



INTERNATIONAL  
TECHNOLOGY  
CORPORATION

# IT Analytical Services

## Oak Ridge Laboratory Standard Operating Procedure

Title: % Moisture of Solid Matrices

Prepared by: Sharon K. Pennington Date: 9/21/92

Reviewed by: Robert W. Martin Date: 11/10/92  
Technical Specialist

Leah K. Rowl Date: 11/16/92  
Quality Control Coordinator

James Ball Date: 2/1/93  
Director, Quality, ITAS

Kim E. Reynolds Date: 12-21-92  
Director, Health and Safety, ITAS

Approved by: Laney G. Kenney Date: 2/4/93  
Laboratory Director

Controlled Copy No: \_\_\_\_\_

Key Words:

Revision #	0						
Date	9/21/92						

Oak Ridge Regional Office  
1550 Bear Creek Road • Kingston, Tennessee 37763 • 615-462-9707

IT Corporation is a wholly owned subsidiary of International Technology Corporation

9402180046 940208  
PDR ADCK 04008984  
C PDR

ITAS-OR-OP-6604  
DATE INITIATED: 09/21/92  
REVISION NO.: 0  
DATE REVISED:  
PAGE 2 OF 8

#### HISTORY OF REVISION

REVISION NO.	DATE	PAGES AFFECTED
0	09/21/92	All

#### REASON FOR REVISION

To place into the ITAS outline and proceduralize the method from the 1992 Annual Book of ASTM Standard Methods, Section 4, Soil and Rocks: Dimension Stone; Geosynthetics, Volume 04.08 and US EPA Contract Laboratory Program, Statement of Work fo Inorganic Analysis, 1991, Document Number ILM01.0, pg. D98.

## 1.0 Purpose, Application, and Responsibility

### 1.1 Purpose

- 1.1.1 This standard operating procedure provides a detailed outline of instructions for moisture determination in soil and other solid samples.

### 1.2 Application

- 1.2.1 This procedure applies to all soils and other solid matrices requiring percent moisture.

### 1.3 Responsibility

- 1.3.1 It is the responsibility of the laboratory analyst to perform this procedure as it is written and to inform the supervisor of any unusual circumstances, abnormal results, or malfunctions.
- 1.3.2 It is the responsibility of the laboratory supervisor or his/her designee to delegate the performance of this procedure to personnel who have demonstrated proficiency in the performance of this procedure and in the use of the equipment and/or instrumentation associated with it.

## 2.0 References

- 2.1 1992 Annual Book of ASTM Standards, Section 4, Soil and Rocks: Dimension Stone; Geosynthetics, Volume 04.08, "Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils," D2974-87, 1991.
- 2.2 US EPA Contract Laboratory Program, Statement of Work for Inorganic Analysis, 1991, Document Number ILM01.0, pg. D98.

## 3.0 Associated SOPs

- 3.1 Chlorinated Herbicides Analysis - GC-6401.
- 3.2 Pesticides and PCB Analysis and Prep - GC-6402.
- 3.3 Procedure for the Analysis of Semi-Volatiles - MS-6821.

3.4 Procedure for the Analysis of Volatiles - MS-6841.

4.0 Definitions

4.1 None.

5.0 Procedure

5.1 Summary

- 5.1.1 Approximately 5.00 g of the sample is weighed into a preweighed aluminum pan and dried at  $105 \pm 5^\circ\text{C}$ . The moisture is expressed as a percent of the sample dried.
- 5.1.2 The analyst conducting this method independently or supervising the conduct of this method must have at a minimum a Bachelor's degree in chemistry or equivalent scientific discipline or an Associate's degree with two years bench experience in an analytical laboratory area and have qualified in the performance of this method as outlined below in Steps 5.1.4 through 5.1.7.
- 5.1.3 Analysts not meeting the minimum qualifications above may conduct this method under the direct supervision of a fully qualified analyst. Analysts assisting in the conduct of this method must have at a minimum a high school diploma with a high school or college course in chemistry and have qualified in the performance of this method as outlined below in Steps 5.1.4 through 5.1.7.
- 5.1.4 Initial training on this method will be performed by personnel qualified on this method and will as a minimum consist of an oral review of the method followed by at least one manual demonstration.
- 5.1.5 The analyst trainee will then conduct several analyses of known and unknown qualification spikes and blank samples under the direct oversight of qualified personnel.
- 5.1.6 After correct results are achieved with direct

oversight the analyst will then proceed to perform analyses of four blind samples without assistance of qualified personnel.

