

GWERD QUALITY ASSURANCE PROJECT PLAN

Title: Hydraulic Fracturing Retrospective Case Study, Wise, TX: Reanalysis of Samples for Metals by the EPA Superfund Analytical Services Contract Laboratory Program for the March 2012 Sampling Event

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The EPA Quality System and the HF Research Study

EPA requires that all data collected for the characterization of environmental processes and conditions are of the appropriate type and quality for their intended use. This is accomplished through an Agency-wide quality system for environmental data. Components of the EPA quality system can be found at <http://www.epa.gov/quality/>. EPA policy is based on the national consensus standard ANSI/ASQ E4-2004 *Quality Systems for Environmental Data and Technology Programs: Requirements with Guidance for Use*. This standard recommends a tiered approach that includes the development and use of Quality Management Plans (QMPs). The organizational units in EPA that generate and/or use environmental data are required to have Agency-approved QMPs. Programmatic QMPs are also written when program managers and their QA staff decide a program is of sufficient complexity to benefit from a QMP, as was done for the study of the potential impacts of hydraulic fracturing (HF) on drinking water resources. The HF QMP describes the program's organizational structure, defines and assigns quality assurance (QA) and quality control (QC) responsibilities, and describes the processes and procedures used to plan, implement and assess the effectiveness of the quality system. The HF QMP is then supported by project-specific QA project plans (QAPPs). The QAPPs provide the technical details and associated QA/QC procedures for the research projects that address questions posed by EPA about the HF water cycle and as described in the *Plan to Study the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources* (EPA/600/R-11/122/November 2011/[www.epa.gov/hydraulic fracturing](http://www.epa.gov/hydraulic%20fracturing)). The results of the research projects will provide the foundation for EPA's 2014 study report.

This QAPP provides information concerning the Chemical Mixing; and Flowback and Produced Water stages of the HF water cycle as found in Figure 1 of the HF QMP and as described in the HF Study Plan. Appendix A of the HF QMP includes the links between the HF Study Plan questions and those QAPPs available at the time the HF QMP was published.

Reanalysis of Samples for Metals by ICP-MS and ICP-OES using the Contract Laboratory Program

Purpose

The purpose of this Addendum to the QAPP for the Hydraulic Fracturing Retrospective Case Study, Wise, TX is to provide specifications and quality control (QC) acceptance criteria for the reanalysis of samples collected in March 2012 for trace metals by Inductively Coupled Plasma – Mass Spectrometry (ICP-MS). Audits of Data Quality on the original ICP-MS results found that the laboratory did not analyze interference check solutions (ICSs) as described in EPA Method 6020A. These ICSs would have enabled the laboratory to evaluate the analytical method's ability to appropriately handle known potential interferents and other matrix effects. In ICP-MS analysis, the ICS is used to verify that the interference levels are corrected by the data system within quality control limits. Because of the importance of this missing quality control check, it was necessary to reject the data from the original analysis.

Audits of Data Quality on the original ICP-OES data found that the laboratory did not analyze matrix spikes for a number of metals and cations as well as the frequency of calibration checks was less than required. Since samples were already being submitted for ICP-MS analysis, it was determined that re-analysis for the metals was ICP-OES was desirable to in an attempt to eliminate or reduce the number of qualified data

The samples were analyzed through the EPA Superfund Analytical Services Contract Laboratory Program (EPA CLP). Samples were sent for analysis under the EPA CLP Inorganic Statement of Work ISMO1.3, Exhibit D – Part B, “Analytical Methods for Inductively Coupled Plasma – Mass Spectrometry” (<http://www.epa.gov/superfund/programs/clp/ism1.htm#pdf>), with some minor requested modifications described in the Analytical Methods section below.

Sample Handling and Custody

Samples were packed in coolers (without ice) and shipped overnight via UPS or Fedex, to the contract laboratory awarded the work through the CLP, with appropriate chain of custody forms and the cooler was sealed with custody seals.

