UNCONTROLLED

WEST VALLEY NUCLEAR SERVICES CO., INC.

ANALYTICAL CHEMISTRY METHOD
ANALYTICAL AND PROCESS CHEMISTRY

ACM-DEN-2401, Rev. 1
Effective Date: 06/28/89

DENSITY

Approved by:

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Analytical Chemistry

Part I

1.0 PURPOSE

This method establishes a method for the determination of density in aqueous and organic samples.

2.0 APPLICATION

This method covers the determination of the wet chemistry method used for density.

3.0 DISCUSSION

> Density is the concentration of matter measured by the mass per unit volume (g/mL) at 20.0°C.

Extensive research and testing has been done on the correlation of density to % total dissolved solids of supernatant and decontaminated supernatant. An equation from this correlation is included in this method.

4.0 REFERENCES

Standard Methods for the Examination of Water and Waste Water, 16th Edition, 213E Specific Gravity.

Part II

5.0 APPARATUS

5.1 Balance capable of weighing to four (4) significant figures.

8910260288 891025
PDR PROJ
M-32 PDC

5.2 One mL calibrated pipets

5.3 Ten mL volumetric flasks.

5.4 Assorted glassware, plasticware, and pipets.

> 5.5 Calibrated thermometer

6.0 REAGENTS AND STANDARDS

Not Applicable

7.0 SAFETY PRECAUTIONS

Observe standard laboratory safety precautions.

8.0 RECORDS

8.1 All measurement data and sample identification shall be recorded on the worksheet attachment A. The final result shall be recorded on the analytical request sheet.

9.0 CALIBRATION AND CONTROL

9.1 Balances will be calibrated on a daily basis, according to manufacturers specifications. Verification of calibration will be recorded in a QA control book.

9.2 Volumetric flasks will be Class A glassware.

> 9.3 Calibrated pipets shall be calibrated to 0.001 mL by laboratory personnel.

> 9.4 Laboratory temperature will be recorded ~~daily~~. EACH analysis ~~will be~~ on the attached work sheet

> 9.5 A QC standard shall be checked and recorded each time this analysis is performed.

7/7/89

> 9.6 The research on the correlation equation of density to % total dissolved solids is included in the Quality Assurance Training Coordinator's records.

10.0 PROCEDURE

10.1 Using a calibrated pipet.

10.1.1 Weigh a suitable capped container on an analytical balance, recording the weight.

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> 10.1.2 Fill the calibrated pipet with the desired sample, expel to waste beaker. Fill the calibrated pipet again with desired sample making sure there are no air bubbles.

> 10.1.3 Expel the sample into the container making sure that all of the sample is expelled from the pipet. Avoid contamination to container such as fingerprints.

10.1.4 Recap the container and weigh on the analytical balance, recording the weight.

> 10.1.5 Rinse pipet with 1M HNO_3 to clean between samples.

10.2 Using a volumetric flask.

10.2.1 Weigh a capped 10 mL volumetric flask on an analytical balance, recording the weight.

10.2.2 Fill the 10 mL volumetric flask to the mark with the sample and recap the flask.

10.2.3 Weigh the flask on the analytical balance.

11.0 CALCULATIONS

11.1 Using a calibrated pipet or volumetric flask.

> 11.1.1 From table 1:

$$\text{Temperature Correction Factor} = \frac{\text{density of water at } 20.0^{\circ}C}{\text{density of water at laboratory temp}}$$

> 11.1.2 $$\text{Density} = \frac{W_2 - W_1}{V} \times \text{Temperature correction factor}$$

Where V = volume of the calibrated pipet or flask
W_1 = weight of the empty container or flask
W_2 = weight of container plus sample or weight of filled flask.

> 11.1.3 Calculate density to three significant figures, e.g., 1.21.

> 11.2 Total dissolved solids of supernatant and decontaminated supernatant can be calculated using the following equation:

$114.535838x - 111.896437 = \%$ TDS of sample
Where x = Density of sample

12.0 ATTACHMENTS

ATTACHMENT A: Density Worksheet
> ATTACHMENT B: Table 1 - Density of Water

ATTACHMENT A

DENSITY WORKSHEET

SAMPLE NAME _____ LOG NUMBER _____

SPECIAL INSTRUCTIONS _____

_____

Instruments Used:

SAMPLE ID					QC STANDARD
SAMPLE VOL. (A) mL					
FLASK + SAMPLE (B) g.					
FLASK (C) g.					
LABORATORY TEMP. °C					
TEMP. CORRECTION FACTOR (D)					
SAMPLE DENSITY $\frac{(B-C)}{A} \times D$ (g/mL)					

If % TDS Requested:

114.535838 x-111.896437 = % TDS

Sample has _____% TDS

ANALYST _____ DATE _____

APPROVED _____ DATE _____

ATTACHMENT B

Table 1. Density of water (kg/m³)

