DETERMINATION OF AMMONIA IN WATER USING THE AA3 GAS DIFFUSION SEGMENTED FLOW ANALYZER

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1. SCOPE AND APPLICATION

1.1. This SOP is applicable to the determination of ammonia in surface, ground, effluents, influents, and saline water. The calibration range for this method is from 0.002 mg N/L to 0.20 mg N/L. The range may be extended by dilution. The MDL is 0.002 mg N/L and the PQL is 0.050 mg N/L.

1.2. Tests covered by this SOP are W-NH3 and W-NH3-F.

2. SUMMARY OF THE METHOD

2.1. This SOP is based upon EPA Method 350.1, Rev. 2.0 (1993) and SEAL Auto Analyzer Method G-427-14 Rev. 3.

2.2. The sample is air-segmented and made alkaline in the donor stream. The ammonia molecules generated at this pH flow into the dialysis block holding the gas diffusion membrane. On the other side of the gas diffusion membrane is an acidic acceptor stream that the ammonia gas diffuses into. The ammonia reacts with salicylate and dichloro-isocyanuric acid at 37˚C to produce a blue-green color proportional to the ammonia concentration. Sodium nitroprusside is used as a catalyst. The absorbance is measured at 660 nm.

2.3. Interferences: EDTA is added to eliminate the precipitation of heavy metals. Samples with background absorbance do not interfere because interferents with color do not diffuse. Samples are filtered prior to analysis. Interferences may occur if the dialyzer donor stream does not reach a pH of at least 12.6.

3. EQUIPMENT AND SUPPLIES

3.1. Instrumentation – SEAL Analytical AA3 HR System (“Bran Luebbe”):

3.1.1. SEAL XY-3 Sampler

3.1.2. SEAL Pump 4 AA3

3.1.3. SEAL AA3 Analytical Manifold with 6” Dialyzer and Heater assembly

3.1.4. SEAL AA3 HR Digital Colorimetric Detector with 10 mm flowcell and 660 nm wavelength filter

3.1.5. AACE 7.10 Software

3.2. Consumable items used by the instrument which are frequently replaced:

3.2.1. Assorted pump tubing:

BLK/BLK (0.32 mL/min)

GRY/GRY (1.00 mL/min)

ORN/WHT (0.23 mL/min)

GRN/GRN (2.00 mL/min)

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Tubing air bar (P/N 117+0540-07)

3.2.2. Membrane, PTFE, 6" (P/N 170+B810-01)

3.3. Class A glassware such as graduated cylinders, volumetric flasks, beakers, and calibrated variable Eppendorf pipettes

3.4. Magnetic stir bar and plate

3.5. Disposable culture tubes, borosilicate glass 3x100 mm

3.6. Disposable syringes and 25 mm syringe filters (0.45 µm pore size) for prefiltering samples

3.7. Assorted disposable beakers and 15 mL polypropylene tubes for sample and spike preparation

3.8. pH paper (range 0-14 or 12.5-14.0)

3.9. Cleaning swaps

4. REAGENTS AND STANDARDS (SEE DEP SOPS NU-041 and NU-042)

Note: Prior to using the chemicals in this analysis, read their MSDS and the safety notes found in section 10 of this SOP.

Note: The volumes prepared for the reagents and standards may be altered by the analyst as necessary. The final concentrations of the constituents of a standard or reagent must not be changed.

Note: Reagent and standard preparations are documented in the Laboratory Information Management System (LIMS) 'Standard Preparation Tracker' module. Unique ID numbers for each standard and reagent are generated in the module and documented in the standard and reagent sheets submitted with each analysis folder. If available, a Certificate of Analysis for each purchased reagent, standard, and standard reference material is maintained on the Nutrients drive in the \REAGENT_PREP\NH3 folder. All containers holding standards or reagents must be labeled with their unique ID and expiration date.