Sample receipt and log-in was conducted as described in EPA CLP Inorganic Statement of Work ISMO1.3, Exhibit F – “Chain-of-Custody, Document Control, and Written Standard Operating Procedures” (<http://www.epa.gov/superfund/programs/clp/download/ism/ism12e-h.pdf>).

Analytical Methods

The contract laboratory analyzed water/aqueous samples for As, Cd, Cr, Cu, Ni, Pb, Se, Tl, U, and V by ICP-MS. In addition, the contract laboratory analyzed water/aqueous samples for Ag, Al, B, Ba, Be, Ca, Co, Fe, K, Mg, Mn, Mo, Na, S, Sb, Si, Sr, and Ti by ICP-OES. The

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reanalysis did not include Hg, Th, Li, or Zn. Mercury was excluded because the sample holding time was exceeded. Li and U were excluded because the specialized low-level quantitation request for these elements could not be accommodated in the necessary timeframe. Li and Th were not believed to be important in Wise Co. so they were excluded from the list. P and Zn were accidentally omitted from the statement of work so these were not analyzed for. The contract laboratory performed the analysis in accordance with the EPA CLP Inorganic Statement of Work (SOW) ISM01.3, Exhibit D – Part B, “Analytical Methods for Inductively Coupled Plasma – Mass Spectrometry” (<http://www.epa.gov/superfund/programs/clp/ism1.htm#pdf>), with the following modifications:

[Note that for analysis conducted under the EPA CLP SOW, samples are grouped into batches of up to 20 called Sample Delivery Groups (SDGs).]

Modification to the SOW Specifications:

The contract Laboratory analyzed water/aqueous samples for the Target Analyte List (TAL) (Al, Sb, Ba, Be, Ca, Co, Fe, Mg, Mn, K, Na, and Ag) and the additional analytes Boron (B, CASRN 7440-42-8), Molybdenum (Mo, CASRN 7439-98-7), Silicon (Si, CASRN 7440-21-3), Strontium (Sr, CASRN 7440-24-6), Sulfur (S, CASRN 7704-34-9), and Titanium (Ti, CASRN 7440-32-6) by ICP-AES as indicated on the Traffic Report/Chain of Custody Record and Laboratory Scheduling Notification form.

The Contract Required Quantitation Limits (CRQLs) for the following analytes and matrices were modified. All other CRQLs remained at the level specified in the SOW.

Analyte	Aqueous CRQL (µg/L)	Aqueous Spike level (µg/L)
Boron	100	1000
Molybdenum	20	200
Silicon	100	2000
Strontium	10	100
Sulfur	500	2000
Titanium	10	100

Some samples may be received at a reduced volume, less than 100ml but greater than 50ml. The samples were not shipped at 4°C (±2°C). The Laboratory noted the temperature at the time of receipt in the SDG Narrative and proceed with analysis.

Due to the reduced volume, the Laboratory used different samples to prepare the Duplicate sample and the Matrix Spike sample. The Laboratory prepared the original samples at an initial and final volume of 50 mL, and the Duplicate and Matrix Spike sample at initial and final volumes of 25 mL, reducing the reagents added appropriately.

The Laboratory prepared the samples for analysis using the aqueous preparation method for ICP-AES. These digestates were analyzed by both ICP-AES and ICP-MS analysis. The Laboratory performed the ICP-AES analysis first to screen for potentially high levels of analytes or interferents that may impact ICP-MS analysis. Based on the results of the ICP-AES analysis, the Laboratory performed the analysis by ICP-MS at the appropriate dilution to avoid potential damage to the ICP-MS instrument.

The Laboratory did use borosilicate glassware to digest the samples for metals analysis or prepare any sample dilutions to avoid contaminating samples with Boron or Silicon. Fluoropolymer or polypropylene digestion vessels were used instead. It was acceptable to use polymethylpentene or polypropylene volumetric flasks that have a tolerance of ± 0.16 mL for diluting the samples to the required final volume after filtering.

