. Samples must be stored in an ice-filled cooler for shipment to the laboratory.

6) **SEDIMENT SAMPLING** - Sediment samples shall be collected following fluid sample collection. A pond sampler may be used to dredge samples from sump or basin bottoms.

a. Sediment VOC - If sediment volatile organics analysis is to be performed, a sediment sample shall be collected first to minimize disturbance of the sediment and loss of volatiles. Using a small stainless-steel scoop, sediment is transferred from the pond sampler into two pre-labeled 250-ml wide-mouth VOC jars with Teflon septa. These jars shall be filled as completely as possible with sample sediment. Jars shall be tapped slightly as they are filled to eliminate air space as much as possible. Both vials comprise a single sample for VOC. The samples must be stored in an ice-filled cooler for shipment to the laboratory.

b. Sediment TCLP Toxicity - A sediment sample for EP Toxicity analysis is collected and transferred into one wide-mouth certified metal-free glass jar with a Teflon lid as described above. The sample must be stored in an ice-filled cooler for shipment to the laboratory.

## 11.0 SAMPLE HANDLING AND CUSTODY REQUIREMENTS

**SAMPLE PRESERVATION AND HANDLING**

All procedures for transferring samples from the field to the laboratory should be specified. The type of sample containers to be used to collect samples, as well as the procedures to be used to ensure that sample containers are free of contamination prior to use, shall be identified. The container type as well as cleaning procedure depend on the parameters being sampled. Sample preservation is intended to retard biological action, hydrolysis and reduce sorption effects. Preservation methods are generally limited to pH control, chemical addition, refrigeration, and protection from sunlight.

1. Sample Labeling. A sample numbering system must be used that provides a tracking mechanism to allow retrieval of sample information, including sampling locations, date, time, and analytical parameters requested. The method of sample identification to be used depends on the type of sample collected and the sample container type.
2. Samples collected for in situ field analysis are those collected for specific field analyses or measurements for which the data are recorded directly in bound field logbooks or recorded on field data sheets along with sample identity information while in the custody of the sampling team.
3. Samples other than those collected for in situ field measurements or analyses are to be identified on a sample label affixed to the sample container by the field data manager. The following information will be included on the sample label:
    - Laboratory
    - Project name (and number where appropriate)
    - Sample ID
    - Station ID
    - Preservation
    - Analysis
    - Sampler's initials/date/time

Each analytical sample will be assigned a unique number by the field data manager.

**Chain-of-Custody Protocol**

Chain-of-Custody (COC) forms should be provided by the laboratory that supplies the sampling containers. These forms should accompany the sample shipment and should also be shipped in the appropriate shipping container (cooler). Legal field custody begins when the clean sample containers are obtained from the laboratory and should end when those samples are relinquished to the laboratory for testing. This continuity will be reflected by the appropriate entries on the COC form.

A sample or other physical evidence is said to be under custody if it meets the following conditions:

- It is in the field investigator's physical possession
- It is in the field investigator's view, after being in his/her possession
- It was in the field investigator's physical possession, and he/she secured it to prevent tampering
- It is placed in a designated secure area

**Field Chain-of-Custody**

Each cooler containing samples sent to the analytical laboratory should be accompanied by a chain-of-custody record. The primary purpose of the COC procedures is to document the possession of the samples from collection through storage, analysis, and reporting. COC forms should become the permanent records of all sample handling and shipment activities.

The sampling person or team that collects the samples should retain sample custody in the field. In collecting samples for evidence, the quality and types of samples and sample locations shall be determined prior to the actual field work. As few people as possible shall handle the samples.

The samples must remain in the possession of and in view of a member of the sampling team until they are placed in a designated secure area or relinquished to the sample custody manager. After the sample custody manager receives the samples and sample tracking forms, he/she should complete and sign the COC forms before the samples are shipped to the laboratory. The sample custody manager determines whether proper custody procedures were followed during the field work and decides if additional samples are required. Samples shall be uniquely identified with the UIC Well Name, Permit number, Date and Time, e.g., "Federal 2 MT5360 XX/XX/XXXX XX:XX"

When custody is transferred to a bonded courier for next-day delivery, the COC form will be signed and dated by the individual who relinquishes custody. The shipping documents from the bonded courier will be used in lieu of a signature on the COC while custody is held by the courier.

**Laboratory Chain-of-Custody**

Laboratory COC procedures, including sample receipt, sample storage and disbursement for extractions and analyses, should be provided in the laboratories' QAPP. The Board has the authority to review, approve, or deny a laboratory's QAPP if COC procedures are unsatisfactory to the Board.

Samples must be accompanied by a Chain-of-Custody Record. When transferring the possession of samples, the individuals relinquishing and receiving shall sign, date, and note the transfer time on the Record. The Record documents sample custody transfer from the sampler, often through another person, to the analyst in a mobile laboratory, or at the laboratory.

**Packaging and Shipping**

Appropriate procedures and safeguards should be used for all sample packaging and shipping activities.

Samples must be packaged according to the Quality Assurance Manual for the contracted lab with a separate Chain-of-Custody Record accompanying each shipment. Shipping containers shall be padlocked or sealed for shipment to the laboratory. Seals are made of paper and perforated so they will tear easily to indicate possible tampering. Samples may be placed in bags, secured with a tape or a knot, and then sealed with custody seals above the knot or on the tape.

Whenever samples are split with another party, it is to be noted in the "Remarks" section of the Chain-of-Custody Record. The note indicates with whom the samples are being split and is signed by both the sampler and the recipient.

All shipments must be accompanied by the Chain-of-Custody Record identifying its contents. The original record shall accompany the shipment, and a copy shall be retained by the project officer/team

leader. Prior to shipping any samples, the field manager must classify the samples collected as either ***environmental*** or ***hazardous materials samples***. Guidance for complying with US Department of Transportation (DOT) regulations in shipping is covered in 49 CFR Parts 171-177. A record custodian or clerk shall receive and date all samples as they arrive and place them in a locked and secure area when necessary.

## 12.0 ANALYTICAL METHOD REQUIREMENTS

The Board, or its authorized representative, reserves the right to inspect the operation, calibration, and QA program of any laboratory submitting data relevant to the UIC program. Laboratory calibrations are to be conducted as per manufacturers' recommendations, per analytical method, or more frequent as deemed necessary to produce good quality data. The sampling and analysis plan shall describe in detail the analytical procedures that will be used to determine the concentrations of constituents or parameters of interest. These procedures will include suitable analytical methods as well as proper quality assurance and quality control protocols. The required precision, bias, accuracy, detection limits, and percent recovery (if applicable) specifications will be clearly identified in the plan.

The sampling and analysis plan shall identify one method that will be used for each specific parameter or constituent. The plan shall specify a method in SW-846 or an EPA-approval method and clearly indicate if there are going to be any deviations from the stated method and the reasons for such deviations.

