

Total Dissolved Solids, SM 2540 C CH-01-11 09/25/2015

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### GUAM ENVIRONMENTAL PROTECTION AGENCY EMAS ANALYTICAL PROGRAM

### STANDARD OPERATING PROCEDURE

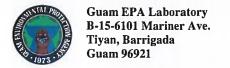
### ANALYSIS OF TOTAL DISSOLVED SOLIDS DRIED at 180°C BY SM 2540 C

Prepared by:	Edelisa S. Yanit, Chemist II	9-25-/5 Date
Peer Reviewed by:	d to a	9-25-15 Date
Reviewed by:	Jesse T. Cruz, EMAS Division Administrator	9/29/15 Date
Approved by:	Eric M. Palacios, GEPA Administrator	02/12/16 Date
Periodic Review: Signature	Title	Date
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PRINCIPLE ASSESSMENT ASSESSMENT

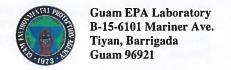
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Total Dissolved Solids, SM 2540 C CH-01-11 09/25/2015 000

### **CONTENTS**

1	SCOPE AND APPLICATION	3
2	METHOD SUMMARY	3
3	INTERFERENCES	3
4	DEFINITIONS	3
5	SAMPLE HANDLING AND PRESERVATION	4
6	EQUIPMENT AND SUPPLIES	4
7	REAGENTS AND STANDARDS	4
8	QUALITY CONTROL	4
9	ANALYTICAL PROCEDURES	6
10	DOCUMENTATION	8
11	REFERENCES	8
Appendix A -	Chain of Custody Form	9
Appendix B -	Analytical Results Report (LIMS or Spreadsheet)	0
Appendix C -	TDS Analytical Results Logbook page	. 1
Appendix D -	Drying Oven Temperature Logbook page	2
Appendix E -	Balance Calibration Logbook page	3



Total Dissolved Solids, SM 2540 C CH-01-11 09/25/2015

### 1 SCOPE AND APPLICATION

- 1.1 This method is applicable for drinking, ground, surface and saline waters, domestic and industrial wastes.
- The practical range of determination is from 5 to 8,000 mg/L. The method reporting limit is 5 mg/L total dissolved solids (TDS).

### 2 METHOD SUMMARY

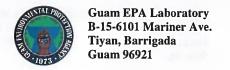
- 2.1 A well-mixed sample aliquot is filtered through standard glass-fiber filter (GF/F). The filtrate is evaporated to dryness in a weighed evaporating dish and dried to constant weight at 180°C. The increase in dish weight represents the total dissolved solids.
- 2.2 If total suspended solids (TSS) is also being determined, the residue retained on the filter from this method may be used for TSS analysis.

### 3 INTERFERENCES

- 3.1 Samples high in calcium, magnesium, chloride and/or sulfates content may be hygroscopic and require prolonged drying, proper desiccation and rapid weighing.
- 3.2 Samples high in bicarbonate require careful and possibly prolonged drying at 180°C to insure complete conversion of bicarbonate to carbonate.
- 3.3 Because excessive residue in the evaporating dish may form a water-trapping crust, limit sample to no more than 200 mg residue.

### 4 DEFINITIONS

- 4.1 Total Dissolved Solids (TDS) (or Filterable Residue) are the solids from an aqueous sample capable of passing through a glass fiber filter and dried to constant weight at 180°C.
- 4.2 Total Suspended Solids (TSS) (or Non-Filterable Residue) are the solids incapable of passing through a glass fiber filter and dried to constant weight at 103-105°C.
- 4.3 Laboratory Duplicate (LD) an aliquot of sample prepared and analyzed separately, using identical procedures. Analyses of a sample and LD indicate precision associated with laboratory procedures, but do not indicate precision in sample collection, preservation or storage procedures.