The Laboratory:

- Performed the Initial Calibration at or below the modified CRQLs.
- Added B, Mo, Si, Sr, S, and Ti to the ICB and CCV at appropriate mid-range concentrations.
- Evaluated the ICB and CCB against the (modified) aqueous CRQLs.
- Performed the Matrix Spike at the levels specified above. Post-digestion spike requirements were per the SOW.
- Added B, Mo, Si, Sr, S, and Ti to the LCS at two times the modified CRQLs.
- Added B, Mo, Si, Sr, S, and Ti to Forms 1, 2A, 3, 4A, 5A (5B), 6, 7, 8, 9, 10A, 13, and 16.

The Laboratory was not required to add B, Mo, Si, Sr, S, or Ti to the ICSA/ICSAB solutions. The Laboratory used a true value of zero (0) and acceptance windows of $\pm 1x$ the modified aqueous CRQLs unless a non-zero value was determined for the solutions.

Due to the single preparation, the Laboratory prepared a single Matrix Spike sample for both ICP-AES and ICP-MS analyses. The Matrix Spike was prepared with the ICP-AES Target Analyte List metals and additional analytes at the levels specified for ICP-AES analysis and the ICP-MS Target Analyte List metals and additional analyte at the level specified for ICP-MS analysis.

The Laboratory prepared separate LCS for ICP-AES and ICP-MS analysis. The LCS for ICP-AES was spiked at two times the CRQL (SOW or modified) for ICP-AES analysis. The LCS for ICP-MS was spiked at two times the CRQL (SOW or modified) for ICP-MS.

As part of the complete data package, the Laboratory provided:

- Method Detection Limits for B, Mo, Si, Sr, S, and Ti.

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- All wavelengths used for inter-element correction and quantitation.
- All corrections applied to the data to handle interferences in addition to the IECs, and used to generate the final corrected instrument result.

Modification to the SOW Specifications:

The contract Laboratory analyzed water/aqueous samples for the Target Analyte List (TAL) (As, Cd, Cr, Cu, Pb, Ni, Se, Tl, and V) and the additional analyte Uranium (U, CASRN 7440-61-1) by ICP-MS as indicated on the Traffic Report/Chain of Custody Record and Laboratory Scheduling Notification form.

The Contract Required Quantitation Limit (CRQL) for the following analyte and matrices were modified. All other CRQLs remained at the level specified in the SOW.

Analyte	Aqueous CRQL (µg/L)	Aqueous Spike level (µg/L)
Uranium	1	100

Some samples may be received at a reduced volume, less than 100ml but greater than 50ml. The samples were not shipped at 4°C (±2°C). The Laboratory noted the temperature at the time of receipt in the SDG Narrative and proceeded with analysis.

Due to the reduced volume, the Laboratory used different samples to prepare the Duplicate sample and the Matrix Spike sample. The Laboratory prepared the original samples at an initial and final volume of 50 mL, and the Duplicate and Matrix Spike sample at initial and final volumes of 25 mL, reducing the reagents added appropriately.

The Laboratory analyzed the samples previously prepared for analysis by the aqueous preparation method for ICP-AES. These digestates were analyzed by both ICP-AES and ICP-MS analysis. The Laboratory performed the ICP-AES analysis first to screen for potentially high levels of analytes or interferences that may impact ICP-MS analysis. Based on the results of the ICP-AES analysis, the Laboratory performed the analysis by ICP-MS at the appropriate dilution to avoid potential damage to the ICP-MS instrument.

The Laboratory did use borosilicate glassware to digest the samples for metals analysis or prepare any sample dilutions to avoid contaminating samples. Fluoropolymer or polypropylene digestion vessels were used instead. It was acceptable to use polymethylpentene or polypropylene volumetric flasks that have a tolerance of ± 0.16 mL for diluting the samples to the required final volume after filtering.

The Laboratory:

- Performed the Initial Calibration as currently in the SOW except that the lowest non-blank standard was set at the CRQL for all analytes (SOW and additional).