- 5.1.7 Qualification is achieved by performance of analyses of known and unknown qualification spikes and blind samples to within three sigma of the normalized deviation for these samples established by laboratory control charts.

## 5.2 Safety

- 5.2.1 All work must be stopped in the event of known or potential compromise to the health and safety of any ITAS associate and must be reported immediately to a laboratory supervisor.

- 5.2.2 Exposure to chemicals will be maintained as low as reasonably achievable; therefore, unless they are known to be non-hazardous, all samples will be opened, transferred and prepared in a fume hood, or under other means of mechanical ventilation. Solvent and waste containers will be kept closed unless transfers are being made.

- 5.2.3 Because hazardous chemicals and materials are used during this method, procedures for handling those hazards must be practiced. Personal protection equipment must include safety glasses with side shields and/or goggles for eye protection, gloves for skin protection, and a lab coat or apron for clothing protection.

## 5.3 Interferences

- 5.3.1 A large amount of oil and tar in the sample may interfere with the evaporation of moisture.

## 5.4 Required Equipment

- 5.4.1 Oven, capable of being regulated at a constant temperature of  $105 \pm 5^{\circ}\text{C}$ .

- 5.4.2 Desiccator.
- 5.4.3 Balance, capable of weighing to the nearest 0.01 g.
- 5.4.4 Aluminum weighing pans.
- 5.4.5 Spatulas, spoons, or tongue depressers.
- 5.5 Reagents/Standards
  - 5.5.1 None.
- 5.6 Calibration
  - 5.6.1 Balance - Check accuracy daily with certified weights and maintain in a logbook. If outside tolerances, have the balance calibration checked before use with the samples.
- 5.7 Analysis/Operation
  - 5.7.1 Weigh an aluminum weighing pan and record the weight to the nearest 0.01 g.
  - 5.7.2 Thoroughly mix a representative aliquot of sample and weigh out approximately 5.00 g. Record the weight of the pan and sample to the nearest 0.01 g.
  - 5.7.3 Place the pan of sample in the drying oven and allow it to dry for approximately 12 to 24 hours at  $105 \pm 5^{\circ}\text{C}$ .
  - 5.7.4 Remove from the oven after 12 hours, but no longer than 24 hours, of drying time and place in a desiccator to allow the pan and sample to cool to room temperature.
  - 5.7.5 Remove from the desiccator and weigh the cooled pan and sample to the nearest 0.01 g, being certain to record the weight.
  - 5.7.6 Calculate the percent moisture and dryness factor using the calculation in section 5.8 and distribute the data to the proper departments.

## 5.8 Calculations

### 5.8.1 Percent Moisture Calculation

$$\% \text{ Moisture} = \frac{\text{Wet Weight} - \text{Dry Weight}}{\text{Wet Weight}} \times 100$$

where:

*Wet Weight* = *Weight of Sample Before Drying* - *Weight of Pan*

and,

*Dry Weight* = *Weight of Sample After Drying* - *Weight of Pan*

### 5.8.2 Dryness Factor

$$\text{Dryness Factor} = \frac{\text{Dry Weight}}{\text{Wet Weight}}$$

## 5.9 Quality Control

5.9.1 A duplicate shall be run for every 20 samples or as required.

## 6.0 Nonconformance and Corrective Action

6.1 Any deviation from this SOP must be approved by the laboratory manager or technical director.

6.2 Any unauthorized deviation from this SOP shall be documented as a nonconformance, with a cause and corrective action described.

6.3 Any deviation from this procedure shall be documented on a Procedures Change/Development form. This form is available from the Quality Assurance office.

## 7.0 Records Management/Documentation

7.1 Sample preparation worksheets shall be generated for all percent moisture determinations.



- 7.1.1 The Percent Moisture Worksheet shall contain project code, sample ID(s), pan weight, weight sample + pan weight, dry sample + pan weight, analyst, date of analysis, times in and out of the oven, and oven temperature. When the worksheets are finished, they will be peer reviewed for completeness of entries then signed and dated.
- 7.1.2 The Percent Moisture Calculations Worksheet shall contain project code, sample ID(s), pan weight, wet sample + pan weight, dry sample + pan weight, dryness factor, and % moisture. This worksheet shall be generated when the weights from the Percent Moisture Worksheet are entered into the calculations program. When the worksheets are finished, they will be peer reviewed for completeness of entries then signed and dated.
- 7.2 Sample worksheets shall be generated for percent moistures which need to be reprep. These worksheets shall contain the same information as the original worksheets (see section 7.1) and will be designated as reprep.
- 7.3 Percent moisture original and reprep worksheets ITAS-generated in section 7.1 and 7.2 shall be maintained in Section C, Organic Analytical/QC Information. Copies of these worksheets shall be maintained in a file in Organic Prep.



