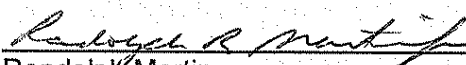
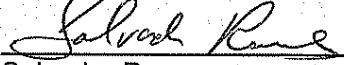
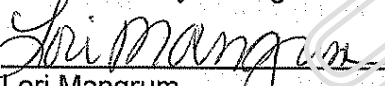
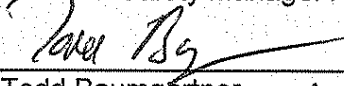
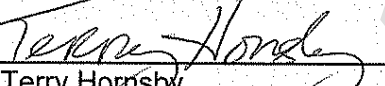
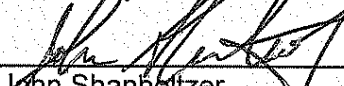


## TITLE: SULFIDE (Titrimetric and Iodometry)

### EPA 376.1/ SM4500-S2-F

#### Approvals (Signature/Date):

 Randolph Martin Wet Chemistry Manager	2/9/10 Date	 Salvador Ramos Health & Safety Manager / Coordinator	2/10/10 Date
 Lori Mangrum Quality Assurance Manager	2/15/10 Date	 Todd Baumgartner Laboratory Director	2/12/10 Date
 Terry Hornsby Operations Manager	2/12/10 Date	 John Shanholtzer Technical Director	2-10-10 Date

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## **1.0 Scope and Application**

### **1.1 Analytes, Matrix(s), and Reporting Limits**

This SOP is applicable to the determination of the concentration of Sulfide in waters, liquids, solids, and sludges.

The SOP is based on EPA 376.1 and Standard Methods 4500-S2-F.

The reporting limits are 1 mg/L for waters and 50 mg/kg for solids.

This SOP can be applied to solid matrices by combining 5g of soil and 250mL of deionized water (for a conversion factor of 50) and swirling lightly. The sample is then analyzed like an aqueous sample.

## **2.0 Summary of Method**

- 2.1 An excess of iodine is added to a sample which oxidizes the Sulfide to sulfur under acidic conditions. The excess iodine is back titrated with sodium thiosulfate.

## **3.0 Definitions**

Refer to SOP TP-AN-005: Definitions, Terms, and Acronyms and to the current revision of the Tampa's Quality Assurance Manual (TP-QAM) for a complete listing of applicable definitions.

## **4.0 Interferences**

- 4.1 Method interferences may be caused by contaminants in solvents, reagents, glassware, and other processing apparatus that lead to discrete artifacts. All of these materials must be routinely demonstrated to be free from interferences under conditions of the analysis by running laboratory method blanks as described in the Quality Control section. Specific selection of reagents may be required to avoid introduction of contaminants.
- 4.2 Reducing substances such as thiosulfite, sulfites, and various organic compounds cause interferences, but treatment with zinc acetate solution will eliminate some of these interferences. (Use approximately 1mL of 2N zinc acetate per 500mL of sample if not already preserved.)
- 4.3 Samples that contain strong oxidizers or reducers will interfere with this method.
- 4.4 Samples that are not water miscible (oils, various solvents) cannot be analyzed using this method.

## **5.0 Safety**

Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001) and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all

of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

## 5.1 Specific Safety Concerns or Requirements

**Sodium Sulfide will form Hydrogen Sulfide (HS) gas if combined with water moisture or strong acids. Inhalation of HS gas may be fatal.**