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- Added U to the ICV and CCV at appropriate mid-range concentrations.
- Evaluated the ICB and CCB against the (modified) aqueous CRQL.
- Added U to the LCS at two times the modified CRQL.
- Added U to Forms 1, 2A, 3, 4B, 5A (5B), 6, 7, 8, 9, 11, 13, and 16.

The acceptance criterion for the initial calibration correlation coefficient was modified to $r \geq 0.998$.

The Laboratory re-analyzed the low-level (at CRQL) calibration standard at the end of the run. The Percent Difference between the true value and the measured value shall be within $\pm 30\%$.

The CCV and CCB was analyzed after every ten analytical samples.

The Laboratory was not required to add U to the ICSA/ICSAB solutions. The Laboratory used a true value of zero (0) and acceptance windows of $\pm 2x$ the modified aqueous CRQLs unless a non-zero value was determined for the solutions.

Due to the single preparation, the Laboratory prepared a single Matrix Spike sample for both ICP-AES and ICP-MS analyses. The Matrix Spike was prepared with the ICP-AES Target Analyte List metals and additional analytes at the levels specified for ICP-AES analysis and the ICP-MS Target Analyte List metals and additional analyte at the level specified for ICP-MS analysis.

The Laboratory prepared separate LCS for ICP-AES and ICP-MS analysis. The LCS for ICP-AES was spiked at two times the CRQL (SOW or modified) for ICP-AES analysis. The LCS for ICP-MS was spiked at two times the CRQL (SOW or modified) for ICP-MS.

The Laboratory was not required to bracket U with an internal standard having a mass greater than 238. The analysis of the Bismuth internal standard at mass 209 was sufficient.

As part of the complete data package, the Laboratory provided:

- Method Detection Limits for U.
- All masses monitored, and all masses used for quantitation.
- All corrections applied to the data to handle interferences and used to generate the final corrected instrument result.

Quality Control

The following Tables 1 and 2 summarize the acceptance criteria and frequency for the QC checks conducted during the course of sample analysis.

Table 1. CLP QC Checks for ICP-MS

QC Type or Operation	Acceptance Criterion	Frequency
Instrument Calibration	The acceptance criterion for the initial calibration correlation coefficient is $r \geq 0.998$.	Each time instrument is turned on or set up, after ICV or CCV failure, and after major instrument adjustment. The lowest non-blank standard shall be set at the CRQL for all analytes.
Initial Calibration Verification	90-110% Recovery; % RSD $\leq 5\%$ for all replicate integrations	Following each instrument calibration for each mass used.
Initial Calibration Blank	\leq CRQL	Following each instrument calibration, immediately after the ICV.
Continuing Calibration Verification	90-110% Recovery; % RSD $\leq 5\%$ for all replicate integrations;	For each mass used, at a frequency of at least after every 10 analytical runs, at the beginning of each day, and at the beginning and end of each run.
Low Level (at CRQL) Calibration Verification	70-130% Recovery	The Laboratory shall re-analyze the low-level (at CRQL) calibration standard at the end of each run.
Continuing Calibration Blank	\leq CRQL	At a frequency of at least after every 10 analytical runs, at the beginning of each day, and at the beginning and end of each run. Performed immediately after the last CCV.
Interference Check Sample	$\pm 20\%$ of the analyte's true value or ± 2 times the CRQL of the analyte's true value, whichever is greater.	At the beginning of the run after the ICB but before the CCV.

