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Department of Environment and Natural Resources
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MEMORANDUM CIRCULAR NO. 012

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SUBJECT: EMB APPROVED METHODS OF ANALYSIS FOR WATER AND WASTEWATER

Pursuant to Section 19g of Republic Act 9275, otherwise known as the Philippine Clean Water Act of 2004; Rule 19.7 of DENR Administrative Order No. 2005-10 (Implementing Rules and Regulations of RA 9275); and DENR Administrative Order No. 2016-08 (Water Quality Guidelines and General Effluent Standards of 2016), the EMB Approved Methods of Analysis for Water and Wastewater listed below is hereby adopted.

The list of analytical methods shall be used as reference for laboratories in the conduct of testing for water (freshwaters, groundwater, marine waters) and wastewater in accordance with the latest edition of the "Standard Methods for the Examination of Water and Wastewater" published by the American Public Health Association/American Water Works Association/Water Environment Federation (APHA/AWWA/WEF), the latest edition of the United States Environmental Protection Agency (US EPA) test methods contained in SW-846: *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods*, and/or in accordance with such other methods of analysis as the EMB may prescribe.

PARAMETERS AND UNITS	ANALYTICAL METHOD/S	REFERENCE/S
Ammonia as NH ₃ -N, mg/L	Ammonia – Selective Electrode Method	SMEWW 4500-NH ₃ D
	Phenate Method	SMEWW 4500-NH ₃ F
	Automated Phenate Method	SMEWW 4500-NH ₃ G
Arsenic, mg/L	Silver Diethyldithiocarbamate Method	SMEWW 3500-As B
	Manual Hydride Generation/ Atomic Absorption Spectrometric Method	SMEWW 3114 B
	Electrothermal Atomic Absorption Spectrometric Method (Nitric Acid / Hotplate or Microwave – Assisted Digestion)	SMEWW 3113 (SMEWW 3030 E or SMEWW 3030 K/ US EPA 3015)
	Inductively Coupled Plasma - Emission Spectroscopy Method (Nitric Acid - Hydrochloric Acid / Hotplate or Microwave – Assisted Digestion)	SMEWW 3120 (SMEWW 3030 F/ US EPA 3010 or SMEWW 3030 K / US EPA 3015)



	Inductively Coupled Plasma - Mass Spectrometry Method (Nitric Acid / Hotplate or Microwave – Assisted Digestion)	SMEWW 3125 (SMEWW3030 E or SMEWW 3030 K / US EPA 3015)
Barium, mg/L	Direct Nitrous Oxide-Acetylene Flame Method (Nitric Acid - Hydrochloric Acid / Hotplate or Microwave – Assisted Digestion)	SMEWW 3111 D (SMEWW 3030 F/ US EPA 3010 or SMEWW 3030 K / US EPA 3015)
	N.B. Extraction/Nitrous-Oxide – Acetylene Flame Method for marine waters or samples with high concentration of dissolved solids	SMEWW 3111 E
	Inductively Coupled Plasma - Emission Spectroscopy Method (Nitric Acid - Hydrochloric Acid/ Hotplate or Microwave – Assisted Digestion)	SMEWW 3120 (SMEWW 3030 F/ US EPA 3010 or SMEWW 3030 K / US EPA 3015)
	Inductively Coupled Plasma - Mass Spectrometry Method (Nitric Acid / Hotplate or Microwave – Assisted Digestion)	SMEWW 3125 (SMEWW 3030 E or SMEWW 3030 K / US EPA 3015)
Benzo(a)pyrene, µg/L	Electrothermal Atomic Absorption Spectrometric Method (Nitric Acid / Hotplate or Microwave – Assisted Digestion)	SMEWW 3113 (SMEWW 3030 E or SMEWW 3030 K/ US EPA 3015)
	High Performance Liquid Chromatographic Method	SMEWW 6440 B / US EPA 8310
	Gas Chromatographic/ Mass Spectrometric Method	SMEWW 6410 B / US EPA 8270
	Gas Chromatographic/ Flame Ionization Detector Method	SMEWW 6440 B/ US EPA 8100
BTX (Benzene, Toluene, Ethylbenzene, Xylene); Trichloroethylene, mg/L	Purge and Trap Capillary-Column Gas Chromatographic Method	SMEWW 6200 C / US EPA 8021
	Purge and Trap Capillary-Column Gas Chromatographic/ Mass Spectrometric Method	SMEWW 6200 B / US EPA 8260