## 5.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **NOTE: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Hydrochloric Acid	Corrosive Poison	5 ppm- Ceiling	Irritation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death. Can cause redness, pain, and severe skin burns. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Sodium Hydroxide	Corrosive	2 Mg/M3- Ceiling	Severe irritant. Effects from inhalation of dust or mist vary from mild irritation to serious damage of the upper respiratory tract, depending on severity of exposure. Symptoms may include sneezing, sore throat or runny nose. Contact with skin can cause irritation or severe burns and scarring with greater exposures. Causes irritation of eyes, and with greater exposures it can cause burns that may result in permanent impairment of vision, even blindness.
Sodium Sulfide	Corrosive	10 ppm- TWA 15 ppm- STEL	Will form Hydrogen Sulfide (HS) gas if combined with strong acids. Inhalation of HS gas may be fatal. Symptoms include painful conjunctivitis, headache, nausea, dizziness, coughing and, in extreme cases, pulmonary edema and possible death. Irritant. Contact with skin can produce serious caustic burns with painful inflammation and possible destruction of tissue. Inflammation, tearing and pain may be expected. Severe contact can cause destruction of tissue.
1 – Always add acid to water to prevent violent reactions.			
2 – Exposure limit refers to the OSHA regulatory exposure limit.			

## 6.0 Equipment and Supplies

### 6.1 Instrumentation

6.1.1 Top loading balance: capable of accurately weighing  $\pm 0.01\text{g}$

## 6.2 Supplies

- 6.2.1 Volumetric pipettes: various
- 6.2.2 Burette: 25mL Class A
- 6.2.3 Erlenmeyer flasks: 500mL
- 6.2.4 Graduated cylinder: 250mL

## 7.0 Reagents and Standard

All reagents and standards are to be labeled with their unique TALS ID, including name of the material, concentration, date prepared/received, expiration date, and analyst name, according to SOP TP-AN-004, *Standard Material and Reagent Traceability*. Certificates of analysis or purity must be received with all neat compounds and stock solutions and scanned into TALS.

7.1 Laboratory reagent grade water (deionized water)

7.2 Hydrochloric Acid (HCl), concentrated, approved for use by the TestAmerica solvent testing program.

7.3 Hydrochloric Acid, 6N

7.3.1 Add 250mL of concentrated Hydrochloric acid (HCl) to 250mL of reagent water.

**CAUTION:** Heat will be evolved as acid mixes with water. These solutions will cause skin burns and destroy unprotected clothing.

7.4 Starch Indicator: Purchased commercially.

7.5 Sodium Thiosulfate, 0.025N. Purchased commercially, store away from light. Must be standardized as described in Section 10.1.

7.6 Iodine Solution, 0.025N: Purchased commercially. Store in a dark container.

7.7 Zinc Acetate, 2N: Purchased commercially or dissolve 220g  $\text{Zn}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot 2\text{H}_2\text{O}$  to 1000mL.

7.8 Potassium Biiodate, 0.025N: Purchased commercially.

7.9 Potassium Iodide: Free flowing crystals, purchased commercially, reagent grade.

7.10 Stock standard (100mg/L Sulfide)

7.10.1 Add 0.70g of sodium sulfide to reagent water in a 1L volumetric flask. Dilute to volume with reagent water. Store at  $\leq 6^\circ\text{C}$ . This solution has an expiration date of 7 days from the preparation date.

7.10.2 To be used for calibration and spiking (LCS/LCSD, MS/MSD).

## 8.0 Sample Collection, Preservation, Shipment and Storage

Sample container, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract or client requests. Listed below are the holding times and the references that include preservation requirements.

Matrix	Sample Container	Min. Sample Size	Preservation	Holding Time	Reference
Waters	HDPE	50mL	NaOH and zinc acetate, pH < 9; Cool ≤ 6°C	7 Days	40 CFR Part 136.3
Soils	Glass	3 grams	Cool ≤ 6°C	7 Days	N/A

- 8.1 All samples should be verified for proper preservation and residual chlorine in custody. If chlorine and/or pH are not appropriate, the samples will be marked for the deficiency. Appropriate steps must be taken by the analyst to adjust the pH and chlorine if samples are not properly preserved. Acid or sodium hydroxide can be added to samples to adjust the pH; and sodium thiosulfate is added for residual chlorine.

## 9.0 Quality Control

Please refer to Appendix 4 of the laboratory QAM for additional information relating to the QC associated with this method.

### 9.1 Sample QC

#### 9.1.1 Batch Definition

- 9.1.1.1 A batch is a group of no greater than 20 samples excluding QC samples (LCS/LCSD, Method Blank, MS, MSD) which are processed similarly, with respect to the procedure. All sample setups must be initiated within a 24-hour period from the initial preparation or extraction and without interruption of the process. All samples within the batch must be treated with the same lots of reagents and the same processes.