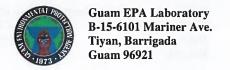


Total Dissolved Solids, SM 2540 C

CH-01-11 09/25/2015 000

4.4 Laboratory Reagent Blank (LRB) – An aliquot of reagent water that is treated exactly as a sample. The LRB is used to detect sample contamination resulting from the procedures used to prepare and analyze the samples in the laboratory environment. 5 SAMPLE HANDLING AND PRESERVATION 5.1 Samples must be stored at 4°C up to the time of analysis to minimize microbiological decomposition of solids. 5.2 Samples must be analyzed within 7 days from the date of collection. 5.3 Samples must be at room temperature for analysis. 6 **EQUIPMENT AND SUPPLIES** 6.1 Analytical balance capable of weighing to 0.1 mg 6.2 NBS Class "S" weights 6.3 Filter holder or membrane filter funnel, 47 mm 6.4 Glass fiber filter disks, 47 mm, without organic binder, Whatman type GF/F (0.45um) 6.5 **Tweezers** 6.6 Suction flask, 250 to 500 mL capacity 6.7 Evaporating dishes (porcelain) or beakers, 150- mL volume 6.8 Desiccator, containing dry desiccant 6.9 Vacuum pump Plastic or Teflon spray bottle 6.10 6.11 Graduated cylinders, 100-mL 6.12 Safety tongs for evaporating dishes 6.13 Drying oven, for operation at  $180 \pm 2^{\circ}$ C and  $104 + 1^{\circ}$ C 7 REAGENTS AND STANDARDS 7.1 Nanopure reagent grade water (ASTM Type I water) 8 **QUALITY CONROL** 8.1 The analytical balance and NBS Class "S" weights must be calibrated at least annually. 8.2 A monthly calibration check using NBS Class "S" weights must be performed on

analytical balances. See Appendix E for details including tolerance range.



Total Dissolved Solids, SM 2540 C CH-01-11 09/25/2015 000

- A balance calibration verification with NBS Class "S" weights heavier or lighter than the weight of the evaporating dishes (i.e., 100 g, 10 g and 1 g) must be performed on analytical balance each day prior to use for TDS measurements. This step enables the analyst to determine if the balance is working properly on a daily basis. See Appendix E.
- 8.4 Routine Analytical Quality Control:
- 8.4.1 LRB The laboratory must analyze at least one LRB with each 20 or fewer samples of the same matrix. LRB data are used to assess contamination from the laboratory environment. LRB values that exceed the reporting limit of 5 mg/L indicate potential laboratory contamination. If the potential contamination significantly impacts the analytical results, the LRB must be re-prepared along with the affected samples, and re-analyzed.
- 8.4.2 LD Sample homogeneity and laboratory variability can affect the quality and interpretation of data. LD results can be used to assess both the sample homogeneity and laboratory variability.

One LD must be prepared for every 10 routine samples of the same matrix in a sample batch (e.g., 1 LD for a batch containing 1-10 routine samples) Shake the sample selected as the LD, obtain a representative aliquot, and proceed with the sample preparation and analysis, treating the LD sample as a routine sample.

Calculate the relative percent difference (RPD) using the following equation:

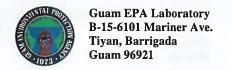
RPD = 
$$\frac{(C_{ld} - C)}{(C_{ld} + C)/2}$$
 X 100

Where

RPD = relative percent difference C<sub>ld</sub> = measured TDS in the LD

C = measured TDS in the routine sample

The relative percent difference (RPD) must be  $\leq 20\%$  for samples with TDS greater than or equal to 50 mg/L. The absolute difference between duplicate results must be less than the reporting limit (5 mg/L) for samples containing less than 50 mg/L TDS. If the control limits are exceeded, re-analyze the sample and duplicate once. If the control limits are exceeded again, flag all associated sample results. Document actions in the **Notes** section of the LIMS analytical results report.



Total Dissolved Solids, SM 2540 C CH-01-11 09/25/2015

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### 9.0 ANALYTICAL PROCEDURES

### 9.1. **Preparation of evaporation dishes:**

- 9.1.1 Heat the clean evaporating dishes to 180°C for at least one hour. Cool in a desiccator and weigh.
- 9.1.2 Repeat heating, cooling, desiccating and weighing until a constant weight is obtained (weight loss is less than 0.5 mg). Store in desiccator until needed.

### 9.2 Preparation of glass fiber filter disk:

- 9.2.1 With tweezers, insert disk with wrinkled side up into filtration apparatus.
- 9.2.2 Apply vacuum and wash disk with three successive 20-mL volumes of reagent-grade water.
- 9.2.3 Remove all traces of water by continuing to apply vacuum after water has passed through.
- 9.2.4 Discard washings.

### 9.3 Determination of volume of sample to be filtered:

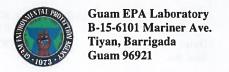
- 9.3.1 Determine the sample conductivity following the SOP for Conductivity by EPA 120.1 (SOP Number: CH-01-05) and record the results in the Analytical Results Logbook (GEPA Log: CH-02-02).
- 9.3.2 From the following table, determine the correct volume to filter for TDS determination. Failure to check the conductivity beforehand may cause technical holding times to be exceeded if samples are reanalyzed because of high TDS.