4.1. Chemicals:

4.1.1. Ammonium chloride, NH_4Cl

4.1.2. Dichloroisocyanuric acid sodium salt (DIC), $2H_2O$, $C_3Cl_2N_3NaO_3 \cdot 2H_2O$

4.1.3. Potassium sodium tartrate tetrahydrate, $C_4H_4KNaO_6 \cdot 4H_2O$

4.1.4. Sodium hydroxide, NaOH

4.1.5. di-Sodium hydrogen phosphate-12-hydrate, $Na_2HPO_4 \cdot 12H_2O$

4.1.6. Sodium nitroferricyanide (sodium nitroprusside), $Na_2[Fe(CN)_5NO] \cdot 2H_2O$

4.1.7. Sodium salicylate, $NaC_7H_5O_3$

4.1.8. Sulfuric acid, concentrated, H_2SO_4

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4.1.9. Tetrasodium EDTA dihydrate, $Na_3C_{10}H_{12}O_8N_2 \cdot 2H_2O$, Highest Purity

4.1.10. Triton X-100, used as a surfactant

4.1.11. Standard Reference Material (ALTQC) from Environmental Research Associates (ERA).

4.1.12. Hydrochloric acid, concentrated, HCl

4.1.13. Bleach, generic, no additives

Note: Wash all glassware with 1:2 HCl and rinse at least 5 times with DI water before preparing reagents and standards.

4.2. Reagents:

4.2.1. Triton X-100, 30% Solution – Add 70 mL of DI water into a 100mL beaker with a stir bar. Use a 50 mL beaker to measure 30 mL of Triton-X (4.1.10.). Add the Triton-X to the DI water very slowly while stirring. Continue stirring overnight covered in parafilm. Do not heat to dissolve. Holding time, 90 days.

4.2.2. System Wash Solution – To a 1 L flask containing approx. 800 mL of DI water, add 2 mL of Triton X-100, 30% solution (4.2.1.) and mix. Bring to volume with DI water. Holding time, 7 days.

4.2.3. Diluent – To a 2 L volumetric flask containing approx. 1.2 L of DI water, add 4 mL of conc. Sulfuric acid (4.1.8.). Dilute to mark and invert to mix. Prepare fresh daily.

Note: This solution is also used for CARs, BLKs, MBLKs, CCBs, the C1 Standard, and to prepare dilutions of samples. See 4.3.3.

4.2.4. EDTA/NaOH Reagent – In a 1 L volumetric flask containing approx. 800 mL of DI water, dissolve 56 g of tetrasodium EDTA dihydrate (4.1.9.) and 23.5 g of NaOH (4.1.4.). Bring to volume with DI water, then add 5 mL of Triton X-100, 30% solution (4.2.1.) and invert to mix. Holding time, 7 days.

4.2.5. Sulfuric Acid Reagent – In a 1 L volumetric flask containing approx. 800 mL of DI water, add 12 mL of sulfuric acid. Bring to volume with DI water, then add 5 mL of Triton X-100, 30% solution (4.2.1.) and invert to mix. Holding time, 7 days.

4.2.6. Buffer Reagent – In a 1 L volumetric flask containing approx. 600 mL DI water, dissolve 16 g of di-sodium hydrogen phosphate-12-hydrate (4.1.5), 27 g of NaOH (4.1.4.), and 24 g of potassium sodium tartrate tetrahydrate (4.1.3.). Bring to volume with DI water, then add 5 mL of Triton X-100, 30% solution (4.2.1.) and invert to mix. Holding time, 7 days.

4.2.7. Salicylate Reagent – In a 1 L volumetric flask containing approx. 700 mL of DI water, dissolve 64 g of sodium salicylate (4.1.7.). Add 0.13 g of sodium nitroprusside (4.1.6.). Bring to volume with DI water and invert to mix. Store in a dark bottle in the refrigerator. Holding time, 7 days.