QC Type or Operation	Acceptance Criterion	Frequency
Serial Dilution for ICP	If the analyte concentration is sufficiently high (minimally a factor of 50 above the MDL in the original sample), the serial dilution (a five-fold dilution) shall then agree within 10% of the original determination after correction for dilution.	For each matrix type or for each SDG, whichever is more frequent.
Preparation Blank	\leq CRQL	For each SDG or each sample preparation and analysis procedure per batch of prepared samples, whichever is more frequent.
Laboratory Control Sample	70-130% Recovery	For each SDG or each sample preparation and analysis procedure per batch of prepared samples, whichever is more frequent.
Spike Sample	75-125% Recovery	For each matrix type or for each SDG, whichever is more frequent.
Post-Digestion Spike	75-125% Recovery	Each time Spike Sample Recovery is outside QC limits.
Duplicate Sample Analysis	RPD < 20 for sample values \geq 5x CRQL; for sample values < 5x CRQL, control limit = CRQL	For each matrix type or for each SDG, whichever is more frequent.
ICP-MS Tune	Mass calibration must be within 0.1 amu over the range of 6 to 210 amu, or the percent Relative Standard Deviation (%RSD) of all the integrations of the absolute signals of the analytes must be \leq 5.0%.	Prior to calibration.
Internal Standards	The absolute response of any one internal standard must not deviate more than 60-125% from the original response in	Internal standards shall be present in all samples, standards, and blanks (except the tuning solution) at

QC Type or Operation	Acceptance Criterion	Frequency
	the calibration blank.	identical levels.
Determination of Method Detection Limits		Prior to contract award, annually thereafter, and after major instrument adjustment.

Table 2. CLP QC Checks for ICP-OES

QC Type	Acceptance Criteria	Frequency
Instrument Calibration	The acceptance criterion for the initial calibration correlation coefficient is $r \geq 0.995$. The percent differences calculated for all non-zero standards must be within $\pm 30\%$ of true value.	Each time instrument is turned on or set up, after ICV or CCV failure, and after major instrument adjustment. The lowest non-blank standard shall be set at the CRQL for all analytes.
Initial Calibration Verification	90-110% Recovery	Immediately after each system has been calibrated.
Initial Calibration Blank	<CRQL	Analyzed after the analytical standards, but not before analysis of the Initial Calibration Verification (ICV) during the initial calibration of the instrument.
Continuing Calibration Verification	90-110% Recovery	At beginning and end of run; every two hours during analytical run.
Low Level (at CRQL) Calibration Verification	70-130% Recovery	The Laboratory shall re-analyze the low-level (at CRQL) calibration standard at the end of each run.
Continuing Calibration Blank	<CRQL	Analyzed immediately after every Continuing Calibration Verification (CCV); at beginning and end of run and every two hours during an analytical run.
Interference Check Sample	$\pm 20\%$ of the analyte's true value or ± 2 times the CRQL of the analyte's true value,	At the beginning of the run after the ICB but before the CCV.

QC Type	Acceptance Criteria	Frequency
	whichever is greater.	
Serial Dilution for ICP	If the analyte concentration is sufficiently high (minimally a factor of 50 above the MDL in the original sample), the serial dilution (a five-fold dilution) shall then agree within 10% of the original determination after correction for dilution.	For each matrix type or for each SDG, whichever is more frequent.
Preparation Blank	<CRQL	Analyzed for each matrix, with every Sample Delivery Group (SDG), or with each batch of samples digested, whichever is more frequent.
Laboratory Control Sample	Percent Recoveries (%R) must fall within the control limits of 70-130%, except for Sb and Ag which must fall within the control limits of 50-150%.	Analyzed for every group of aqueous/water samples in a Sample Delivery Group (SDG), or with each batch of samples digested, whichever is more frequent. The LCS shall be spiked such that the final digestate contains each analyte at two times the CRQL for the associated matrix.
Spike Sample	75-125% Recovery	For each matrix type or for each SDG, whichever is more frequent.
Post-Digestion Spike	75-125% Recovery	Each time Spike Sample Recovery is outside QC limits.
Duplicate Sample Analysis	RPD<20 for sample values $\geq 5x$ CRQL; for sample values $< 5x$ CRQL, control limit = CRQL	Analyzed from each group of samples of a similar matrix type (e.g., water or soil) or for each Sample Delivery Group (SDG).
Determination of Method Detection Limits		Prior to contract award, annually thereafter, and after major instrument adjustment.