Sample Conductivity (µmhos/cm)	Volume to filter (mL)
0 – 3000	100
3000 - 6000	50
6000 - 12000	25

Total Dissolved Solids, SM 2540 C CH-01-11 09/25/2015 000

9.4	Sample Analysis:
9.4.1	Assemble the filtering apparatus and begin suction.
9.4.2	Shake the sample vigorously and rapidly transfer the appropriate volume to the prewashed filter apparatus using a 100-mL Class A graduated cylinder.
9.4.3	Wash with three successive 10-mL volumes of reagent-grade water, allowing complete drainage between washings, and continue suction for about 3 minutes after filtration is complete.
9.4.4	Transfer total filtrate (with washings) to a weighed evaporating dish and evaporate to dryness in a drying oven. Continue to dry the evaporated sample for at least 1 hour in an oven at $180 \pm 2^{\circ}$ C.
9.4.5	Cool in desiccator to balance temperature, and weigh.
9.4.6	Repeat drying, desiccating and weighing cycle until the weights from two consecutive cycles differ by less than 0.5 mg. Use the smallest weight from the final two cycles for calculation purposes.
9.5	Data Reduction and Reporting:
9.5.1	Calculate TDS as follows: (A-B)
	TDS = X 1000
	Where: TDS = Total Dissolved Solids in mg/L
	A = weight of dried residue + dish in mg after drying B = weight of dish in mg C = sample volume in mL

- 9.5.2 Reporting Results will be reported to 2 significant figures for TDS less than 100 mg/L, and 3 significant figures for TDS greater than or equal to 100 mg/L. For rounding results, adhere to the following rules:
  - a) If the number following those to be retained is less than 5, round down;
  - b) If the number following those to be retained is greater than 5, round up; or



Total Dissolved Solids, SM 2540 C

CH-01-11 09/25/2015

c) If the number following the last digit to be retained is equal to 5, round down if the digit is even, round up if the digit is odd.

### 10 DOCUMENTATION

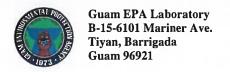
- When samples are received in the laboratory, the laboratory personnel verify that the Chain of Custody Form (Appendix A) is properly filled out. The Chain of Custody Form should contain the following information:
  - a. Project name
  - b. Sampler's name and signature
  - c. Date and time of sample collection
  - d. Field sample ID
  - e. Source of sample (including name, location and sample type)
  - f. Analyses required
  - g. Preservative used if applicable

The person who delivers the samples may relinquish custody and laboratory personnel may then receive and sign the Chain of Custody Form.

- 10.2 Raw analytical data and results are recorded in the logbook, Total Dissolved Solids Dried at 180°C, SM 2540 C (GEPA Log: CH-02-05) (Appendix C), and then entered in the Laboratory Information Management System (LIMS). Analytical results are reported either in LIMS format or Microsoft Excel format as required by customer. (Appendix B).
- Oven temperature readings are recorded in the Drying Oven Temperature Logbook (GEPA Log: QC-12-01) (Appendix D).
- Balance calibration data are recorded in the Balance #2 (Sartorius) Calibration Logbook (GEPA Log: QC-10-02) (Appendix E).

### 11 REFERENCES

- 11.1 SM 2540 C, Standard Methods for the Examination of Water and Wastewater, 20<sup>th</sup> Edition, 1998.
- USEPA Region 9 Lab SOP #461, Analysis of Total Dissolved Solids By EPA Method 160.1, Revision 1, June 16, 1998.