Records of sampling analyses shall include the methods used, extractions date, date of actual analysis, notation of any sample dilution required, and results of all QC activities conducted. Data from samples that are not analyzed within recommended holding times will not be used. Any deviation from an EPA approved method (SW-846) shall be adequately tested to ensure that the quality of the results meets the performance specifications, such as detection limit, sensitivity, precision, and accuracy of the reference method. It is recommended that the operator contact the analytical laboratory to determine the proper sample holding time and to discuss the analytical methodology being used by the lab.

The analytical methods requested are dependent on the specific result sought for the sampling event, the compatibility of the analysis method with the sample and matrix, and the reporting limits required to determine compliance with the SDWA (see recommended analytical methods in **Appendix H)**. Only laboratories that are currently certified for analysis of SDWA Samples for the specific method an analyte will be used. A copy of the lab's certification will be placed in the project file. It is important to check with the laboratory prior to the sampling event to confirm that the analytical method(s) requested is compatible for the sample matrix and will provide low enough detection limits to address the reporting requirements. Analysis methods must be chosen to meet the appropriate data quality objectives or the sampling event.

Laboratory turnaround times of 30 days are normally required and would be considered a maximum holding time; sites or projects requiring different times will be specified in the laboratory contract or purchase order.

The laboratory is responsible for disposal of unused portions of samples.

The data quality objectives for most UIC sampling involved comparison of injectate constituents against regulatory limits. The regulatory limits that are used to evaluate contamination of a USDW are the Maximum Contaminant Limits (MCLs) for drinking water contained in 40 C.F.R. 141 - National Primary

Drinking Water Regulations. As per CCOJ Title XXII, Chp2, SubCh2 Sec. 211 (b)(6), any fluids not adequately confined to prevent migration into a USDW through an injection well must not exceed the MCLs for any regulated constituent. The detection limits for methods analyzing fluids and Analytical Methods for non-routine analyses must be specified in a site-specific sampling and analysis plan. Use of analytical methods for non-routine analysis must be approved by the Regional Quality Assurance Manager.

## 13.0 QUALITY CONTROL REQUIREMENTS

One of the fundamental responsibilities of the operator is the establishment of continuing programs to ensure the reliability and validity of field and analytical laboratory data gathered as part of the overall sampling program. The operator's sampling and analysis plan must explicitly describe the QA/QC program that will be used. Board staff will review data packages to verify adherence to these quality control requirements. Any non-conformances with the Board's QAPP will be noted and the effect of the non-conformance on the overall usability of the data will be evaluated as part of the overall data quality evaluation, whether it be for a permit application or other Class II UIC program requirement. Board staff will notify the operator if data quality is not suitable for the intended purpose and resampling is required.

**Table 1. Quality Control Checks**

| QC Check | Information Provided | Control Limits |
|---|---|---|
| Blanks<br>a) bottle blank<br>b) field blank<br>c) reagent blank<br>d) rinsate or equipment blank<br>e) method blank | a) cleanliness of sample bottles<br>b) transport, storage, and field handling bias<br>c) contaminated reagent<br>d) contaminated equipment<br>e) response of an entire laboratory analytical system | Below analytical method detection limit. |
| Spikes<br>a) matrix spike<br>b) matrix spike replicate<br>c) analysis matrix spike<br>d) surrogate spike | a) analytical (preparation + analysis) bias<br>b) analytical bias and precision<br>c) instrument bias<br>d) analytical bias | Percent recovered should be within 80% to 120% of the spiked value. |
| Calibration Check Samples<br>a) zero check<br>b) span check<br>c) mid-range check | a) calibration drift and memory effect<br>b) calibration drift and memory effect<br>c) calibration drift and memory effect | Calibration limits as prescribed in the analytical method. |
| Replicates, splits, etc.<br>a) field collocated samples<br>b) field replicates<br>c) field splits<br>d) laboratory splits<br>e) laboratory replicates<br>f) analysis replicates | a) sampling + measurement precision<br>b) precision of all steps after acquisition<br>c) shipping + interlaboratory precision<br>d) interlaboratory precision<br>e) analytical precision<br>f) instrument precision | Relative percent difference (RPD) should be within ±25% for constituents in water and within ±35% for constituents in sludge or soil. |

**Field QC Checks**

Field blank samples for water will be collected as field QC checks. Field blanks are check samples that monitor contamination associated with the collection of the sample. The number of required QC samples may vary from site to site as well as from sampling event to sampling event. The types of QC samples are trip blanks, equipment rinsates, field blanks, and duplicates.

**Trip Blanks**

Trip Blanks are used to detect contamination by VOCs during sample shipping and handling. Trip blanks are not opened in the field. Trip blanks are analyzed for VOCs only.

**Equipment Rinsate Blanks**

Equipment rinsate blanks are samples of analyte-free water that are rinsed through and over the surface of decontaminated sampling equipment. These blanks are used to monitor the effectiveness of the decontamination process. Equipment rinsates are typically collected at a rate of one per day or one per sampling event, whichever is more frequent. If more than one type of equipment is used to collect samples for a particular matrix, a rinsate blank is typically collected from each representative group of equipment. Equipment rinsates should be analyzed for the same analytical parameters as the corresponding samples.

**Field Blanks**

Field blanks are samples of the water used to decontaminate equipment. Typically, one sample for each source of water is collected and analyzed for the same analytical parameters as the corresponding samples.

**Field Duplicates**

Field duplicate samples are collected immediately after the native sample using the same procedure as the native sample. Field duplicates are used to monitor field sampling accuracy and precision; the results of this evaluation are influenced by the homogeneity of the sample matrix. Typically, field duplicate samples should be collected at a frequency of 1 for every 10 field samples of the same matrix collected during a discrete field event.

**Laboratory QC Checks**

Laboratories will be notified upon primacy delegation of the Board's QAPP and the laboratory's responsibility to conform to the Board's requirements. Failure to comply could result in the Board's failure to accept analysis results.

The Board has identified two types of QA checks that will be used to assess the production of analytical data of known and documented quality. These include the following:

- Program QA
- Analytical method QC

The stated objectives of the laboratory QA/QC program are as follows:

- To verify that all procedures are documented, including any changes in administrative and/or technical procedures
- To document that all analytical procedures comply with sound scientific principles and have been validated
- To monitor the performance of the laboratory by a systematic inspection program and provide for corrective action as necessary
- To collaborate with other laboratories in establishing quality levels, as appropriate
- To verify that all data are properly recorded and archived

Internal quality control procedures for all critical analytical methods have can be reviewed by the Board for compliance with the Board's objectives. The laboratory internal quality control specifications must include the types of audits required (sample spikes, method spikes, reference samples, controls, blanks), the compounds to be used for sample spikes, and QC acceptance criteria.

The laboratory must document, in each data package provided, that the Board's analytical QC functions have been met. Any samples analyzed in non-conformance with the QC criteria will not be accepted by the Board and must be re-analyzed by the laboratory if the laboratory procedures were not in control. QC check samples analyzed (method blank, field blank, etc.) will be run concurrently with the sample batch (maximum of 20 environmental samples) to which they are assigned. The method blanks will be analyzed at a rate of 1 in 20, or as stated in the analytical method.