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4.2.8. DIC Reagent – In a 200 mL volumetric flask containing approx. 150 mL of DI water, dissolve 0.15 g of DIC (4.1.2.). Bring to volume with DI water and invert to mix. Prepare fresh daily.

4.2.9. 0.1 HCl – In a 1 L volumetric flask containing approx. 800 mL of DI water, add 100 mL of concentrated hydrochloric acid (4.1.12). Bring to volume with DI water and invert to mix. Used for cleaning.

4.2.10. 1 N NaOH – In a 1 L volumetric flask containing approx. 800 mL of DI water, dissolve 40 g of NaOH (4.1.4.). Bring to volume with DI water and invert to mix. Used for cleaning.

4.2.11. 10% bleach – In a 200 mL volumetric flask containing approx. 150 mL of DI water, add 20 mL of bleach (4.1.13). Bring to volume with DI water and invert to mix. Used for cleaning. Prepared fresh each use.

4.3. Standards:

4.3.1. NH_3 stock, 1000 mg N/L – Dry at least 4 g of NH_4Cl (4.1.1.) for 12-24 hours at 105ºC. Dissolve 3.819 g of dried NH_4Cl in 800 mL of DI water in a 1 L volumetric flask. Dilute to volume using DI water and invert 12 times. Store under refrigeration. This standard may also be used for TKN analysis (see DEP SOP NU-092). Holding time, 180 days.

4.3.2. NH_3 intermediate and spiking solution, 10 mg N/L – To a 100 mL volumetric flask containing about 50 mL reagent water, add 1 mL of the 1000 mg N/L NH_3 stock standard (4.3.1.). **Do not acidify**. Bring to volume with DI water and invert to mix. Store at room temperature. Prepare fresh daily.

4.3.3. NH_3 working calibration standards – Prepare standards by pipetting specified amounts of the 10 mg N/L NH_3 intermediate standard (4.3.2.) into volumetric flasks according to the table below. Acidify with conc. Sulfuric acid (4.1.8.). Use DI water to dilute the standards. Invert each standard 12 times. Store at room temperature. Prepare fresh daily.

Standard Concentration (mg N/L)		QC standard	Final Volume (mL)	Volume of conc. H_2SO_4 (4.1.8.) (mL)	Volume of Intermediate (4.3.2.) (mL)
CAL1	0	MBLK, CCB, BLK, CAR	2000	4	None
CAL2	0.005	PQCK	200	0.4	0.1
CAL3	0.010		200	0.4	0.2
CAL4	0.02		200	0.4	0.4
CAL5	0.05		200	0.4	1
CAL6	0.10	CCV	200	0.4	2
CAL7	0.20	Drift	100	0.2	2

4.3.4. ALTQC standard (NHXERA) –

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4.3.4.1. The supplier for the standard reference material (currently Environmental Resource Associates) differs from the supplier of the calibration standards. This quality control standard (4.1.11.) is prepared from the ampule according to the manufacturer's instructions. For the concentration and expiration date of the ampule, see the manufacturer's certificate. The ampule and prepared stock standard are stored in the refrigerator. Holding time of prepared stock standard, 180 days.

4.3.4.2. This ALTQC stock solution may be diluted appropriately with the diluent (4.2.3.) so that the working concentration falls within the calibration range. Prepare fresh daily.

5. SAMPLE PREPARATION PROCEDURE (NU-033)

5.1. Samples are preserved in the field to a final concentration of 0.2 % (v/v) with H_2SO_4, shipped on ice, and stored ≤ 6 ºC (not frozen).

5.2. Samples must be analyzed within 28 days of collection date for the data to be reported unqualified. Samples analyzed more than 28 days after collection date are reported with the Q qualifier.

5.3. Remove samples from the Receiving Room refrigerator and allow them to come to room temperature. Samples are filtered prior to analysis.

5.4. Samples with conductivities greater than 5000 µmhos/cm are batched separately. If no conductivity value is given, batch according to the matrix identification in LIMS. Effluents are batched separately.