Quality Controls	Frequency	Control Limit
Method Blank (MB)	1 in 20 or fewer samples	< MDL
Laboratory Control Sample (LCS)	1 in 20 or fewer samples	75-125% <sup>2</sup>
Laboratory Control Sample (LCSD)*	1 in 20 or fewer samples	75-125% <sup>2</sup>
Matrix Spike (MS) <sup>1</sup>	1 in 20 or fewer samples	75-125% <sup>2</sup>
MS Duplicate (MSD) <sup>1</sup>	1 in 20 or fewer samples	75-125% <sup>2</sup>

\* LCS Duplicate (LCSD) is performed only when there are samples for a TMDL project included in the batch.

<sup>1</sup> The sample selection for MS/MSD are randomly selected, unless specifically requested by a client.

<sup>2</sup> Statistical control limits are updated annually and are updated into LIMS.

#### 9.1.2 Method Blank

9.1.2.1 One method blank (MB) must be processed with each preparation batch. The method blank consists of reagent water or Ottawa sand. The method blank is carried through the entire analytical procedure, including preparation and analysis.

9.1.2.2 The method blank is used to identify any system and process interferences or contamination of the analytical system that may lead to the reporting of elevated analyte concentrations of false positive data. The method blank may not contain any analyte of interest at or above the reporting limit.

#### 9.1.3 Laboratory Control Sample (LCS/LCSD)

9.1.3.1 An LCS/LCSD must be processed with each preparation batch. The LCS/LCSD consists of reagent water or Ottawa sand spiked with a known amount of the target analyte. The LCS/LCSD must be carried through the entire analytical procedure.

9.1.3.2 The LCS is used to monitor the accuracy of the analytical process. On going monitoring of the LCS results provides evidence that the laboratory is performing the method within acceptable accuracy and precision guidelines.

#### 9.1.4 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

9.1.4.1 One MS/MSD pair must be processed for each batch. A matrix spike (MS) is a field sample to which known concentrations of target analytes have been added. A matrix spike duplicate (MSD) is a second aliquot of the same sample (spiked identically as the MS) prepared and analyzed along with the sample and matrix spike. Some projects may require the use of sample duplicates in place of or in addition to MS/MSD's. The MS/MSD results are used to determine the effect of a matrix on the precision and accuracy of the analytical process. Due to the potential variability of the matrix of each sample, these results may have immediate bearing only on the specific sample spiked. Samples identified as field blanks cannot be used for MS/MSD analysis.

9.1.4.2 If an MS/MSD is not possible due to limited sample volume then a laboratory control sample duplicate (LCSD) should be analyzed. The RPD of the LCS and LCSD must be compared to the matrix spike RPD limits.

9.1.5 One time procedural variations are allowed only if deemed necessary in the professional judgment of supervision to accommodate variation in sample matrix, radioactivity, chemistry, sample size, or other parameters. Any variation in procedure shall be completely documented using a NCM and is approved by a Technical Specialist and QA Manager. If contractually

required, the client shall be notified. The NCM shall be filed in the project file.

- 9.1.6 Any unauthorized deviations from this procedure must also be documented as a nonconformance, with a cause and corrective action described.

## 9.2 **Instrument QC**

- 9.2.1 The accuracy (% Recovery) and precision (% RPD) for the lab spike and matrix spikes should be checked against the limits listed in the method. The lab spikes must meet these accuracy and precision limits. If limits are not met, investigate the cause and either reanalyze or re-extract. The matrix spike recoveries are used to evaluate the matrix effect on the analysis and are advisory.