The following sample level QC samples are common to most analytical suites and methods. However, there may be additional QC requirements, or the frequency of QC may be changed, depending on the project objectives.

**Matrix Spike**

A matrix spike is an environmental sample to which known concentrations of analytes have been added. The matrix spike is taken through the entire analytical procedure and the recovery of the analytes calculated. Results are expressed as percent recovery of the known amount spiked. The matrix spike is used to evaluate the effect of the sample matrix on the accuracy of the analysis. Matrix spike analysis will be conducted at a rate of 1 per matrix per 20 environmental samples analyzed and will be designated on the COC by field sampling personnel.

**Matrix Spike Duplicate**

A matrix spike duplicate is an environmental sample that is divided into two separate aliquots, each of which is spiked with known concentrations of analytes. The two spiked aliquots are processed separately, and the results compared to evaluate the effects of the matrix on the precision, bias, and accuracy of the analysis. Matrix spike duplicates are generally analyzed at a rate of 1 per matrix per 20 environmental samples analyzed.

**Method Blank**

A method blank consists of analyte-free water. The method blank is carried through each step of the analytical method. Method blanks will be analyzed at a rate of one per batch of environmental samples analyzed.

**Control Limits**

The control limits on blanks are constituent concentrations below analytical method detection limits for the constituents being analyzed.

For spiked constituents in water samples, the control limits are based on the percent difference between the analyzed or "recovered" concentration and spiked concentration. Percent recovered should be within 80% to 120% of the spiked value.

Calculation of percent difference between spiked concentration and analyzed concentration:

$$\% \text{ RECOVERED} = \frac{(\text{Measured Value} - \text{True Value})}{\text{True Value}} * 100$$

Where: True Value = Amount Spiked
Measured Value = Amount measured

For duplicate, replicate, co-located or split samples, the control limits are based on the relative percent difference (RPD) between analyte concentrations in the compared samples. Analyte concentrations in water samples should be within ±25% RPD; analyte concentrations in soil/sludge samples should be within ±35% RPD. RPD between compared samples should be calculated using the following equation:

$$RPD = \frac{|(R1-R2)|}{(R1+R2)/2} * 100$$

Where:
R1 = Result Sample 1
R2 = Result Sample 2

## 14.0 INSTRUMENT MAINTENANCE, CALIBRATION AND FREQUENCY

Permittees and permit applicants should inspect, test, and maintain field instruments according to the manufacturer's instructions. Field instruments should be inspected prior to use in the field and calibration procedures performed at the beginning of each day using the method described by the manufacturer's instructions and then check calibration periodically during the day and at the end of the measurement period, as appropriate.

Different types of laboratory instruments require different procedures for setup, calibration, and periodic checks on their operation, and these requirements are detailed in the laboratory specific QAPP and standard operating procedures (SOPs). Often, the initial setup and calibration are acceptable over a long period of time. The instrument setup and initial calibration procedures are generally complex and time consuming, and do not need to be repeated for every group of samples. Instead, the initial criteria can be verified by daily or continuing calibrations. If the daily criteria fall within preestablished ranges, the instrument setup and calibration can be inferred to be valid. If the criteria are not met, minor or major corrections to the system may be necessary. The extent of corrections needed depends on the type of problem. The laboratory will include calibration information in the analytical results report.

Laboratory Instrument units should be calibrated before samples are analyzed using the criteria prescribed in the appropriate laboratory SOP. The calibration then should be verified using standards from an independent source. The linear range of the instrument will be established by the initial calibration. No values are reported above this upper concentration value without dilution. Instruments should be calibrated using standards traceable to a certified source such as EPA or NIST.

The Board, the Montana Department of Health and Environmental Sciences, and the EPA reserve the right to request a copy of a laboratory's Quality Assurance documents, conduct an inspection of any field or laboratory equipment or activities relevant to this QA project plan for the UIC program.

## 15.0 DATA ACQUISITION REQUIREMENTS (NON-DIRECT MEASUREMENTS)

Data from Non-direct data sources such as computer databases, spreadsheet programs, literature files (American Association of Petroleum Geologists or AAPG articles, USGS sources, Geological Guidebooks, MBMG sources), and other non-direct data sources are used for decision making. Uncertainty concerning the validity of the data they present is vetted by professional staff at the time of use.

## 16.0 DATA MANAGEMENT

Sampling and analysis results and field measurement data are received primarily in the form of permit applications, monthly monitoring, fluid analysis reports, MBOGC inspection reports, and mechanical integrity testing reports. Trained staff enter this data into the UIC Program RBDMS database. The RBDMS was developed by the Ground Water Protection Council (GWPC) and member states, in partnership with the U.S. Department of Energy. The database consists of a suite of integrated software products that assists state agencies in the regulating, oversight and management of oil, gas and UIC facilities and activities. RBDMS has evolved to the latest .NET technologies and has been adopted as a national standard.[2] MBOGC performs routine maintenance and backups the RMDMS database twice a week to ensure that program data can be accessed through the MBOGC office and data is available on site for archival and retrieval. Data is also stored in on-site filing cabinets in the MBOGC Office.

## 17.0 ASSESSMENT AND RESPONSE ACTIONS

Performance and systems will be audited to verify documentation and implementation of the QC program, identify any nonconformances, and verify correction of identified deficiencies.

**Assessment**

Assessment activities may include surveillance, inspections, management system reviews, technical system audits, performance evaluations, data quality assessments, etc. It is the responsibility of the operator and laboratory to ensure that proper assessment activities are undertaken to assure data quality objectives are achieved. However, the UIC Program Manager may also initiate an independent assessment including any of the above activities. These activities may be performed by the Board's staff as directed and documented by the UIC Program Manager.

MBOGC inspectors may occasionally conduct verification sampling and field data collection to compare with information reported by operators. The Board will review analytical results received from the

[2] Ground Water Protection Council RBDMS webpage: https://www.gwpc.org/rbdms/

operator or laboratory to verify that the detection limits reported by the laboratory are adequate to address the reporting limit requirements, and that proper QA/QC procedures were performed by the laboratory. The QC report provided by the laboratory in the analytical results data package will be reviewed to evaluate the adequacy of calibration frequency. If there is any need to deviate from this procedure, the reason and the revised acceptance criteria will be documented in the report provided by the operator or, for MBOGC work, the individual Inspection Report.

**Response Actions**

It is the responsibility of the operator and laboratory to ensure that proper corrective actions are taken in response to any assessment activities. However, the Board and EPA maintain the right to review assessments and perform investigations to verify that proper corrective actions were implemented. MBOGC will initiate investigations when inspection results identify discrepancies in data included in permit applications or reported by the operators.

## 18.0 DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

The Board's data review, validation, and verification requirements specific to the Class II UIC program will primarily include a detailed review of all data submitted to the Board in association with Class II injection activities. Data will be reviewed and validated to assure that the data was collected in adherence to this QAPP. As outlined in the Board's Program Description, Class II injection well operators must adhere to Board statutes, rules, orders, permits, etc. Adherence is validated through the permit review process, file review process, and other permitting, compliance, field oversight, and enforcement activities. Using this process, as outlined in the Program Description and herein, the Board can confirm that a process, item, data set, or other related activity satisfies the requirements of the Board.