	Equilibrium Headspace Analysis/ Capillary-Column Gas Chromatographic Method	US EPA 5021/ US EPA 8021
BOD, mg/L	5-Day BOD Test	SMEWW 5210 B
Boron, mg/L	Curcumin Method	SMEWW 4500-B B
	Carmin Method	SMEWW 4500-B C
	Inductively Coupled Plasma - Emission Spectroscopy Method (Nitric Acid - Hydrochloric Acid/ Hotplate or Microwave – Assisted Digestion)	SMEWW 3120 (SMEWW 3030 F/ US EPA 3010 or SMEWW 3030 K / US EPA 3015)
	Inductively Coupled Plasma - Mass Spectrometry Method (Nitric Acid / Hotplate or Microwave – Assisted Digestion)	SMEWW 3125 (SMEWW 3030 E or SMEWW 3030 K / US EPA 3015)
Cadmium, Iron, Lead, Manganese, Nickel, Zinc, mg/L ¹ Copper as Dissolved Copper, mg/L	Direct Air-Acetylene Flame Method ² (Nitric Acid - Hydrochloric Acid/ Hotplate or Microwave – Assisted Digestion)	SMEWW 3111 B (SMEWW 3030 F/ US EPA 3010 or SMEWW 3030 K / US EPA 3015)
	N.B. Extraction/Air-Acetylene Flame Method for marine waters or samples with high concentration of dissolved solids	SMEWW 3111 C
	Inductively Coupled Plasma - Emission Spectroscopy Method (Nitric Acid - Hydrochloric Acid/ Hotplate or Microwave – Assisted Digestion)	SMEWW 3120 (SMEWW 3030 F/ US EPA 3010 or SMEWW 3030 K / US EPA 3015)
	Inductively Coupled Plasma - Mass Spectrometry Method (Nitric Acid / Hotplate or Microwave – Assisted Digestion)	SMEWW 3125 (SMEWW 3030 E or SMEWW 3030 K / US EPA 3015)
	³ Electrothermal Atomic Absorption Spectrophotometric Method (Nitric Acid / Hotplate or Microwave – Assisted Digestion)	SMEWW 3113 (SMEWW 3030 E or SMEWW 3030 K / US EPA 3015)

	N.B. 1. Filter samples through 0.45µm membrane filters for dissolved copper 2. Use Nitric Acid Digestion for Lead 3. Not applicable for Zinc determination	SMEWW 3030 B SMEWW 3030 E
Chemical Oxygen Demand, mg/L	Open Reflux Method	SMEWW 5220 B
	Closed Reflux, Titrimetric Method	SMEWW 5220 C
	Closed Reflux, Colorimetric Method	SMEWW 5220 D
Chloride, mg/L	Argentometric Method	SMEWW 4500-Cl ⁻ B
	Potentiometric Method	SMEWW 4500- Cl ⁻ D
	Ion Chromatography with Chemical Suppression of Eluent Conductivity	SMEWW 4110 B
Chromium as Hexavalent Chromium (Cr ⁶⁺), mg/L	Colorimetric Method	SMEWW 3500-Cr B
Coliform, Fecal MPN/100 mL	Multiple Tube Fermentation Technique – Fecal Coliform Procedure	SMEWW 9221 E
Coliform, Total MPN/100 mL	Multiple Tube Fermentation Technique – Standard Total Coliform Fermentation Technique	SMEWW 9221 B
	Enzyme Substrate Test	SMEWW 9223 B
Color (True), TCU	Visual Comparison Method	SMEWW 2120 B
Cyanide as Free Cyanide, mg/L	Cyanide – Selective Electrode (w/o distillation)	SMEWW 4500-CN ⁻ F/ US EPA 9213
Dissolved Oxygen, mg/L	Iodometric Methods	SMEWW 4500-O B to SMEWW 4500-O F
	Membrane Electrode Method	SMEWW 4500-O G
Fluoride, mg/L	Ion-Selective Electrode Method	SMEWW 4500-F ⁻ C
	SPADNS Method	SMEWW 4500-F ⁻ D
	Ion Chromatography with Chemical Suppression of Eluent Conductivity	SMEWW 4110 B
Malathion (Organophosphate), µg/L	Gas Chromatographic / Flame Photometric Detector Method	US EPA 8141