5.5. For each batch (maximum of 10 samples), prepare:

- One method blank (MBLK or MBLK_F) (4.3.3.)
- A sample in duplicate and/or two sample matrix spikes to calculate precision.
    - Matrix spikes are prepared by adding 50 µL of the spiking solution (4.3.2.) to 10 mL portions of a selected sample for a 0.050 mg N/L spike (spike code: LO).
    - The selected sample is representative of the samples in the batch as the QC sample. If the selected sample has a high NH3 level (i.e., the combined sample and spike concentration is outside the calibration range), select another sample to spike from the same batch. Alternatively, if all samples are high, the entire batch may be diluted.
- One lab fortified blank (LFB) following the same procedure substituting diluent (4.2.3.) for sample.

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6. SAMPLE ANALYSIS AND QUANTITATION

6.1. Instrument Startup:

6.1.1. Turn on the power to the sampler, pump, and colorimeter. The heater is kept plugged in. The colorimeter is ready for operation when the status light on the back is green.

6.1.1.1. Check the condition of the tubing and make sure all connections are made according to the following:

Path into the top of the dialyzer (donor stream):
BLK/BLK – Air
GRY/GRY – Sample
ORN/WHT – EDTA/NaOH Reagent* (4.2.4.)

Path into the bottom of the dialyzer (acceptor stream):
BLK/BLK – Air
ORN/WHT – Sulfuric Acid Reagent* (4.2.5.)

Path out of the dialyzer:
ORN/WHT – Buffer Reagent* (4.2.6.)
ORN/WHT – Salicylate Reagent (4.2.7.)
ORN/WHT – DIC Reagent (4.2.8.)

To autosampler wash receptacle:
GRN/GRN – Diluent (4.2.3.)

6.1.2. Flush the instrument by placing tubing for reagents containing surfactant (designated with an '*' above) in the System Wash solution (4.2.2.) and reagent lines without surfactant in DI water. Secure pump platen and turn pump switches to 'Run' and 'Normal.'

6.1.3. Open AACE software. Username is "Superuser" with no password.

6.1.4. Click Charting in the System window, make sure <<Ammonia GD>> analysis is selected, and click OK. The sample probe should move down into sampler wash receptacle.

6.1.5. Right-click the chart and click "Set Base/Offset" (normally 5%) and set the smoothing to 16.

6.1.6. After 15 minutes, check that a good bubble pattern is established and that the water baseline is stable.

6.1.7. Place the tubing for the EDTA/NaOH, Sulfuric Acid, Buffer, and DIC reagents in the respective reagent bottles. Place the autosampler wash tubing into the Diluent.

6.1.8. After 10 minutes, place the tubing for the Salicylate reagent in the respective bottle.

Note: Salicylate should never be added at the same time as the other reagents.

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Otherwise, precipitation will occur in the system.

6.1.9. Allow reagents to pump for 15 minutes, then check that a good bubble pattern is established and the heater is at 37˚C.

6.1.10. Set the base once again and let the reagent baseline stabilize.

6.1.11. Check that the pH of the colorimeter waste line is 12.6-12.9 once a week prior to analysis.

Note: If the final pH is too high, decrease the amount of NaOH in the Buffer reagent (4.2.6.). If the final pH is too low, increase the amount.

6.2. Create a new run sequence:

6.2.1. Click Set Up → Analysis/Run → Ammonia GD. Select "Ammonia GD.anl" so that it is highlighted, then select New Run.

6.2.2. Rename the run with the NHYYMMDDX format, where NH stands for ammonia, YY is the year, MM is the month, DD is the day, and X indicates the instrument used ('C' for Bran Luebbe C and 'D' for Bran Luebbe D). Postscripts 2, 3, etc. are used to denote the second, third, etc. runs of the day if necessary.