## 10.0 **Procedure**

### 10.1 **Standardization of Sodium Thiosulfate Solution**

- 10.1.1 The titrant is standardized weekly and documented in the titrant standardization logsheet.
- 10.1.2 Weigh 2g Potassium Iodide (KI) in a 500mL Erlenmeyer flask.
- 10.1.3 Add 100 to 150mL reagent water, 2 ml HcL (1:1) and 20mL 0.025N Biiodate Solution using a Class A graduated cylinder or Class A volumetric pipette.
- 10.1.4 Titrate with Sodium Thiosulfate. When a pale yellow color is reached, add 1-2mL of starch. Continue titrating from a blue to a clear end point.
- 10.1.5 Calculate the normality of the sodium thiosulfate solution using Equation 1.

### 10.2 **Calibration**

- 10.2.1 Not applicable to this SOP.

### 10.3 **Sample Analysis**

- 10.3.1 Excess Iodine is added to a sample and under acidic conditions is back titrated with sodium thiosulfate from a blue to a clear color.
- 10.3.2 Using a Class A graduated cylinder pour 250mL of sample into a 500mL Erlenmeyer flask.
- 10.3.3 Add 2mL of 6N HCl.
- 10.3.4 Place 20.0mL of 0.025N Iodine solution into the flask. The volume may be adjusted based on estimates that it may be in excess of the amount of sulfide expected.

- 10.3.5 Titrate with the 0.025N sodium thiosulfate using a starch indicator until the blue color disappears. Record the number of milliliters used. Some matrices may be turbid or colored and the color change from blue to clear may not be easily seen. In this case, look for a shade change.
- 10.3.6 If the iodine color disappears, add more iodine until the color remains. Record the total number of milliliters of standard iodine used.
- 10.3.7 The iodine should turn a yellow-orange color when added to the samples. If it does not, the sample may be high in sulfide and less sample should be used.
- 10.3.8 Record all analytical information in the analytical logbook/logsheet including the analytical data from standards, blanks, LCS's, MS/MSD's, and any corrective actions or modifications to the method.
- 10.3.9 Sample results and associated QC are entered into the TALS.

## 11.0 Calculations / Data Reduction

- 11.1 Equation 1. Calculation of sodium thiosulfate normality.

$$\text{Na}_2\text{S}_2\text{O}_3 \text{ Normality} = \frac{0.5}{\text{Volume of Na}_2\text{S}_2\text{O}_3 \text{ used to titrate}}$$

- 11.2 Equation 2. Calculation of Sulfide (Solid Samples) mg/Kg

$$\text{Sulfide, mg/L or mg/kg} = \frac{(20 \text{ -- mL titrant}) \times 400}{\text{mL or g of sample used}}$$

- 11.3 Equation 3. Calculation of Sulfide Aqueous Samples (mg/L)  

$$\text{mgS}^2/\text{L} = \frac{(A \times B) - (C \times D) \times 16000}{\text{mL sample}}$$

Where:

- |   |   |  |
|---|---|--|
| A | = | mL Iodine  |
| B | = | Normality of Iodine  |
| C | = | mL Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>           |
| D | = | normality of Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> |

- 11.4 Equation 4. LCS/LCSD % Recovery = (A / B) X 100

Where:

- |   |   |                                      |
|---|---|--------------------------------------|
| A | = | LCS/LCSD actual concentration (mg/L) |
| B | = | LCS/LCSD True Value (mg/L)           |

- 11.5 Equation 5. MS/MSD % Recovery = [(A – B) / C] X 100

Where:

- |   |   |                                    |
|---|---|------------------------------------|
| A | = | MS/MSD actual concentration (mg/L) |
| B | = | Concentration of sample (mg/L)     |
| C | = | MS/MSD True Value (mg/L)           |