Data Review and Validation

Initial data validation was conducted by the EPA CLP Sample Management Office (SMO) contractor. The EPA CLP SMO contractor performed a data assessment on the laboratory's hardcopy and electronic deliverable based on the requirements of the EPA CLP SOW ISM01.3, the elements of the modified analysis as described above (and in the Request for Proposal), and the "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review" (<http://www.epa.gov/superfund/programs/clp/download/ism/ism1nfg.pdf>).

Neptune & Co., a QA contractor, under the direction of the GWERD Quality Assurance Manager (QAM) subsequently conducted an Audit of Data Quality on the data set according to NRMRL SOP LSAS-QA-02-0 "Performing Audits of Data Quality (ADQs)". The auditors reviewed the information presented in the EPA CLP SMO data assessment, reviewed the data, and ensure that appropriate project-specific data qualifiers were added to the data tables. Data transcription checks occurred after the ADQ was completed.

Reporting Requirements

Hardcopy and electronic data reporting were required as specified per EPA CLP SOW ISM01.3. All hardcopy and electronic data were adjusted to incorporate modified specifications. This included attaching a copy of the requirements for modified analysis to the SDG Narrative. All samples analyzed for the same fraction within an SDG were analyzed under the same fractional requirements. The Laboratory did not include data for the same fraction with different requirements in the same SDG.

The Laboratory included the Modification Reference Number on each hardcopy data form under the "Mod. Ref. No." header appearing on each form as well as the SamplePlusMethod/ClientMethodModificationID element of the electronic deliverable. The Laboratory also documented the Modification Reference Number and Solicitation Number on the SDG Coversheet and SDG Narrative.

Revision History

Revision Number	Date Approved	Revision
0	6/20/11	New document
1	2/27/12	<ul style="list-style-type: none"> • Added $^{87}\text{Sr}/^{86}\text{Sr}$ isotopes and O,H stable isotopes of water to analyte list to ascertain if the water is from a different source or is mixture of aquifer water and source water. (Sections 2.2.1.1, 2.4.1, 2.5.1, and Tables 6, 8, 9, and 13) • Added USGS Laboratory contact information (2.3.3) • Added Appendix A for Sr isotope methodology used by USGS • Revised Project /Task organization (Section 1.1) to reflect change in personnel • Revised location information (1.2.4 and 1.2.5) • Updated Region VIII accreditation status and text to 2nd paragraph to provide clarification (1.5) • Added geophysical measurements and methods to help identify the source of contamination and determine the extent of contamination (2.1.3 and 2.2.2) • Added USGS sample shipping information (2.3.3) • Section 2.2.1.1, #4o, made corrections to cited methods • Section 2.5.1, for Region VIII, #5, indicated that Region VIII has provided their results for performance evaluations • Section 2.7, provided clarification of steps taken to check performance of field measurements for sulfide, ferrous iron, alkalinity, and turbidity • Sec. 3.1, provided clarification that ADQs are performed on the first data sets

		<ul style="list-style-type: none"> • Sec. 3.1.2 and 3.2, corrected to whom audit reports are submitted • Sec. 4.2, added text to clarify data verification/validation process as well as addition of new Table 18 on Data Qualifiers • Added references for geophysical measurements, stable isotopes, data review, low molecular weight acids, microwave digestion for unfiltered metals samples • Revised Table 2 Field Activities Schedule • Made corrections to methods in Table 5 (methods for ferrous iron and sulfide are not EPA); replaced alkalinity method # with correct #; added pH, DO, ORP, and specific conductance • Added bromide analysis by RSKSOP-288v3 in Tables 6 and 11; this method can analyze for Br in samples with high chloride concentrations • Revised Region VIII SVOC, Table 12 with updated limits • Table 13, corrections were made for DIC/DOC • Table 14, replaced with updated/corrected version from Region VIII • Added Table 16 showing USGS QA/QC requirements for Sr isotopes • Revised Figure 1 and Sec. 1.1 to reflect current project organization (replaced Puls with Jewett; added Peterman, Costantino, Groves, and McElmurry)
2	5/25/12	<ul style="list-style-type: none"> • Section 1.1, added new data management duties for Susan Mravik. • Updated section 1.2.2 Phase 2 Investigations to reflect how phase 2 GW sampling will be done • Updated section 2.2.1.1 Domestic wells to reflect how