In instances where the Board believes data submitted is suspect, Section 82-11-111 provides the Board and its staff with the authority to enter upon any public or private property at reasonable times to:

1. Investigate conditions relating to violations of permit conditions
2. Have access to and copy records required under this chapter
3. Inspect monitoring equipment or methods
4. Sample fluids which the operators are required to sample

Further, the Board requires all permit applications (including associated environmental data) to be signed by a principle executive officer, agent and attorney-in-fact, general partner, or the sole proprietor (whichever is appropriate). The Board accepts this signatory requirement as authenticating the truth that the process, item, data set, or service is, in fact, that which is claimed.

## 19.0 VALIDATION AND VERIFICATION METHODS

**FIELD MEASUREMENTS (PRESSURE, VOLUME, FLOWRATE, ETC.):**

Review of field measurement data (wellhead pressures, flowrates, volumes, etc.) shall include a review of each applicable item listed under Section 10.0 of this document. This review must attempt to determine if measurements were made according to the accepted methods and taken at an appropriate

location, if proper QA/QC measures were followed, if the instrument was on an accepted maintenance schedule, and if the instrument was properly calibrated prior to taking the measurement. In addition, data submitted by operators is verified against field data for verification of actual versus reported values at the wellhead. The UIC Program Director is responsible for this verification.

On site records reviews are also completed by the UIC Program Director. Records reviews are completed at the operator's premise where actual record on pressure, flow, and volumes are compared to reported values submitted in the monthly monitoring reports. In addition, records are reviewed for any reworking of the well which was not approved or reported to MBOGC.

**FOR PERMIT DATA**

Data submitted for permit applications is generated by applicants who submit them to the UIC Program Director for the purposes of generating a permit which will allow the injection of produced water into underground formations and protect the USDWs. This data consists of well construction data for the proposed injection well, along with the well construction and location of other wells in the area of review, geologic setting information, pressure data, aquifer exemption data if applicable, formation water analysis, who reviews it for completeness against a checklist. If the any of the data is determined to be invalid, additional testing or request for additional information is made to the operator and the Permit submission is not deemed complete. After all the permit information is provided and deemed complete, the operator is notified by letter that the permit application is complete. A copy of the permit checklist is provided in **Appendix F**.

**LABORATORY DATA**

Validation and verification evaluation processes are typically used to assess the effect of the overall analytical process on the usability of laboratory data. The two major categories of data evaluation are laboratory performance, and matrix interferences. Evaluation of laboratory performance is a check for compliance with the method requirements and is a straightforward examination; either the laboratory did, or did not, analyze the samples within the limits of the analytical method. Evaluation of the matrix interferences is more subtle and involves analysis of several results, including surrogate spike recoveries, matrix spike recoveries, and duplicate sample results.

Before the analytical results will be released by the laboratory, both the sample and QC data should be carefully reviewed to verify sample identity, instrument calibration, detection limits, dilution factors, numerical computations, accuracy of transcriptions, and chemical interpretations. Additionally, the QC data are generally reduced, and the resulting data reviewed to ascertain whether they are within the laboratory-defined limits for precision, bias, and accuracy. Any non-conforming data "must" be discussed in the data package cover letter and case narrative. The laboratory will retain all analytical and QC documentation associated with each data package. Such retained documentation need not be hard (paper) copy but can be available on other storage media such as magnetic tape. However, the laboratory must be able to produce a hard copy of all the retained information upon request.

The data package will be reviewed by Board staff (see Section 13.0). Any non-conformances with the Board's QAPP will be noted and the effect of the non-conformance on the overall usability of the data will be evaluated as part of the overall data quality evaluation, whether it be for a permit application or

other Class II UIC program requirement. MBOGC will notify the operator if data does not meet the data quality needs and resampling is required.

**Field and Laboratory Blank Contamination**

Appearance and concentration of target compounds in field and laboratory blanks as well as environmental samples. Field blanks and laboratory method blanks should not contain any analytes of interest at or above the quantitation limit of the analytical method. If field blank contamination is documented, all positive sample results are suspect, and depending on the level of contamination, may require re-sampling.

**Surrogate Spike Recoveries**

Compounds for each of the organic analytical methods. Surrogate spike compounds are the structural homologs of target compounds, often with deuterium substituted for hydrogen, and are therefore expected to behave in a similar manner during analysis. Surrogate spike recoveries are used to monitor both laboratory performance and matrix interferences. Surrogate spike recoveries from field and laboratory blanks are used to evaluate laboratory performance because these blanks represent an ideal sample matrix. Surrogate spike recoveries for field samples are used to evaluate the potential for matrix interferences. When surrogate spike recoveries for field samples fall outside the method target acceptance windows, the samples are reanalyzed. If the surrogate spike recovery is still outside the acceptance window for the reanalyzed sample, then the sample results are qualified as affected by matrix interferences.

**Matrix Spike Recoveries**

For this QC measure, three aliquots of a single sample are analyzed: one native and two spiked with the same concentration of matrix spike compounds. Unlike the surrogate spike compounds, matrix spike compounds are found on the method target compound list. Spike recovery is used to evaluate potential matrix interferences as well as accuracy. The duplicate spike results are compared to evaluate precision and bias.

**Duplicate Sample Results**

Typically, one duplicate field sample will be collected for every 10 field samples. Both the native and duplicate samples are analyzed for the same parameters. Target compounds that are detected in both the native and duplicate samples can be compared and precision for the sample results calculated.

## 20.0 RECONCILIATION WITH DATA QUALITY OBJECTIVES

The final activity of any data quality evaluation is an assessment of whether the data meets the Data Quality Objectives (Section 7.0). This is accomplished by determining if the criteria for the Board's data quality indicators, as discussed in Section 7.0, are met. The goal of this assessment is to demonstrate that enough representative samples were collected to meet the completeness criteria, and the review of the resulting analytical data indicates the data can be used to support the project decision making process, which may include a Class II injection well permit application, permit modification request, reporting requirement, compliance determination or enforcement action. In cases where Data Quality Objectives are not met, the Board may require the operator to conduct follow-up sampling, analysis,

and reporting activities. In the case of permit application information, MBOGC may deny the permit application. In addition, MBOGC reserves the right to conduct an inspection of any field or laboratory procedures or equipment or activities relevant to this QA project plan for the UIC program to evaluate non-conformance with this QAPP.

## 21.0 REFERENCES

American Petroleum Institute, 1998, API Recommended Practice for Analysis of Oil Field Water, Third Edition. API Report No. 45. Reaffirmed: 2/20/2012. https://www.apiwebstore.org/standards/45

Application and Calibration of Pressure Instruments, Flowmeters, and Flow Control Devices, SMC Martin - Prepared for: Environmental Protection Agency, Washington, DC, February 1985.