## 12.0 Method Performance

- 12.1 The laboratory operates a formal quality control (QC) program. The minimum requirements of this program are an initial demonstration of laboratory capability and the periodic analysis of laboratory reagent blanks, fortified blanks and other laboratory solutions as a continuing check on performance. The laboratory maintains performance records that define the quality of the data that are generated.
- 12.2 Method Detection Limit Study (MDL). The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined accordance with 40 CFR, Chapter 1, Part 136, Appendix B and with reference to the laboratory's MDL procedure in Section 20 of the Quality Assurance Manual. An MDL reflects a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually unless method requirements require a greater frequency.
- 12.3 Demonstration of Capabilities. Each analyst must perform an Initial Demonstration of Capability (IDOC) in accordance with the procedure outlined in Section 20 of the Quality Assurance Manual. The evaluation of the IDOC data should be completed prior to the analysis of samples.
- 12.3.1 The analyst is required to perform a Continuing Demonstration of Capability (CDOC) annually or whenever there is a significant change in the instrument parameters or the associated method. The IDOC includes the preparation of standards, demonstration of instrument linearity, and the analysis of a mid-point laboratory standard within 90-110% recovery. The IDOC must be from a source other than the source used for the calibration standards.
- 12.4 Training Requirements – Each analyst's required employee training (such as orientation to the laboratory's policies and procedures and in-house method training) are outlined in Section 18 of the Quality Assurance Manual.

## 13.0 Data Assessment And Acceptance Criteria For Quality Control Measures

- 13.1 QC sample acceptance criteria
- 13.1.1 **Method Blank.** The laboratory must analyze at least one MB with each batch of samples. Data produced are used to assess contamination from the laboratory environment. Values that exceed the method detection limit indicate laboratory or reagent contamination should be suspected and corrective actions must be taken before continuing the analysis. If the sample concentration is greater than 10 times the blank, the result may be reported.
- 13.1.2 **Laboratory Control Sample (LCS).** The laboratory must analyze at least one LCS with each batch of samples. Calculate accuracy as percent

recovery (Section 9.4.2). If the second-source recovery of any analyte falls outside the required control limits, that analyte is judged out of control, and the source of the problem should be identified and resolved before continuing analyses.

13.1.3 **Matrix Spike (MS) and Matrix Spike Duplicate (MSD).** The laboratory must add a known amount of analyte to a minimum of 5% of the routine samples (one MS for each 20 samples). In each case the MS aliquot must be a duplicate of the aliquot used for sample analysis. The analyte concentration must be high enough to be detected above the original sample and should not be less than four times the MDL. If the recovery of any analyte falls outside the designated MS recovery range and the laboratory control sample (LCS) for that analyte is shown to be in control, the recovery problem encountered with the MS is judged to be either matrix or solution related, not system related.

13.1.4 Where reference materials are available, they should be analyzed to provide additional performance data. The analysis of reference samples is a valuable tool for demonstrating the ability to perform the method acceptably.

## 13.2 Procedural Variation

13.2.1 One time procedural variations are allowed only if deemed necessary in the professional judgment of the analyst to accommodate variation in sample matrix, radioactivity, chemistry, sample size, or other parameters. Any variation shall be completely documented using a Nonconformance Memo and approved by the Supervisor and QA Manager. If contractually required, the client shall be notified. The Nonconformance Memo shall be filed in the project file.

## 13.3 Non-Conformance Memo and Corrective Action

13.3.1 Any deviations from QC procedures must be documented as a non-conformance memo (NCM), with applicable cause and corrective action approved by the facility QA Manager.

13.3.2 When data is out-of-control or does not meet the acceptance criteria, the laboratory supervisor and Project Management must be notified immediately and a NCM must be written as documentation for the PM to include in the project folder.

13.3.3 Data that does not meet acceptance criteria may be conditionally reported with the use of data flags on the final report or through the use of a case narrative attached to the final report.

## 14.0 Corrective Actions For Out Of Control Data

14.1 **Method Blank.** The samples in the batch associated to the defective method blank are evaluated. If the analyte found in the method blank is confirmed to not be present in one or more of the associated samples at any level, the contamination

did not affect those samples. This represents a non-impact situation and no specific corrective action is taken. A NCM is written to notify project management of the situation for evaluation against project requirements. If the analyte found in the method blank is confirmed to be present in one or more of the associated samples, the concentrations are compared. If the concentration in the method blank exceeded 10% of concentration found in one or more samples, the prescribed corrective action is to re-analyze all affected samples. If the concentration in the method blank was less than 10% of the concentration found in one or more samples, the sample can be reported by qualifying the affected analytes. A NCM is written and discussed with the laboratory supervisor and Project Management for evaluation against project requirements.