	Gas Chromatographic / Mass Spectrometric Method	SMEWW 6410 B / US EPA 8270
Mercury, mg/L	Cold – Vapor Atomic Absorption Spectrophotometric Method	SMEWW 3112 B/ US EPA 7470
	Cold – Vapor Atomic Fluorescence Spectrometry	US EPA 245.7
Nitrate as NO ₃ -N, mg/L	Cadmium Reduction Method with Nitrite correction using Colorimetric Method	SMEWW 4500-NO ₃ ⁻ E SMEWW 4500-NO ₂ ⁻ B
	Ion Chromatography with Chemical Suppression of Eluent Conductivity	SMEWW 4110 B
	Nitrate Electrode Method	SMEWW 4500-NO ₃ ⁻ D / US EPA 9210
	Colorimetric, Brucine	US EPA 352.1
Oil and Grease, mg/L	Liquid-Liquid, Partition - Gravimetric Method	SMEWW 5520 B
	Solid – Phase, Partition Gravimetric Method	SMEWW 5520 G
Organochlorine Pesticides, µg/L	Gas Chromatographic / Electron Capture Detector Method	SMEWW 6630 B/ SMEWW 6630 C / US EPA 8081
	Gas Chromatographic / Mass Spectrometric Method	SMEWW 6410 B / US EPA 8270
pH	Electrometric Method	SMEWW 4500 - H ⁺ B
Phenol and Phenolic Substances, mg/L	Gas Chromatographic Method	SMEWW 6420 B / US EPA 8041
	Gas Chromatographic/ Mass Spectrometric Method	SMEWW 6420 C / US EPA 8270
Phosphate, mg/L	Vanadomolybdophosphoric Acid Colorimetric Method	SMEWW 4500-P C
	Stannous Chloride Method	SMEWW 4500-P D
	Ascorbic Acid Method	SMEWW 4500-P E
	Automated Ascorbic Acid Reduction Method	SMEWW 4500-P F
Polychlorinated Biphenyls, µg/L	Gas Chromatographic / Electron Capture Detector Method	SMEWW 6630 B / SMEWW 6630 C / US EPA 8082
	Gas Chromatographic / Mass Spectrometric Method	SMEWW 6410 B / US EPA 8270
Selenium, mg/L	Manual Hydride Generation/ Atomic Absorption Spectrometric Method	SMEWW 3114 B

	Inductively Coupled Plasma/ Emission Spectroscopy Method (Nitric Acid - Hydrochloric Acid / Hotplate or Microwave – Assisted Digestion)	SMEWW 3120 (SMEWW 3030 F/ US EPA 3010 or SMEWW 3030 K / US EPA 3015)
	Inductively Coupled Plasma - Mass Spectrometry Method (Nitric Acid / Hotplate or Microwave – Assisted Digestion)	SMEWW 3125 (SMEWW3030 E or SMEWW 3030 K / US EPA 3015)
	Electrothermal Atomic Absorption Spectrophotometric Method (Nitric Acid / Hotplate or Microwave – Assisted Digestion)	SMEWW 3113 (SMEWW 3030 E or SMEWW 3030 K / US EPA 3015)
Sulfate, mg/L	Turbidimetric Method	SMEWW 4500-SO ₄ ²⁻ E
	Automated Methylthymol Blue Method	SMEWW 4500-SO ₄ ²⁻ F
	Ion Chromatography with Chemical Suppression of Eluent Conductivity	SMEWW 4110 B
Surfactants (Methylene Blue Active Substances), mg/L	Anionic Surfactants as MBAS	SMEWW 5540 C
Temperature, °C	Laboratory and Field Methods	SMEWW 2550 B
Total Suspended Solids, mg/L	Gravimetric, Dried at 103- 105°C	SMEWW 2540 D

All other issuances which are inconsistent with this Memorandum Circular are hereby amended accordingly.

This Memorandum Circular shall take effect immediately.


GILBERT C. GONZALES
 Director