ITAS - St. Louis  
November 17, 1993 06:13 pm  
Percent Solids

IT - Washington D.C.  
1133 21st Street, N.W.  
Suite 710  
Washington, DC 20036-3390

Project Number: 327.02

Category: Percent Solids

Sample Date : 04-OCT-93  
Received Date: 05-OCT-93  
Report Date : 17-NOV-93

Method : SL 4005

---

Client ID	ITAS ID	Matrix	Decant Type	Prep Date	Percent Solids	Percent Moisture
1-A01	3656-001	Sludge	N	16-NOV-93	15.69	84.31
1-A02	3656-002	Sludge	N	16-NOV-93	16.51	83.49
1-A03	3656-003	Sludge	N	16-NOV-93	17.23	82.77
1-B01	3656-004	Sludge	N	16-NOV-93	19.53	80.47
1-B02	3656-005	Sludge	N	16-NOV-93	16.94	83.06
1-B04	3656-006	Sludge	N	16-NOV-93	17.66	82.34

---

ITAS - St. Louis  
November 17, 1993 06:22 pm  
Percent Solids

IT - Washington D.C.  
1133 21st Street, N.W.  
Suite 710  
Washington, DC 20036-3390

Project Number: 327.02

Category: Percent Solids

Sample Date : 05-OCT-93  
Received Date: 06-OCT-93  
Report Date : 17-NOV-93

Method : SL 4005

---

Client ID	ITAS ID	Matrix	Decant Type	Prep Date	Percent Solids	Percent Moisture
7UL	3657-001	Soil	N	16-NOV-93	51.87	48.13
7UR	3657-002	Soil	N	16-NOV-93	60.45	39.55
7LR	3657-003	Soil	N	16-NOV-93	20.92	79.08
7LL	3657-004	Soil	N	16-NOV-93	42.98	57.02

---

ITAS - St. Louis  
November 17, 1993 06:07 pm  
Percent Solids

IT - Washington D.C.  
1133 21st Street, N.W.  
Suite 710  
Washington, DC 20036-3390

Project Number: 327.02

Category: Percent Solids

Sample Date : 06-OCT-93

Received Date: 08-OCT-93

Method : SL 4005

Report Date : 17-NOV-93

Client ID	ITAS ID	Matrix	Decant Type	Prep Date	Percent Solids	Percent Moisture
6E-10-1	3669-001	Sludge	N	16-NOV-93	20.70	79.30
6E-10-2	3669-002	Sludge	N	16-NOV-93	28.31	71.69
6-B11-1	3669-003	Sludge	N	16-NOV-93	15.49	84.51
6-B11-2	3669-004	Sludge	N	16-NOV-93	22.75	77.25
6-A09-1	3669-005	Sludge	N	16-NOV-93	12.59	87.41
6-A09-2	3669-006	Sludge	N	16-NOV-93	21.67	78.33
6-C09-1	3669-009	Sludge	N	16-NOV-93	14.69	85.31
6-C09-2	3669-010	Sludge	N	16-NOV-93	22.50	77.50
6-E09-1	3669-012	Sludge	N	16-NOV-93	19.65	80.35
6-E09-2	3669-013	Sludge	N	16-NOV-93	29.73	70.27
6-B10-1	3669-016	Sludge	N	16-NOV-93	14.00	86.00
6-B10-2	3669-017	Sludge	N	16-NOV-93	22.81	77.19
6-C10-12	3669-018	Sludge	N	16-NOV-93	18.69	81.31
6-F10-2	3669-022	Sludge	N	16-NOV-93	39.17	60.83
6-A11-12	3669-023	Sludge	N	16-NOV-93	19.08	80.92
6-D11-1	3669-026	Sludge	N	16-NOV-93	17.78	82.22
6-D11-2	3669-027	Sludge	N	16-NOV-93	22.08	77.92
6-E11-12	3669-028	Sludge	N	16-NOV-93	20.97	79.03
6-B12-1	3669-032	Sludge	N	16-NOV-93	14.64	85.36
6-B12-2	3669-033	Sludge	N	16-NOV-93	22.59	77.41