U.S. Environmental Protection Agency-Region I, 2003. Index to EPA Test Methods, April 2003 Revised Edition. https://www.epa.gov/sites/default/files/2015-03/documents/testmeth.pdf

U.S. Geological Survey, National Field Manual for the Collection of Water-Quality Data. https://www.usgs.gov/mission-areas/water-resources/science/national-field-manual-collection-water-quality-data-nfm

## APPENDIX A – APPLICATION FOR PERMIT TO DRILL

FORM NO. 22 R 10/09 SUBMIT IN QUADRUPLICATE TO: ARM 36.22.307 ARM 36.22.601

**MONTANA BOARD OF OIL AND GAS CONSERVATION**
**2535 ST. JOHNS AVENUE, BILLINGS, MONTANA 59102**

Application for Permit To:

Drill ☐ Deepen ☐ Re-enter ☐
Oil ☐ Gas ☐ Other _____ ☐

Operator:
Address:
City: State: Zip:
Telephone Number:

Surface Location of Well (quarter-quarter and footage measurements):

Proposed Total Depth and Bottom-hole Location(s) if directional or horizontal well:

Lease Name:

Lease Type (Private/State/Federal):

Well Number:

Field Name or Wildcat:

Unit Name (if applicable):

Objective Formation(s):

Township, Range, and Section:

County:

Elevation (indicate GL or KB):

| Size and description of drilling/spacing unit and applicable order, if any: | Formation at total depth: | Anticipated Spud Date: |
|---|---|---|
| | | |

| Hole Size | Casing Size | Weight / Foot | Grade (API) | Depth | Sacks of Cement | Type of Cement |
|---|---|---|---|---|---|---|
| | | | | | | |
| | | | | | | |
| | | | | | | |

Describe Proposed Operations:
Describe or attach labeled diagram of blowout preventer equipment. Indicate if air drilled or describe mud program.

**BOARD USE ONLY**

Approved (date) _____ Permit Fee _____
By _____ Check Number _____
Permit Expires _____
Title _____ Permit Number _____

**THIS PERMIT IS SUBJECT TO THE CONDITIONS OF APPROVAL STATED ON THE BACK**

API Number: 25 - _____ - _____

The undersigned hereby certifies that the information contained on this application is true and correct.

Signed (Agent) _____
Title _____
Date _____
Telephone Number _____

Samples Required: NONE _____ ALL _____ FROM _____ feet to _____ feet

Core chips to address below, full cores to USGS, Core Laboratory, Arvada, CO. Required samples must be washed, dried and delivered prepaid to:

Montana Board of Oil and Gas Conservation
2535 St. Johns Avenue
Billings, MT 59102

## SUPPLEMENTAL INFORMATION

Note: Additional information or attachments may be required by Rule or by special request.

1. Attach a survey plat certified by a registered surveyor. The survey plat must show the location of the well with reference to the nearest lines of an established public survey.

2. Attach an 8 1/2 x 11" photocopy of that portion of a topographic map showing the well location, the access route from county or other established roads, residences, and water wells within a 1/2 mile radius of the well.

3. Attach a sketch of the well site showing the dimensions and orientation of the site, the size and location of pits, topsoil stockpile, and the estimated cut/fill at the corners and centerstake. (Note: the diagram need not be done by an engineer or surveyor). Attach a sketch of a top view and two side views of the reserve pit(s), if utilized. The reserve pit sketch must show the length, width, depth, cut and fill, amount of freeboard, area of topsoil stockpile, and the height and width of berms.

4. Describe the type and amount of material or liner, if any, to be used to seal the reserve pit. If a synthetic liner is used, indicate the liner thickness (mils), bursting strength, tensile strength, tear strength, puncture resistance, hydrostatic resistance, or attach the manufacturer's specifications.

5. Describe the proposed plan for the treatment and/or the disposal of reserve pit fluids and solids after the well is drilled. If the operator intends to dispose of or treat the reserve pit contents off-site, specify the location and the method of waste treatment and disposal. (Note: The operator must comply with all applicable federal, state, county, and local laws and regulations with regard to the handling, transportation, treatment, and disposal of solid wastes.)

6. Does construction of the access road or location, or some other aspect of the drilling operation require additional federal, state, or local permits or authorizations? If yes, indicate the type of permit or authorization required:

- ☐ No additional permits needed
- ☐ 310 Permit (apply through county conservation district)
- ☐ Air quality permit (apply through Montana Department of Environmental Quality)
- ☐ Water discharge permit (apply through Montana Department of Environmental Quality)
- ☐ Water use permit (apply through Montana Department of Natural Resources and Conservation)
- ☐ Solid waste disposal permit (apply through Montana Department of Environmental Quality)
- ☐ State lands drilling authorization (apply through Montana Department of Natural Resources and Conservation)
- ☐ Federal drilling permit (specify agency)
- ☐ Other federal, state, county, or local permit or authorization: (specify type) _____

NOTICES:

1. Date and time of spudding must be reported to the Board verbally or in writing within 72 hours after the commencement of drilling operations.

2. The operator must give notice of drilling operations to the surface owner as required by Section 82-10-503, MCA, before the commencement of any surface activity.

**BOARD USE ONLY** | CONDITIONS OF APPROVAL

The operator must comply with the following condition(s) of approval:

**WARNING: Failure to comply with conditions of approval may void this permit.**

APPENDIX B – SUNDRY NOTICE

FORM NO. 2 R 10/09

ARM 36.22.307, 601, 809, 1003, 1004, 1011, 1013, 1103, 1222, 1240, 1301, 1308, 1309, and 1417

**Submit in Quadruplicate To:**

**MONTANA BOARD OF OIL AND GAS CONSERVATION**
**2535 ST. JOHNS AVENUE**
**BILLINGS, MONTANA 59102**

## SUNDRY NOTICES AND REPORT OF WELLS

| | |
|---|---|
| Operator<br>Address<br>City State Zip Code<br>Telephone Fax | Lease Name:<br>Type (Private/State/Federal/Tribal/Allotted):<br>Well Number: |
| Location of well (1/4-1/4 section and footage measurements): | Unit Agreement Name:<br>Field Name or Wildcat:<br>Township, Range, and Section: |
| API Number: 25 ___ ___ ___<br>State County Well<br>Well Type (oil, gas, injection, other): | County: |

Indicate below with an X the nature of this notice, report, or other data:

| | |
|---|---|
| Notice of Intention to Change Plans ☐ | Subsequent Report of Mechanical Integrity Test ☐ |
| Notice of Intention to Run Mechanical Integrity Test ☐ | Subsequent Report of Stimulation or Treatment ☐ |
| Notice of Intention to Stimulate or to Chemically Treat ☐ | Subsequent Report of Perforation or Cementing ☐ |
| Notice of Intention to Perforate or to Cement ☐ | Subsequent Report of Well Abandonment ☐ |
| Notice of Intention to Abandon Well ☐ | Subsequent Report of Pulled or Altered Casing ☐ |
| Notice of Intention to Pull or Alter Casing ☐ | Subsequent Report of Drilling Waste Disposal ☐ |
| Notice of Intention to Change Well Status ☐ | Subsequent Report of Production Waste Disposal ☐ |
| Supplemental Well History ☐ | Subsequent Report of Change in Well Status ☐ |
| Other (specify) _____ ☐ | Subsequent Report of Gas Analysis (ARM 36.22.1222) ☐ |
| _____ ☐ | _____ ☐ |

**Describe Proposed or Completed Operations:**

Describe planned or completed work in detail. Attach maps, well-bore configuration diagrams, analyses, or other information as necessary. Indicate the intended starting date for proposed operations or the completion date for completed operations.

