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APPENDIX 12

METHOD: ASTM D854
STANDARD OPERATING PROCEDURE
FOR: SPECIFIC GRAVITY
Applicable Matrix or Matrices: Soil, Sediment, Sludge
Standard Compound List and Reporting Limits: NA

Approvals and Signatures

Laboratory Director:	Christopher A. Ouellette	Date: 5-12-00
QA Manager:	Kim B. Watson	Date: 5-12-00
Inorganics Technical Director:	Kristine A. Dusablon	Date: 5-12-00
Geotechnical Supervisor:	Jeffrey R. McMahon	Date: 5/12/00

1.0 SCOPE AND APPLICATION

1.1 This method covers the determination of specific gravity of soil.

1.2 Minimum quantity of sample is 25 grams of dry soil.

1.3 There is no specified holding time.

1.4 This analysis is amenable to sand, silt and clay samples.

2.0 SUMMARY OF METHOD

2.1 Weigh out a representative portion of the sample passing the No. 10 (2.00 mm) sieve (25 to 30 grams) and record this mass. Place the sample in a calibrated volumetric flask, add enough de-ionized (DI) water to cover the sample, and allow the sample to soak overnight. Apply a vacuum to the flask for 30 minutes and periodically tap the flask to dislodge any trapped air. Fill the flask to the referenced volume with DI water. Weigh the flask\sample\water and record the weight and the temperature of the water.

3.0 DEFINITIONS

N/A

4.0 INTERFERENCES

N/A

5.0 SAFETY

5.1 The toxicity or carcinogenicity of each reagent used in this method has not been fully established. Each chemical should be regarded as a potential health hazard and exposure should be as low as reasonably achievable. Cautions are included for known extremely hazardous materials or procedures.

5.2 STL Burlington maintains a current awareness file of OSHA regulations regarding the safe handling of the chemicals specified in this method. Material Safety Data Sheets (MSDS) are made available to all personnel involved in the chemical analysis. STL Burlington also has a written environmental health and safety plan.

5.3 Please note chemicals that have the potential to be highly toxic or hazardous, the appropriate MSDS must be reviewed by the employee before handling the chemical.

6.0 EQUIPMENT AND SUPPLIES

6.1 Balance sensitive to 0.01 grams

6.2 No. 10 (2.00mm) sieve.

6.3 Volumetric flask, 100 mL or 500 mL.

6.4 Spatulas, brushes and mixing utensils for mixing and sample recovery.

6.5 Squirt bottles for de-ionized water.

6.6 Oven with a temperature control ranging from 60°C to 110°C.

6.7 Mortar and Pestle.

6.8 Blender and dispersion cup as specified in ASTM D422 (wet preparation method only).

6.9 Temperature measuring device accurate to $\pm$ 0.5°C.

6.10 1000 mL beaker, plastic or glass.

7.0 REAGENTS AND STANDARDS

N/A

8.0 SAMPLE COLLECTION, PRESERVATION, SHIPMENT AND STORAGE

8.1 At minimum a 25 grams of sample is used for analysis. The sample container must remained sealed to maintain natural water content.

9.0 QUALITY CONTROL

9.1 Check the balance daily with Class S weight and yearly by factory calibration.

9.2 Check the temperature of the 110°C oven daily in the morning.

9.3 Temperature measuring device is checked against similar or more accurate temperature measuring device.

9.4 A duplicate analysis is recommended for every set of 20 samples.

10.0 CALIBRATION AND STANDARDIZATION

10.1 Calibrate the pycnometer biannually, as replaced, or as requested.

10.2 Calibrate the sieves biannually or as requested.

11.0 PROCEDURE

11.1 Flask Preparation: Pycnometer calibration: Weigh the mass of the clean and oven dried volumetric flask. Fill flask with DI water to reference volume line and weigh. Measure temperature of water in degrees Celsius.

11.2 Soil Preparation

11.1.1 Dry: Separate soil particles with mortar and pestle. Remove particles greater than 2.00 mm in size using a No.10 sieve. Tare a calibrated 100 mL volumetric flask. Add 25 grams of a representative soil sample passing the No. 10 sieve, place in the flask and record this mass. Fill flask 3/4 full with DI water and allow to sit overnight.

11.1.2 Wet Prep: Add 25 to 30 grams of the dry soil sample passing the No. 10 sieve into dispersion cup and blenderize for 5 minutes. Pour and wash (using DI water) contents of dispersion cup through No. 10 sieve into a 500 mL volumetric flask. Discard any particles retained on the No. 10 sieve.