6.2.3. Fill out the Tray Protocol, click Print in the Main Page tab, and then OK to save the sequence. This will print out the run sequence with the analysis parameters.

An example run sequence includes:

Primer (0.20 mg N/L, 4.3.3.)
Drift (0.20 mg N/L)
BLK (4.3.3.)
CAL1-7 (Calibration Standards, 4.3.3.)
High (0.20 mg N/L, to calculate carryover)
Low (BLK)
Low (BLK)
Baseline (Diluent, 4.2.3.)
BLK
CCB
CCV (CAL6)
PQCK1 (CAL2)
NHXERA (ALTQC, 4.3.4.2.)
Batched samples, with a **MBLK(_F)**, **LFB**, and **spikes** (5.5) in each batch
BLK
Baseline
CCB
CCV
Drift (0.20 mg N/L)
BLK
End

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6.3. Load the sampler tray with calibration standards (4.3.3.) and batches (5.5.) according to the corresponding positions in the Tray Protocol.

6.4. Once the baseline is stabilized, start the run by going to Run → Start → Ammonia GD → Double click the sequence → OK.

6.5. The pump and autosampler cannot be paused while running, but the sequence can be changed in the Tray Protocol.

6.6. When ready to stop the run, go to the Tray Protocol and add the "End" function to the cup where the run should stop. There should be a BLK, Baseline, CCB, CCV, and Drift prior to the "End." Delete all unused lines after the "End" and click "OK" to save the changes.

6.7. Once analysis is complete, the software will automatically print the final report containing the calibration and the chart of the peaks. Print the raw data file in Retrieve → Raw Data. Run files are automatically exported to the Nutrients drive (see 7.4).

6.8. Instrument Daily Shutdown:

6.8.1. Place the tubing for the Salicylate reagent and autosampler wash into DI water. Pump on fast for 5 minutes to flush the salicylate out of the system.

6.8.2. Place the tubing for the EDTA/NaOH, Sulfuric Acid, Buffer reagents into the system wash solution. Place the tubing for the DIC reagent in DI water. Pump on fast for 10 minutes.

6.8.3. Turn off autosampler and raise probe out of the wash receptacle. Then place all the tubing that was in the System Wash Solution into DI water and continue pumping for 10 minutes.

6.8.4. Remove all tubing from the DI water. Pump air through the system for 10 minutes to dry off the membrane.

6.8.5. Release the pump platen and turn off the pump and colorimeter.

6.9. Quantitation/Calculations:

6.9.1. The instrument reports results for Ammonia analysis in mg N/L.

6.9.2. The QC Manager calculates recoveries for spikes and QC standards as well as relative percent differences (RPD) for duplicate samples and spikes. For general calculations including RPDs and spike recoveries, see the FDEP Quality Manual.

6.9.3. The individual calibration standards are prepared according to section 4.3.3. The linear calibration and percent error of the standards are calculated by the instrument software and are part of the analysis report. It includes the correlation coefficient to evaluate the fit (see 8.2.).

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7. DATA ARCHIVAL

7.1. The raw data is archived in paper format. A report folder is created for each analytical run. Occasionally more than one run may be in one folder. The folder is labeled with the test(s) (W-NH3(-F)), filename/s (NHYYMMDDX), and initials of the analyst.

7.2. Each report folder should contain the following items – result report, calibration curve, chart of the peaks, bench sheet with analysis parameters, raw data printout, backlog, Reagent and Standard Logsheet, and a copy of the QC assessments uploaded from QC Manager to LIMS at the time of test authorization.

7.3. The report folders are on file with the nutrients and general chemistry supervisory personnel. Periodically, the files are moved to the State Records Center for long time storage according to DEP SOP LB-006.

7.4. SEAL Bran Luebbe instrument run and text files for upload to QC manager are stored in electronic format in the current year's subfolder located at \\FLDEP1\DEAR\Labs\lab3\Chem_Data\Inorganic\Nutrients\SFA\BL\NH3\.