- 14.2 **Laboratory control sample.** If the analyte is out of control for accuracy (75-125%) the associated samples are evaluated. If the recovery is biased high and the associated samples have no positive results for that analyte, a non-impact situation ensues. A NCM is written to notify project management of the situation for evaluation against project requirements. If the recovery is biased high and the associated samples have positive results for that analyte, the prescribed corrective action is reanalysis of the affected sample(s). If the recovery is biased low and the samples have no positive results for that analyte, the prescribed corrective action is reanalysis of the affected sample(s). If the analyte is out of control for precision (RPD), the associated samples are evaluated. All decisions about corrective action(s) are made in consultation with the project manager. If there are no positive results in one or more samples, a non-impact situation ensues for those samples. A nonconformance memo is written to notify project management of the situation for evaluation against project requirements.

## 15.0 Contingencies For Handling Out-Of-Control Or Unacceptable Data

- 15.1 **Method blanks.** If there is insufficient sample to perform re-analysis, the analyst must notify the project manager for consultation with the client. In this situation, all associated samples are flagged with a "I" qualifier and appropriate comments in the narrative.
- 15.2 **LCS.** If the batch is not reanalyzed, the reasons for accepting the batch must be clearly presented in the project records and the report. Acceptable matrix spike recoveries are not sufficient justification to preclude re-extraction of the batch. If reanalysis of the batch is not possible due to limited sample volume or other constraints, the LCS is reported, all associated samples are flagged, and appropriate comments are made in a narrative to provide further documentation. An NCM will have to be filled out stating this problem and or a solution.
- 15.3 **Insufficient sample.** If there is insufficient sample to repeat the analysis, the situation is discussed with the project manager for consultation with the client and documentation is provided in an NCM.

## 16.0 Pollution Control

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability).

Employees must abide by the policies in Section 13 of the Corporate Environmental Health and Safety Manual (CW-E-M-001) for "Waste Management and Pollution Prevention."

## **17.0 Waste Management**

Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to Tampa's current revision of SOP TP-HAZ-001 *Waste Management*. The following waste streams are produced when this method is carried out.

### **17.1 WASTE STREAMS PRODUCED BY THE METHOD**

The waste stream that is generated by instrument is collected in a secondary container then disposed by neutralization and dumped via sewer system.

## **18.0 Method Modifications**

18.1 None.

## **19.0 References / Cross-References**

- 19.1 SW846, Test Methods of Evaluating Solid Waste, Third Edition, Sulfide, Method 9030A, Update 1 September 1994.
- 19.2 EPA 376.1, Sulfide(Titrimetric, Iodine).
- 19.3 Standard Methods for the Examination of Water and Wastewater, 21<sup>st</sup> Edition; American Public Health Association: Washington, DC, 2005
- 19.4 TestAmerica Tampa's Laboratory Quality Assurance Manual (QAM), current revision
- 19.5 TestAmerica Corporate Environmental Health and Safety Manual (CW-E-M-001), current revision
- 19.6 TestAmerica Tampa SOP's:
  - 19.6.1 TP-AN-005: *Definitions, Terms, and Acronyms*
  - 19.6.2 TP-AN-011: *Standard Preparation*
  - 19.6.3 TP-AN-004: *Standard Material and Reagent Traceability*
  - 19.6.4 TP-AN-012: *Balance Calibration and Use*
  - 19.6.5 TP-HAZ-001: *Waste Management (Non-Hazardous and Hazardous Waste Disposal)*

## **20.0 Attachments**

This section is not applicable to this SOP.

## 21.0 Revision History

- Revision 3, 15 February 2010
  - Updated format
  - Updated Procedure
  - Clarified sample dilutions section 10.3.7
  - Removed section 13.4
  - Renamed section 10.1 as Standardization of Sodium Thiosulfate
- Revision 2, 15 February 2009
  - Updated format from STL to TestAmerica
  - Updated Reference section
  - Added Revision History
  - Updated Safety section