**BOARD USE ONLY**

Approved _____
Date

Name Title

The undersigned hereby certifies that the information contained on this application is true and correct

Date Signed (Agent)

Print Name and Title

Telephone _____

## APPENDIX C – INSPECTION REPORT

API#: 25- _____

# Inspection Report

Date: _____

**Montana Board of Oil and Gas Conservation**

01/2014

UIC: ☐ Oil/Gas/Other: ☐

Exception/Violation: Yes: ☐

Inspector: _____ **Date Operator Notified:** _____

Arrival Time: _____ am/pm **Date Remedy Required:** _____

Operator Representative(s) _____

Others Present: _____

Well name: _____ Q: _____ Sec: ____ Township: _____ Range: _____

Operator: _____ Field: _____

Latitude / Longitude, NAD83 decimal degrees (if taken): _____

Failed Items or Violation Description:

_____

_____

_____

_____

**Inspection Type**

| | | | |
|---|---|---|---|
| Routine/Periodic | ☐ | Pre-drill / Well permitting | ☐ |
| Change of Operator | ☐ | Pre-regulatory/Orphan | ☐ |
| Complaint Response | ☐ | Remediation / Restoration | ☐ |
| Compliance Verification | ☐ | Plugging Witnessed | ☐ |
| Construction | ☐ | SRA/Expiration | ☐ |
| Drilling / Service Rig | ☐ | Seismic Inspection | ☐ |
| Emergency Response | ☐ | _____ | ☐ |
| Pit Inspection | ☐ | | |

**Class II UIC Wells**

| | | | |
|---|---|---|---|
| Injecting: | ☐ | Tubing Pressure: _____ | PSI |
| Not Injecting: | ☐ | Annulus Pressure: _____ | PSI |

**Non-UIC Wells**

| | | | |
|---|---|---|---|
| Oil Well: | ☐ | Producing: | ☐ |
| Gas Well: | ☐ | Shut-In / TA: | ☐ |
| Other: _____ | | Abandoned: | ☐ |

**Comments / Description** **Picture:** ☐

_____

_____

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_____

_____

FORM NO. 5 R 10/09

**MBOGC**

Montana Board of Oil & Gas Conservation
2535 St. Johns Aven
Billings, Montana 59102

# Report of Subsurface Injection

(Submit in duplicate)
ARM 36.22.307 and ARM 36.22.1415

For Month of: _____ (Month and Year)

| For Board Use Only | |
|---|---|
| Operator Number: | |
| Injection Codes: | |

Operator: _____ County: _____ Check if Amended Report: ☐

Field: _____ Unit/Lease Name: _____

Injection Fluid Type: _____ Fluid Source: _____

Project Type: _____ Formation Injected into: _____

| API Well Number | Well Name and Number | Sec. | Twp. | Rge. | Days Inj. | Monthly Injection Volume (Bbls or MCF) | Max. Injection Rate (Bbls or MCF per day) | Total Cumulative Injection (Bbls or MCF) | Max Inj. Pressure (psig) | Avg. Inj. Pressure (psig) | Max Annulus Pressure (psig) | Average Annulus Pressure (psig) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
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Remarks:

Agent's Signature: _____
Agent's Name: _____
Title: _____ Date: _____
Address: _____
_____
Telephone Number: _____

Note: Mail two (2) copies of this report to the Montana Board of Oil and Gas Conservation at Billings, Montana, on or before the last day of each month following the month covered by the report. Separate report(s) must be filed covering each injection or disposal project.

## APPENDIX E – MECHANICAL INTEGRITY TEST REPORT

### Mechanical Integrity Test Report

**Casing or Annulus Pressure Test**

Montana Board of Oil and Gas Conservation

2535 St. Johns Avenue

Billings, Montana 59102

State Inspector:_____ Date:_____/_____/_____ Start Time:_____am/pm

Operator Representative(s):_____

Others Presents:_____

**General Well Data and Prevoius MIT information**

API Well No.: _____ Location: _____ Sec. _____ Township _____ Range _____

Operator Name/Number: _____

Well Name/Number: _____

Field name: _____ County: _____

Date Last MIT: _____ Last Test Result: _____ Type of Test Used: _____ Reason: _____

Corrective Action Due: _____ Dt CA Complete: _____

Cause of Failure (Last Test): _____ Type of Failure (Last Test): _____

Well Status at Last Test: _____ Inj. Rate and Pressure During Last Test: _____ bpd and _____ psig

Required Minimum Test Pressure: _____ psig

Pkr Depth: _____ feet GL Top of Perfs: _____ feet GL

**Casing/Annulus Pressure Test Results**

| Time (minutes) | TEST # 1 (psig) | Time (minutes) | TEST #2 (psig) |
|---|---|---|---|
| 0 | | 0 | |
| 5 | | 5 | |
| 10 | | 10 | |
| 15 | | 15 | |
| **Result (circle)** | **PASS/FAIL** | **Result (circle)** | **PASS/FAIL** |
| Tubing Presure | | Tubing Presure | |

**Current Well Data and Information for Testing**

Type of Test Used:_____ Reason For Test:_____

Cause of Failure (this test):_____ Type of Failure (this test):_____

Well Status During Test: Injection / Shut-in

Injection Rate During Test:_____bpd Injection Pressure During Test:_____psig

Pkr Depth:_____ feet GL

| |
|---|
| Signature of State Inspector/Representative: |
| Signature of Operator Representative: |

APPENDIX F – PERMIT APPLICATION CHECKLIST

PERMIT APPLICATION CHECKLIST

Company _____ Current Owner _____

Well name _____ Location _____

API # 25- _____ Field: _____

Date received: _____ Proper signature? _____

SWD EOR Area Permit New well in Area Permit

Current Status _____ Unitized (if EOR)? _____

Injection Formation _____

Depth _____ top perf _____

TDS _____

Confining Zones: _____

USDWs: _____

Source/SG of injectate: _____

FG used: _____

AE needed? YES NO AE volume limit _____

Affidavit of landowner/mineral owner notification: _____

Newspaper affidavit: Helena _____ local _____

TOC on longstring: _____ data from: _____

Public comment? _____

Hearing Date: _____ Docket _____ Order _____

Wells in AOR (incl. water wells):

## APPENDIX G - INSPECTION STANDARD OPERATION PROCEDURE

In the Field:

- Contact oil company representative(s) to get clear about where and when to meet
- Present inspection credentials to oil company representative
- Confirm wells to inspect
- Ask about any special safety concerns (gas, wildlife, sirens, etc.)