7.5. Method validation data is on file with the supervisor. Digital copy is also stored on the network, under an appropriate sub-folder in

\\fldep1\dear\Labs\Lab5\Chemistry\Inorganic\Nutrient\Validations**.**

8. QUALITY CONTROL/DATA ASSESSMENT (NU-038 AND NU-043)

8.1. For method performance and acceptance criteria for QC measures and corrective action for handling out-of-control or unacceptable data refer to DEP SOPs NU-038 and NU-043.

8.2. Linear Calibration Range (LCR) - See Quality Manual, Appendix B, Section 7.0, 'Protocol for Determining the Test Method Range of Applicability'. The correlation coefficient of the linear calibration must be equal to or larger than 0.995. Acceptance limits for the percent error of the PQL level standard is ±30%. Acceptance limits for the percent errors of calibration standards above the PQL is ±10 %. A new calibration is performed every day samples are analyzed at the beginning of the analysis. Consecutive runs on one day may use the same calibration.

8.3. A continuing calibration verification, CCV (4.3.3.) and a CCB (4.3.3.) are run every 10 samples and at the beginning and end of each run. Acceptance limits for the recoveries of the check standard are 90-110 %. Acceptance limits for all BLK/CCB/CAR's are < 0.002 and > -0.002 mg N/L.

8.3. One certified standard reference material, ALTQC (4.3.4.), is analyzed on every analytical run. The supplier for the QC stock standard differs from the supplier of the calibration standards. Acceptance limits for the recovery of the ALTQC are 90-110 %.

8.4. One practical quantitation limit level standard, PQCK (4.3.3.), is analyzed on

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every analytical run. Acceptance limits for the recovery of the PQCK standard are 70-130 %. The PQCK is also used as a spike for the ongoing MDL and PQL verification.

8.5. A MBLK, LFB, matrix spike, and a matrix spike duplicate or a sample in duplicate must be analyzed for every batch of 10 samples (see section 5.5.). The MBLK's are filtered if the samples in the batch are filtered in house (indicated with an "_F"). Acceptance limits for the MBLK's are between < 0.002 and > -0.002 mg N/L. Acceptance limits for the recoveries of the LFB's and matrix spikes are 90-110 %. The sample/matrix spike reproducibility should be less than 20 % RPD for results above the practical quantitation limit (PQL).

9. MAINTENANCE/TROUBLESHOOTING

9.1. Write down all maintenance, troubleshooting, and service visits in the instrument's maintenance logbook.

9.2. Remove the PTFE membrane from the dialyzer block if the system is not in use for more than a week. Otherwise, membrane can stick to block and damage dialyzer channels causing leaks. Make a note in maintenance book and place membrane back into plastic bag during storage.

9.3. Weekly Cleaning Procedure:

9.3.1. In all reagent lines:

- Pump 0.1 HCl (4.2.9.) on fast for 10 minutes.
- Pump DI water on fast for 5 minutes.
- Pump System Wash Solution on fast for 15 minutes.
- Pump DI water on fast for 15 minutes.

9.4. Monthly Cleaning Procedure:

9.4.1. Remove the membrane.

9.4.2. In the reagent lines:

- Pump 0.1 HCl on fast for 5 minutes.
- Pump water on fast for 5 minutes.
- Pump 1 N NaOH (4.2.10.) on fast for 5 minutes.
- Pump Water on fast mode for 5 minutes.
- Pump 10 % Bleach (4.2.11.) on fast for 5 minutes.
- Pump Water on fast mode for 5 minutes.

9.4.3. Replace the dialyzer membrane.

9.4.4. With the probe raised, clean the autosampler wash receptacle with 10% bleach and a cleaning swap. Rinse thoroughly with DI water.

9.5. Troubleshooting Tips:

9.5.1. Make sure waste lines from dialyzer, autosampler, and colorimeter are not submerged. Submerged waste lines can cause a drifting baseline or air

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spikes.