ITAS - St. Louis  
November 17, 1993 06:07 pm  
Percent Solids

IT - Washington D.C.  
1133 21st Street, N.W.  
Suite 710  
Washington, DC 20036-3390

Project Number: 327.02

Category: Percent Solids

Sample Date : 06-OCT-93

Received Date: 08-OCT-93

Method : SL 4005

Report Date : 17-NOV-93

---

Client ID	ITAS ID	Matrix	Decant Type	Prep Date	Percent Solids	Percent Moisture
6-D12-12	3669-036	Sludge	N	16-NOV-93	21.07	78.93
6-F12-12	3669-038	Sludge	N	16-NOV-93	37.33	62.67
6-B08-12	3669-041	Sludge	N	16-NOV-93	19.89	80.11
6-D08-12	3669-044	Sludge	N	16-NOV-93	22.09	77.91
6-F08-12	3669-047	Sludge	N	16-NOV-93	31.77	68.23

---

ITAS - St. Louis  
November 17, 1993 06:14 pm  
Percent Solids

IT - Washington D.C.  
1133 21st Street, N.W.  
Suite 710  
Washington, DC 20036-3390

Project Number: 327.02

Category: Percent Solids

Sample Date : 07-OCT-93  
Received Date: 11-OCT-93  
Report Date : 17-NOV-93

Method : SL 4005

Client ID	ITAS ID	Matrix	Decant Type	Prep Date	Percent Solids	Percent Moisture
6-B1-1	3678-003	Sludge	N	16-NOV-93	16.94	83.06
6-B1-2	3678-004	Sludge	N	16-NOV-93	25.56	74.44
6-D1-1	3678-007	Sludge	N	16-NOV-93	13.58	86.42
6-D1-2	3678-008	Sludge	N	16-NOV-93	27.22	72.78
6-F1-1	3678-011	Sludge	N	16-NOV-93	14.61	85.39
6-F1-2	3678-012	Sludge	N	16-NOV-93	27.26	72.74
6-A2-1	3678-013	Sludge	N	16-NOV-93	14.23	85.77
6-A2-2	3678-014	Sludge	N	16-NOV-93	24.00	76.00
6-C2-1	3678-017	Sludge	N	16-NOV-93	21.22	78.78
6-C2-2	3678-018	Sludge	N	16-NOV-93	28.75	71.25
6-E2-1	3678-021	Sludge	N	16-NOV-93	15.34	84.66
6-E2-2	3678-022	Sludge	N	16-NOV-93	24.78	75.22
6-C3-1	3678-029	Sludge	N	16-NOV-93	21.58	78.42
6-C3-2	3678-030	Sludge	N	16-NOV-93	26.65	73.35
6-D3-1	3678-031	Sludge	N	16-NOV-93	19.78	80.22
6-D3-2	3678-032	Sludge	N	16-NOV-93	27.32	72.68
6-F3-1	3678-035	Sludge	N	16-NOV-93	16.42	83.58
6-F3-2	3678-036	Sludge	N	16-NOV-93	29.11	70.89
6-A4-1	3678-037	Sludge	N	16-NOV-93	16.17	83.83
6-A4-2	3678-038	Sludge	N	16-NOV-93	30.97	69.03

ITAS - St. Louis  
November 17, 1993 06:14 pm  
Percent Solids

IT - Washington D.C.  
1133 21st Street, N.W.  
Suite 710  
Washington, DC 20036-3390

Project Number: 327.02

Category: Percent Solids

Sample Date : 07-OCT-93  
Received Date: 11-OCT-93  
Report Date : 17-NOV-93

Method : SL 4005

Client ID	ITAS ID	Matrix	Decant Type	Prep Date	Percent Solids	Percent Moisture
6-C4-1	3678-041	Sludge	N	16-NOV-93	22.74	77.26
6-C4-2	3678-042	Sludge	N	16-NOV-93	30.65	69.35
6-D4-1	3678-043	Sludge	N	16-NOV-93	21.01	78.99
6-D4-2	3678-044	Sludge	N	16-NOV-93	29.60	70.40
6-E4-12	3678-045	Sludge	N	16-NOV-93	28.84	71.16
6-B5-1	3678-049	Sludge	N	16-NOV-93	26.14	73.86
6-B5-2	3678-050	Sludge	N	16-NOV-93	30.08	69.92
6-D5-1	3678-053	Sludge	N	16-NOV-93	27.55	72.45
6-D5-2	3678-054	Sludge	N	16-NOV-93	31.17	68.83
6-F5-12	3678-057	Sludge	N	16-NOV-93	34.25	65.75