Tabelle 1: Dichte von Wasser in kg/m³ in Abhängigkeit von der Celsius-Temperatur in der Internationalen Praktischen Temperaturskala von 1968

t °C	0,0	0,1	0,2	0,3	0,4	0,5	0,6	0,7	0,8	0,9
0	999.84	999.85	999.85	999.86	999.87	999.87	999.88	999.88	999.89	999.89
1	999.90	999.90	999.91	999.91	999.92	999.92	999.93	999.93	999.93	999.94
2	999.94	999.94	999.95	999.95	999.95	999.95	999.96	999.96	999.96	999.96
3	999.96	999.97	999.97	999.97	999.97	999.97	999.97	999.97	999.97	999.97
4	999.97	999.97	999.97	999.97	999.97	999.97	999.97	999.97	999.97	999.97
5	999.96	999.96	999.96	999.96	999.96	999.95	999.95	999.95	999.95	999.94
6	999.94	999.94	999.93	999.93	999.93	999.92	999.92	999.91	999.91	999.91
7	999.90	999.90	999.89	999.89	999.88	999.88	999.87	999.87	999.86	999.85
8	999.85	999.84	999.84	999.83	999.82	999.82	999.81	999.80	999.79	999.79
9	999.78	999.77	999.76	999.76	999.75	999.74	999.73	999.72	999.72	999.71
10	999.70	999.69	999.68	999.67	999.66	999.65	999.64	999.63	999.62	999.61
11	999.60	999.59	999.58	999.57	999.56	999.55	999.54	999.53	999.52	999.51
12	999.50	999.48	999.47	999.46	999.45	999.44	999.43	999.41	999.40	999.39
13	999.38	999.36	999.35	999.34	999.32	999.31	999.30	999.28	999.27	999.26
14	999.24	999.23	999.21	999.20	999.19	999.17	999.16	999.14	999.13	999.11
15	999.10	999.08	999.07	999.05	999.04	999.02	999.01	998.99	998.97	998.96
16	998.94	998.92	998.91	998.89	998.88	998.86	998.84	998.82	998.81	998.79
17	998.77	998.76	998.74	998.72	998.70	998.68	998.67	998.65	998.63	998.61
18	998.59	998.57	998.56	998.54	998.52	998.50	998.48	998.46	998.44	998.42
19	998.40	998.38	998.36	998.34	998.32	998.30	998.28	998.26	998.24	998.22
20	998.20	998.18	998.16	998.14	998.12	998.10	998.08	998.05	998.03	998.01
21	997.99	997.97	997.95	997.92	997.90	997.88	997.86	997.84	997.81	997.79
22	997.77	997.75	997.72	997.70	997.68	997.65	997.63	997.61	997.58	997.56
23	997.54	997.51	997.49	997.46	997.44	997.42	997.39	997.37	997.34	997.32
24	997.29	997.27	997.24	997.22	997.19	997.17	997.14	997.12	997.09	997.07
25	997.04	997.02	996.99	996.97	996.94	996.91	996.89	996.86	996.83	996.81
26	996.78	996.76	996.73	996.70	996.67	996.65	996.62	996.59	996.57	996.54
27	996.51	996.48	996.46	996.43	996.40	996.37	996.34	996.32	996.29	996.26
28	996.23	996.20	996.17	996.15	996.12	996.09	996.06	996.03	996.00	995.97
29	995.94	995.91	995.88	995.85	995.83	995.80	995.77	995.74	995.71	995.68
30	995.65	995.62	995.58	995.55	995.52	995.49	995.46	995.43	995.40	995.37
31	995.34	995.31	995.28	995.25	995.21	995.18	995.15	995.12	995.09	995.06
32	995.02	994.99	994.96	994.93	994.90	994.86	994.83	994.80	994.77	994.73
33	994.70	994.67	994.64	994.60	994.57	994.54	994.50	994.47	994.44	994.40
34	994.37	994.34	994.30	994.27	994.23	994.20	994.17	994.13	994.10	994.06
35	994.03	994.00	993.96	993.93	993.89	993.86	993.82	993.79	993.75	993.72
36	993.68	993.65	993.61	993.58	993.54	993.51	993.47	993.43	993.40	993.36
37	993.33	993.29	993.25	993.22	993.18	993.15	993.11	993.07	993.04	993.00
38	992.96	992.93	992.89	992.85	992.82	992.78	992.74	992.70	992.67	992.63
39	992.59	992.55	992.52	992.48	992.44	992.40	992.37	992.33	992.29	992.25
40	992.21	992.17	992.13	992.10	992.06	992.02	991.98	991.95	991.91	991.87
41	991.83	991.79	991.75	991.71	991.68	991.64	991.60	991.56	991.52	991.48
42	991.44	991.40	991.36	991.32	991.28	991.24	991.20	991.16	991.12	991.08
43	991.04	991.00	990.96	990.92	990.88	990.84	990.79	990.75	990.71	990.67
44	990.63	990.59	990.55	990.51	990.47	990.43	990.39	990.34	990.30	990.26
45	990.22	990.18	990.14	990.10	990.05	990.01	989.97	989.93	989.88	989.84
46	989.80	989.76	989.71	989.67	989.63	989.59	989.54	989.50	989.46	989.41
47	989.37	989.33	989.28	989.24	989.20	989.16	989.12	989.07	989.03	988.98
48	[illegible]	988.90	988.85	988.81	988.76	[illegible]	988.67	988.62	988.58	988.53
49	[illegible]	988.45	988.40	988.36	988.31	[illegible]	988.23	988.19	988.14	988.10
50	988.05	988.00	987.96	987.91	987.87	987.82	987.77	987.73	987.68	987.64