9.5.2. Carryover should be below 2%. A higher carryover indicates the need for maintenance and/or troubleshooting.

9.5.3. If the top of the peaks are noisy or take a long time to come to a plateau, the membrane most likely needs to be changed.

9.5.4. An increase of air spikes in the run usually indicates pump tubing needs to be changed. Tubing joints may also need to be replaced if there is a white band and/or bubbles that are getting caught in the joint's gap.

9.5.5. A noisy baseline with fresh reagents and diluent can indicate a contaminated autosampler wash receptacle or sampling probe.

9.5.6. Failing blanks can indicate contamination. There are multiple approaches to fixing this.

- Acid soak with diluted HCl all glassware used to make reagents and standards overnight with diluted HCl and replace all bottles. Remake reagents and standards. Acid soak the standards rack glass tubes.
- Clean the system, replace the membrane, and tubing.
- If the problem persists, the Buffer Reagent may have become contaminated and should be re-made with a new bottle of potassium tartrate (4.1.3.). If the stock bottle becomes contaminated, see "SEAL AQ2 Technical Tips Removal of Ammonia Contamination from Sodium Potassium Tartrate" for guidance.

10. SAFETY/HAZARDOUS WASTE MANAGEMENT/POLLUTION PREVENTION

10.1. Review the Laboratory Health and Safety Plan (accessible on the intranet at https://www.fldepnet.org/content/dear/bureau-laboratories-safety-documents).

10.2. Safety glasses, gloves and lab coats should be worn at all times whilst handling samples and reagents.

10.3. Read the MSDS information for safe reagent and sample handling.

10.4. The instrument waste from the dialyzer and colorimeter produced during analysis is corrosive due to the high pH. All corrosive waste should be collected in bottles clearly labeled as hazardous waste. The waste should be disposed of as Basic Corrosive.

10.5. Noncorrosive, nonhazardous waste is disposed of down the sink with tap water.

10.6. The sodium nitroprusside (4.1.6.) used to prepare the salicylate reagent (4.2.7.) produces cyanide gas if it encounters acid. Wear all personal PPE when preparing and thoroughly rinse flasks and containers after acid washing. Dispose excess sodium nitroprusside crystals by lab packing. Excess salicylate reagent can be

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disposed of down the sink when flushed thoroughly with water.

10.7. Excess DIC (4.1.2.) and DIC Reagent (4.2.8.) should be disposed of in the same hazardous waste container as the instrument waste (see section 10.4.).

11. REFERENCES/DEFINITIONS

For definitions see section 3 of the FDEP Quality Manual. All abbreviations used throughout the document are defined at least once in the document usually at the first time of use.

11.1. EPA method 350.1, Rev. 2.0 (1993).

11.2. SEAL Auto Analyzer Method G-427-14 Rev. 3

11.3. SEAL Method Comparison Table for Ammonia G-427-14 (2019)

11.4. SEAL Analyzer AA3 Operation Manual System

11.5. SEAL AQ2 Technical Tips “Removal of Ammonia Contamination from Sodium Potassium Tartrate.”

11.6. Quality Manual, Bureau of Laboratories, FDEP.

11.7. Laboratory Health and Safety Plan.

11.8. DEP SOP NU-033, Summary of Sample Analysis Procedures for the General Chemistry and Nutrients Workgroups.

11.9. DEP SOP NU-038, Nutrients and General Chemistry: Quality Assurance and Quality Control.

11.10. DEP SOP NU-041, Reagent Preparation Procedure.

11.11. DEP SOP NU-042, Standard Preparation Procedure.

11.12. DEP SOP NU-043, Nutrients and General Chemistry Quality Assurance and Data Authorization Guidelines.

11.13. DEP SOP LB-006, Standard Operating Procedure for Records Maintenance and Storage.

Appendix of Significant Changes

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