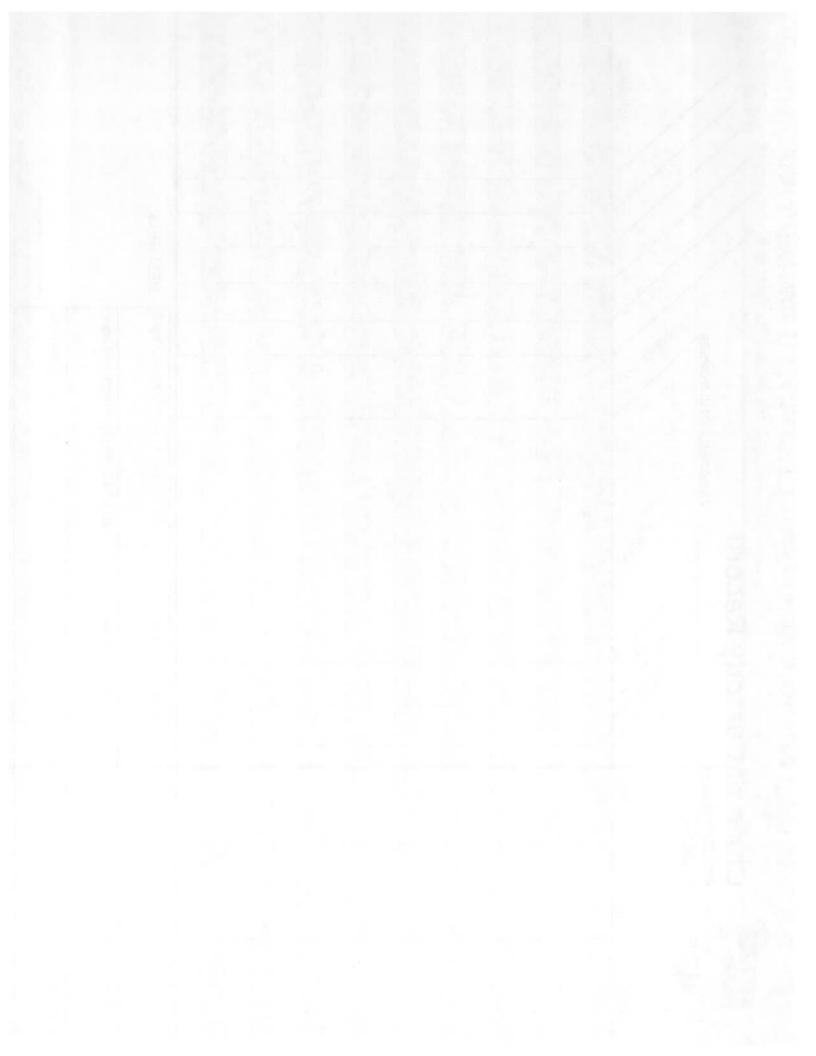


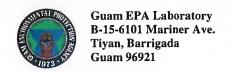
Total Dissolved Solids, SM 2540 C CH-01-11 09/25/2015

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**Attachment A: Chain of Custody Form** 

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AHENSIAN PROTEKSION LINATA GUAHAN chain of custody # REMARKS SAINIME NOO NO \* RECEIVED BY (Print name and sign) RECEIVED FOR LAB by(Print name and sign) RECEIVED BY (Print name and sign) **ASSIGNED LAB ID NUMBER** NOILEGO NOILEGO Chain of Custody Record TIME TIME Oppo Oppo SH SOMOS DATE DATE RELINQUISHED BY (Print name and sign) RELINQUISHED BY (Print name and sign) RELINQUISHED BY (Print name and sign) PROJECT NAME: TIME SAMPLERS (Print name and sign) DATE FIELD SAMPLE ID





Total Dissolved Solids, SM 2540 C CH-01-11 09/25/2015

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Attachment B: Analytical Results Report (LIMS or Spreadsheet)

# **GUAM ENVIRONMENTAL PROTECTION AGENCY**

**EMAS Analytical Program** 

### ANALYTICAL REPORT

Report: TDS-02347\_02348
Parameter: Total Dissolved Solids
Method: SM 2540 C

Matrix:

water

Date of Report: 02/14/2012

Analyst: E. Yanit M

	alyzed	eter																
Remarks	Note: ** Not analyzed	for the parameter	100					30 graen				- 8	Lab blank					
Unit	*	*	*	**	*	* *	*	*	*	*	* *	*	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Result	*	*	*	**	* *	*	*	*	*	*	**	* *	<10	1014	638	208	296	221
MDL	*	*	*	*	*	*	*	*	*	*	*	*	10	10	10	10	10	10
Date Analyzed	**	*	*	**	*	*	*	*	* *	**	**	* *	2/7/2011	2/7/2011	2/7/2011	2/7/2011	2/7/2011	2/7/2011
Date Collected		2/1/2011	2/1/2011	2/1/2011	2/1/2011	2/1/2011	2/1/2011	2/1/2011	2/1/2011	2/1/2011	2/1/2011	2/1/2011		2/2/2011	2/2/2011	2/2/2011	2/2/2011	2/2/2011
Field Sample ID	Lab Blank	AGMS	AGMD	AGMT	AGMP	AGM11	AGMB	AGMFb	ASM22	ASM14	PBM15	PBM16	Lab Blank	AGRD	AGRA-3	AGRF-2	ASRI-2	ASRI-4
GEPA Lab ID		02347-015	02347-016	02347-017	02347-018	02347-019	02347-020	02347-021	02347-022	02347-023	02347-024	02347-025		02348-018	02348-019	02348-020	02348-021	02348-022