11.2 Connect volumetric flask to a vacuum for 30 minutes. Tap flask with a rubber covered pestle to remove air bubbles.

11.3 Fill the volumetric flask to the reference line with DI water, weigh and record mass.

11.4 Measure temperature of water in flask and record.

11.5 If wet preparation was used, weigh and record the mass of 1000 mL beaker. Completely wash contents of volumetric flask into beaker using DI water. Place beaker into 110°C oven until dry. Weigh and record mass of beaker/dry sample.

12.0 CALCULATIONS

12.1 The mass of the pycnometer and water is calculated using the following equation (mass used in test = beaker & dry sample – beaker):

Ma at Tx = Mf + (Dw at Tx/(Dw at Ta) * (Ma at Ta - Mf)

where:
Dw = Density of water
Ma = Mass of pycnometer and water, g
Mf = Mass of pycnometer, g
Ta = Observed temperature of water, °C
Tx = any other desired temperature, °C

Note 1: Density of water is from Table 1 of ASTM D854 or equivalent.

12.2 The Specific Gravity of the sample is calculated using the following equation:

SG at Ta = [Mo/(Mo + (Ma - Mb)] x (Dw at Tb/Dw at Ta)

where:
SG = Specific Gravity
Mo = Mass of oven dried sample see (note 1)
Ma = Mass of pycnometer filled with DI water at Temp. a (typically 20 C)
Mb = Mass of pycnometer/sample/DI water at Temp. b (observed during step 11.4)
Ta = Temp. of water at desired reference temperature. (typically 20 C)

Note 2: If sample was not oven dried, the soil mass is multiplied by the hydroscopic moisture correction factor (see ASTM D422).

13.0 METHOD PERFORMANCE

N/A

14.0 POLLUTION PREVENTION

14.1 Pollution prevention encompasses any technique that reduces or eliminates the quantity or toxicity of waste at the point of generation. Numerous opportunities for pollution prevention exist in laboratory operation. The USEPA has established a prevention hierarchy of environmental management techniques that places pollution prevention as the management option of first choice. Whenever

feasible, laboratory personnel should use pollution prevention techniques to address their waste generation. When wastes cannot be feasibly reduced at the source, the agency recommends recycling as the next best option.

14.2 The quantity of chemical purchased should be based on expected usage during its shelf life and disposal cost of unused material. Actual reagent preparation volumes should reflect anticipated usage and reagent stability.

14.3 For information about pollution prevention that may be applicable to laboratories and research institutions, consult "Less is Better: Laboratory Chemical Management for Waste Reduction", available from the American Chemical Society's Department of Government Regulations and Science Policy, 1155 16th Street N.W., Washington, D.C. 20036; (202) 872-4477.

15.0 DATA ASSESSMENT AND CRITERIA AND CORRECTIVE ACTIONS FOR OUT-OF-CONTROL DATA

15.1 Data is initially reviewed by the analyst in the lab. Following this, the data is secondarily reviewed by QC personnel before being put into its final data package form (where the data is thirdly reviewed before being sent to the client).

15.2 Data that is out of control is marked as such and slated for re-analysis. Any corrective action undertaken is documented on a corrective action form (detailing the client information, problem, investigation findings and solution). This form is kept together with the project.

16.0 CONTINGENCIES FOR HANDLING OUT-OF-CONTROL OR UNACCEPTABLE DATA

16.1 Generally, any data that is out of control is considered unusable. There are, however, cases in which laboratory supervisor will be made aware of the issue and, if the data is used, it will be thoroughly narrative noted.

17.0 WASTE MANAGEMENT

17.1 The USEPA requires that laboratory waste management practices conducted be consistent with all applicable rules and regulations. Excess reagents, samples, and method process wastes should be characterized and disposed of in an acceptable manner. The Agency urges laboratories to protect the air, water and land by

minimizing and controlling all releases from hoods, and bench operations, complying with the letter and spirit of any waste regulations, particularly the hazardous waste identification rules and land disposal restrictions. For further information on waste management consult the "Waste Management Manual for Laboratory Personnel", available from the American Chemical Society at the address listed in Section 14.3.

18.0 REFERENCES

18.1 Annual Book of ASTM Standards, volume 04.08 Soil and Rock (I): D 420 - D4914, Section 4, Construction edition; American Society for Testing and Materials, Philadelphia, Pa., 1994.

19.0 TABLES, DIAGRAMS, FLOWCHARTS AND VALIDATION FORMS

N/A