At each Well:

- Follow operator to wellhead
- Park so your vehicle is not too close to well, and in manner that any "blow" from the well will not spray on vehicle
- Fill out date, time, and personnel on inspection form
- Approach well house with care, looking for snakes, other wildlife
- Note general condition of well, including if any gauges already on the well show a pressure value
- Open well house door and look in from outside, being careful to spot varmints and rodent droppings
- If lots of droppings are present, exercise care about breathing dust [hanta virus potential]. Typically take deep breath before looking in to take readings while holding breath for a few seconds.
- Check inspection form for MAIP
- Injection tubing: make determination about which MBOGC gauge to use first on tubing...start with a bigger range gauge and go smaller. [If MAIP is 1800 psi, start with a 2000 psi gauge and reduce to get a more accurate lower pressure]
- Annulus: make determination about which MBOGC gauge to use first on annulus. Typically start by assuming there is no mechanical integrity and that whatever pressure was just observed on the tubing may also be on the annulus. If, however, the operator has a gauge on the annulus which appears to work (and if the operator tells you he checks it often, then you can likely trust the value on the operator's annulus gauge, in which case still put an MBOGC gauge on the annulus or have the operator just open the annulus valve carefully (never stand in front on the valve opening when it is being opened, and be mindful of the vehicle's location, too). If the annulus opens and there is no gas "blow" or just a small trickle of water, then just shut it again and record the annulus pressure as zero.
- Gauges: for each use of a gauge make a strike mark on the brown box in which the gauge belongs. Every 50 uses, re-check the gauge against a new out of the box gauge of the same pressure span. If the gauge being tested fails to "zero" after taking it off the well, or if the gauge is more than one detent different from the "new" gauge, then consider it out of calibration and retire it from use. Also, if the gauge in use shows a violation (i.e. over pressure), photograph it, then put another MBOGC gauge on and photograph that one, too. Both should show the violation, in which case the violation is clearly documented.
- Photos: as stated above under Gauges, photograph any violation seen. The photos should be clear and with the digital camera, one can review the photo to see if it looks clear. It is also best to start any photo series at a well by photographing the well sign first. Take your time.
- Pump house: if you can, go to the pump house. At an enhanced oil recovery field, each pump will likely serve 10 to 30 wells. Look at the manifold if you can, check any gauges you see on the pump's discharge side to see if the operator has set a "Murphy" kill switch at the appropriate level to ensure that wellhead pressure will not exceed its MAIP. If it is set above the MAIP, ask

why. Communicate what the MAIP is and check to see if there is any signage about MAIP and for accuracy.

- GPS: Take a latitude and longitude reading at each well for which we don't already one. Read the instructions for the GPS unit to be sure it is properly calibrated before recording values. At the conclusion of the reading, save the file (if you have a file name option, try to save the well number as part of the file name – such as UT02199_040908 – which means the well in UT ending in "02199" was recorded on April 9, 2008). Also, write down on the inspection form both the GPS file name (see page 2 of the form) as well as the actual lat/long data (such as 41° 34' 19.998" N, 104° 13' 34.220 E). The Tribes GIS can covert from degree/minute/second to decimal and vice versa, so either convention will do.
- Inspection forms: be sure to record all observed pressure readings on the appropriate inspection form for the well. If only one injection tubing pressure value is appropriate (i.e., not a dual injection well), then record in the first (also known as "upper") zone field. Record the span of the gauge used on which you base your pressure recorded. Note if it is EPA's or operator's gauge. Be sure to note and describe photos taken. Also, note GPS data if recorded. Any information conveyed to operator should be noted (i.e., told operator to lower the Murphy kill switch setting and this was done in your presence).

When leaving well, be sure that you have all your equipment, and that the well is left in the appropriate condition. For instance, point out to operators who have an annulus gauge on the well that they should not maintain the well's annulus valves closed since it defeats the purpose of having a gauge to read.

## APPENDIX H - REGULATED DRINKING WATER CONTAMINANTS OF CONCERN FOR THE UIC PROGRAM

| **Metals** | **MCLs [SMCLs] (mg/l)** | **Detection Limits Required** | **EPA Method** |
|---|---|---|---|
| Aluminum | [0.05 to 0.2] | 0.1 | 200.7, 200.8, 200.9 |
| Antimony | 0.006 | 0.003 | 200.8, 200.9 |
| Arsenic | 0.05 | 0.025 | 200.7, 200.8, 200.9 |
| Barium | 2 | 1 | 200.7, 200.8 |
| Beryllium | 0.004 | 0.002 | 200.7, 200.8, 200.9 |
| Cadmium | 0.005 | 0.0025 | 200.7, 200.8, 200.9 |
| Chromium | 0.1 | 0.05 | 200.7, 200.8, 200.9 |
| Copper | Treatment technique action level=1.3 [1.0] | 0.5 | 200.7, 200.8,200.9 |
| Iron | [0.3] | 0.15 | 200.7, 200.9 |
| Lead | treatment technique action level=0.015 | 0.0075 | 200.8, 200.9 |
| Manganese | [0.05] | 0.025 | 200.7, 200.8, 200.9 |
| Mercury | 0.002 | 0.001 | 245.1, 245.2, 200.8 |
| Nickel | Health advisory, lifetime 0.1 | 0.05 | 200.7, 200.8, 200.9 |
| Selenium | 0.05 | 0.025 | 200.8, 200.9 |
| Silver | [0.01] | 0.0075 | 200.7, 200.8, 200.9 |
| Thallium | 0.002 | 0.001 | 200.8, 200.9 |
| Zinc | 5.0(SMCL) | 2.5 | 200.7, 200.8 |

| Inorganics | MCLs [SMCLs](mg/l) | Detection Limits Required | EPA Method |
|---|---|---|---|
| Asbestos | 7 million fibers/liter longer than 10 µm | | 100.1, 100.2 |
| Chloride | [250] | 125 | 300.0 |
| Cyanide | 0.2 | 0.1 | 335.4 |
| Fluoride | 4.0<br>[2.0] | 1.0 | 300.00 |
| Nitrate as N | 10 | 5 | 353.2, 300.0 |
| Nitrite as N | 1 | 0.5 | 353.2, 300.0 |
| Nitrate/Nitrite (as N) | 10 | 5 | - |
| pH | 6.5-8.5<br>[6.5-8.5] | | 150.1, 150.2<br>9040, 1110 |
| Solids (TDS) | [500] | 250 | 2540C |
| Sulfate | [250] | 125 | 300.0, 375.2 |