		<p>sampling will occur for Phase 2 GW sampling</p> <ul style="list-style-type: none"> • Updated Section 2.3.3. Replaced Shaw lab contact person due to departure of employee • Updated 2.4.1. Modified first sentence for clarification. • Updated Section 2.5.3. Added text on isotope analysis and detection limits • Updated Section 2.5.4. Added language describing process for evaluating field duplicates and blanks • Updated Section 3.1.1. Added text clarifying that PE samples are not available or needed for isotope analysis • Revised Table 2 Field Activities Schedule to reflect modified sampling frequency and ceasing of sampling at Locations A and C • Table 6, replaced EPA Method 200.7 with 6010C; both are ICP-MS methods, but 6010C is the more appropriate method based on SW846 inherent method flexibility • Table 13, replaced metals QC criteria with revised criteria to make them more consistent with 6010C • Revised Table 18 to clarify qualifiers and add new ones
3	9/10/12	<ul style="list-style-type: none"> • Title changed to reflect we are not doing any investigations in Denton Co., TX and to identify the special sampling event in September 2012 • Distribution list changed to reflect additional personnel involved with the study • Section 1.1 changed to reflect update to David Jewett's responsibilities • Section 1.2, Denton Co., TX removed, no longer part of project • Section 1.2.1, added description of this sampling event • Section 1.2.2, changed sampling date for Phase 2 from May 2012 to November-December 2012 • Section 1.2.3, deleted Ra because at this time no evidence suggests this to be important parameter in Wise Co.

		<ul style="list-style-type: none"> • Section 1.2.6, added information supplied to us by the homeowner and TRRC. • Section 1.3, added information on March 2012 sampling; added strontium and stable water isotopes to analyte list; added statement on the September 2012 sampling event • Section 1.3, deleted DRO and GRO. Data from previous sampling events indicated that these have limited utility for the study. • Section 2.2, added information for sampling production wells and scope of sampling for this sampling event, including samples for metals analysis by a CLP lab and samples for iodide • Section 2.3.2, added information for CLP lab • Section 2.3.3, added information for CLP lab • Section 2.4.1, changed title from “Ground Water” to “Ground, Surface, and Produced Waters” to reflect scope of samples to be analyzed; added analysis of iodide for this sampling event; added analysis of samples for metals by CLP lab • Section 2.5.1, added information for CLP lab analysis of metals • Section 4.2, added data validation of metals data from CLP lab • Table 2, added the September 2012 sampling event • Table 6; replaced EPA Method 6010C with 200.7 (ICP-OES analysis for metals). 200.7 was referenced in QAPP Revisions 0 and 1. It was changed in Revision 2 to 6010C but since then it was determined by QA staff that use of 200.7 as the “base” method was appropriate as 200.7 incorporates 6010C by reference. Added volume and bottle requirements for metals analysis by CLP lab. Added Iodide analysis to table. • Table 7, all instances of RL were replaced with QL; criteria for blanks were updated to be consistent with data qualifier table. • Table 11, replaced EPA Method 6010C with 200.7 (see above); replaced SOPs listed in table with their corresponding EPA Methods, and added footnotes to indicate the SOPs that implement these EPA Methods • Table 13, added table of CLP CRQLs for metals
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		<ul style="list-style-type: none"> • Table 14, added Laboratory Control Sample and information for iodide • Table 18, added CLP lab QA/QC requirements • Table 20, table replaced with most recent version; U, U1, D, and T removed as they will not be used; J10 has been added.
3, Addendum	11/30/12	<ul style="list-style-type: none"> • Title changed to reflect the focus of this addendum • Scope of addendum is limited to the CLP metals reanalysis