Peer Reviewed By: Date Reviewed: \_\_\_\_

Page 1 of 13

# **GUAM ENVIRONMENTAL PROTECTION AGENCY**

## **EMAS Analytical Program**

### ANALYTICAL REPORT

Report: TDS-02348\_02350\_02351 Parameter: Total Dissolved Solids Method: SM 2540 C

Matrix:

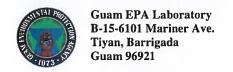
water

Date of Report: 02/14/2012

Analyst: E. Yanit

				1									_			-	_	-
Remarks			Lab duplicate	Lab blank								Lab duplicate		Note: ** Not analyzed	for the parameter			
Unit	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	**	*	**	*	* *	*
Result	314	172	163	<10	260	269	217	1198	261	385	256	229	*	* *	*	*	*	*
MDL	10	10	10	10	10	10	10	10	10	10	10	10	*	*	*	*	*	*
Date Analyzed	2/7/2011	2/7/2011	2/7/2011	2/14/2011	2/14/2011	2/14/2011	2/14/2011	2/14/2011	2/14/2011	2/14/2011	2/14/2011	2/14/2011	*	*	*	*	*	*
Date Collected	2/2/2011	2/2/2011	2/2/2011		2/8/2011	2/8/2011	2/8/2011	2/8/2011	2/8/2011	2/8/2011	2/8/2011	2/8/2011	2/9/2011	2/9/2011	2/9/2011	2/9/2011	2/9/2011	2/9/2011
Field Sample ID	ASRM	APRM-1B	APRM-1B - LD	Lab Blank	ATRN-2	ATRTO	ATRF-3	ATRT-2	ULRU-2	MZRT-2	MZRG-2	ATRF-3 - LD	APM-18	APMOb	APM-20	ATMN	ATMTO	ATMS
GEPA Lab ID	02348-023	02348-024	02348-024		02350-017	02350-018	02350-019	02350-020	02350-021	02350-022	02350-023	02350-019	02351-013	02351-014	02351-015	02351-016	02351-017	02351-018

Page 2 of 13



Total Dissolved Solids, SM 2540 C CH-01-11 09/25/2015 000

Attachment C: TDS Analytical Results Logbook page

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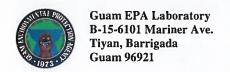
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## **GUAM ENVIRONMENTAL PROTECTION AGENCY - EMAS Analytical Program** Total Dissolved Solids (TDS) Dried at 180°C, SM 2540 C.

Date:			An	Analyst:	
GEPA LAB ID#					Remarks
Sample ID/Station Location					
A = Weight of dish + dried residue (g)					
Trial # 1					
Trial # 2					
Trial # 3					
B = Weight of dish (g)					
Trial # 1					
Trial # 2					
Trial # 3					
(A-B)x1000 = Weight of dried residue (mg)					
Sample Volume (L)					
TDS (mg/L)= A-B (mg) /sample volume (L)	**************************************				

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Revision: 2 - 09/23/2015 esy file: tdslog.xls



Total Dissolved Solids, SM 2540 C CH-01-11 09/25/2015

Attachment D: Drying Oven Temperature Logbook page

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### GEPA Log: QC-11-02

### GUAM EPA LABORATORY DRYING OVEN TEMPERATURE LOG

Date	Time	Temperature (°C)	Acceptable (Y/N)	Initials	Notes

<u>CRITERIA</u>: Temperature range: 103°C to 105°C (SM 2540D - Total Suspended Solids) 105°C (SM10300C - Dry and Ash-Free Weight)

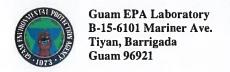
180  $\pm$  2°C (SM 2540C - Total Dissolved Solids)

Revision: 1 - 09/14/2015 esy

File: Oven Log.xls

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### PROTABOSAL ASSISTANS



Total Dissolved Solids, SM 2540 C CH-01-11 09/25/2015

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Attachment E: Balance Calibration Logbook page

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GEPA Log: QC-10-02

### GUAM EPA LABORATORY ANALYTICAL BALANCE # 2 (Sartorius ED224S) CALIBRATION LOG

		Class "S" V	Veights (g)			
Date					Initials	Notes
	0.1000	1.0000	10.0000	100.0000		
<u></u>	1					
			:			
_	<u> </u>					-
						· · · · · · · · · · · · · · · · · · ·
<u> </u>						

**CRITERIA**: Monthly calibration check with NBS Class"S" weights to ± 0.0005g.

**ACTION:** If value is greater than criteria, inform supervisor. **NOTE:** Class "S" weights equivalent to ASTM type 1 or 2.

Revision 1 - 09/16/2015 esy file: balance2 cal log

CALIFORNIA (Samorine EDITAS)