| Volatile Organic Contaminants | MCLs or [SMCLs] (mg/l) | Detection Limits Required (mg/l) | EPA Method |
|---|---|---|---|
| Benzene | 0.005 | 0.0025 | 502.2, 524.2, 551 |
| Carbon Tetrachloride | 0.005 | 0.0025 | 502.2, 524.2 |
| Chlorobenzene | 0.1 | 0.05 | 502.2, 524.2, 551 |
| Dichlorobenzene (o-)(1,2-) | 0.6 | 0.03 | 502.2, 524.2 |
| Dichlorobenzene (p-)(1,4-) | 0.075 [0.005] | 0.0375 | 502.2, 524.2 |
| Dichloroethane (1,2-) | 0.005 | 0.0025 | 502.2, 524.2 |
| Dichloroethylene (1,1-) | 0.007 | 0.0035 | 502.2, 524.2 |
| Dichloroethylene (cis-1,2-) | 0.07 | 0.035 | 502.2, 524.2 |
| Dichloroethylene (trans-1,2-) | 0.1 | 0.05 | 502.2, 524.2 |
| Dichloromethane | 0.005 | 0.0025 | 502.2, 524.2 |
| Dichloropropane (1,2-) | 0.005 | 0.0025 | 502.2, 524.2 |
| Ethylbenzene | 0.7 | 0.035 | 502.2, 524.2 |
| Styrene | 0.1 | 0.05 | 502.2, 524.2 |
| Tetrachloroethylene | 0.005 | 0.0025 | 502.2, 524.2, 551 |
| Toluene | 1 | 0.5 | 502.2, 524.2 |
| Trichlorobenzene (1,2,4-) | 0.07 | 0.035 | 502.2, 524.2 |
| Trichloroethane (1,1,1-) | 0.2 | 0.1 | 502.2, 524.2, 551 |
| Trichloroethane (1,1,2-) | 0.005 | 0.0025 | 502.2, 524.2 |
| Trichloroethylene (TCE) | 0.005 | 0.0025 | 502.2, 524.2, 551 |
| Trihalomethanes (Total) | 0.10 | 0.05 | 502.2, 524.2, 551 |
| Vinyl Chloride | 0.002 | 0.001 | 502.2, 524.2 |
| Xylenes (Total) | 10 | 5 | 502.2, 524.2 |

| Synthetic Organic Contaminants | MCLs or [SMCLs] (mg/l) | Detection Limits Required (mg/l) | EPA Method |
|---|---|---|---|
| Alachlor | 0.002 | 0.001 | 505, 507, 508.1. 525.5 |
| Atrazine | 0.003 | 0.0015 | 505, 507, 508.1. 525.5 |
| Carbofuran | 0.04 | 0.02 | 531.1, 6610 |
| Chlordane | 0.002 | 0.001 | 505, 508, 508.1, 525.2 |
| 2,4-D | 0.07 | 0.035 | 515.1, 515.2, 555 |
| Dalapon | 0.2 | 0.01 | 515.1, 552.1 |
| Dibromochloroppropane | 0.0002 | 0.0001 | 504.1, 551 |
| Dinoseb | 0.007 | 0.0035 | 515.1, 515.2, 555 |
| Diquat | 0.02 | 0.01 | 549.1 |
| Endothall | 0.1 | 0.05 | 548.1 |
| Endrin | 0.002 | 0.001 | 505, 508, 508.1, 525.2 |
| Ethylenedibromide (EDB) | 0.00005 | 0.000025 | 504.1, 551 |
| Glyphosate | 0.7 | 0.35 | 547, 6651 |
| Heptachlor | 0.0004 | 0.0002 | 505, 508, 508.1, 525.2 |
| Heptachlor epoxide | 0.0002 | 0.0001 | 505, 508, 508.1, 525.2 |
| Lindane | 0.0002 | 0.0001 | 505, 508, 508.1, 525.2 |
| Mehtoxychlor | 0.04 | 0.02 | 505, 508, 508.1, 525.2 |
| Oxamyl (Vydate) | 0.2 | 0.1 | 531.1, 6610 |
| Pentachlorophenol | 0.001 | 0.0005 | 515.1, 515.2, 525.2, 555 |
| Picloram | 0.5 | 0.25 | 515.1, 515.2, 555 |
| Simazine | 0.004 | 0.001 | 505, 507. 508.1, 525.2 |
| Toxaphene | 0.003 | 0.0015 | 505, 508, 525.2 |
| 2,4,5-TP (Silvex) | 0.05 | 0.025 | 515.1, 515.2, 555 |
| Hexachlorobenzene | 0.001 | 0.0005 | 505, 508, 508.1, 525.2 |
| Hexachlorocylcopentadiene | 0.05 | 0.025 | 505, 508, 508.1, 525.2 |
| Benzo(a)pyrene | 0.0002 | 0.0001 | 550, 550.1, 525.2 |
| PCBs (as Aroclors) (as decachlorobiphenyl) | 0.0005 | 0.00025 | 505, 508, 508A |
| 2,3,7,8-TCDD (Dioxin) | $3x10^{-6}$ | $1.5x10^{-6}$ | 1613 |

| Synthetic Organic Contaminants | MCLs or [SMCLs] (mg/l) | Detection Limits Required (mg/l) | EPA Method |
|---|---|---|---|
| Acrylamide | | | |
| Epichlorohydrin | | | |
| Di(2-ethylexyl)adipate | 0.4 | 0.2 | 506, 525.2 |
| Di(2-ethylhexyl)phthalate | 0.006 | 0.003 | 506, 525.2 |

## APPENDIX I - REFERENCES FOR ANALYTICAL PROCEDURES

All water quality chemical tests required for the UIC program must be performed in accordance with special permit requirements or one of the following methods:

1. Organic and inorganic compounds, water quality measurements: 40 CFR Part 136 "Guidelines Establishing Test Procedures for the Analysis of Pollutants" (as revised on October 26, 1984, and January 4, 1985), 136.3, Table I. This list references the accepted methods to analyze waters for organic and inorganic contaminates. It also includes some physical tests (temperature, specific gravity, etc.).

2. Organic compounds, water quality measurements: "Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater." EPA-600/4-82-057, July 1982, available from the Center for Environmental Research Information (CERI), 26 West St. Clair Street, Cincinnati, Ohio 45268, Phone: (513) 684-7562 or FTS 684-7562. NOTE: This technical report provides procedures that are as uniform and cost effective as possible (with some minor compromises) for the analysis of some organic pollutants. It also provides references that would be helpful to the analyst.

3. Methods for the analysis of inorganic compounds: "Methods for Chemical Analysis of Water and Wastes," EPA-600/4-79-020, March 1979; available from the Center for Environmental Research (CERI), 26 West St. Clair Street, Cincinnati, Ohio 45268.
   NOTE: This reference is included in 1, above, and provides acceptable analytical methods.

4. Other analyses not covered above should be performed in accordance with the most recent edition of "Standard Methods for the Examination of Water and Wastewaters": American Public Health Association, American Water Works, and the Water Pollution Control Federation.

5. For Class II programs, analyses which require a high degree of accuracy must be done as explained above or in accordance with "API Recommended Practice for Analysis of Oil-Field Waters" API Report No. 45.

NOTE: Techniques already approved and used for other programs (RCRA, CERCLA, NPDES, PWSS, etc.) should be deemed acceptable for the same type of analyses.