

SEPIOLITE IN ASPHALT EMULSIONS



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1. What is Sepiolite?

Sepiolite is a non-swelling, lightweight, porous clay. Unlike other clays, the individual particles of Sepiolite have a needle-like shape, as shown in Exhibit "A" of this brochure. The high surface area as expressed in $M^2/gm.$ and porosity, as well as the unusual particle shape of this clay accounts for outstanding colloidal properties and reinforcing characteristics. This valuable material is applied in a wide range of industrial applications.

Chemically, Sepiolite is a hydrated magnesium silicate. Its structure can be described as chain-like, producing needle-like particles instead of plate-like particles of other common clays. There is little negative charge on the crystal lattice resulting in low cation exchange capacity.

Colloidal grades of Sepiolite must be dispersed into water or other liquid systems using high-shear mixers. Once dispersed in the liquid, it forms a structure of randomly intermeshed elongated particles, which are maintained by physical interference and hydrogen bonding that entraps the liquid, thereby stabilizing the emulsion. This structure in Sepiolite is stable even in systems containing surfactants. On the other hand, bentonite clay suspensions will flocculate and fail when certain surfactants and/or ionic solutions are introduced.

2. Where Does Sepiolite Come From?

Sepiolite is an uncommon clay, both for the peculiar characteristics and scarce occurrence. There are very few commercial deposits in the world. Most of the world production (90+ %) of this clay comes from deposits of sedimentary origin near Madrid, Spain. IMV Nevada has the only known commercial deposit of Sepiolite in North America.

IMV's clays are mined and processed in Amargosa Valley, Nevada, approximately 90 miles northwest of Las Vegas, Nevada.

3. Why Use Sepiolite in Asphalt Emulsions?

Sepiolite provides in-package stability, flow control and optimum workability in such different applications as paints, adhesives, mastics and sealants. In asphalt emulsions, Sepiolite is not merely just a replacement for other commonly used clays. As a result of the network formed by the Sepiolite needles in the applied sealcoat, Sepiolite provides your product with superior wear characteristics as measured by film strength and water resistance and offers your customer the benefit of a clearly differentiated and superior product.

4. What are the Alternatives?

Commodity clays, such as Wyoming bentonites and ball clays, combined with various additives have traditionally been used in asphalt emulsion applications. Bentonite is a swelling clay, sensitive to surfactants and possesses a high

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cationic exchange capacity. Exhibit "B" shows a scanning electron microscope analysis of common bentonite, showing the platelet structure that swells when hydrated. In certain circumstances the high swelling nature of bentonite can lead to premature failure and the observance of dry "flecks" of clay that are actually particles of clay sealed on the outside.

Ball clays do little other than act as a filler and they must often be supplemented with expensive additives to produce desired results. When formulated into asphalt sealcoats the water sensitivity of ball clays and bentonites result in slower cure time, susceptibility to cracking, poorer adhesion and decreased wear properties compared to asphalt emulsions based upon Sepiolite.

5. Sepiolite vs. Bentonite and ASMA Specifications

IMV Nevada's Sepiolite clay exceeds the performance of bentonite in critical measurements for wet track abrasion and water sensitivity and ASMA specifications in all major categories. Exhibit "C" shows test results from a manufacturer's laboratory.

6. The Next Generation

Empirical evidence from current users of IMV's Sepiolite clay in asphalt emulsions substantiates the claim that a new generation of clearly differentiated product is produced with superior film strength and water resistance. With the inevitable move from coal-tar to asphalt based emulsions across the country, now is an ideal time to incorporate Sepiolite into your formulations for a new and improved product.

7. a

THERMOGEL



PRODUCT BULLETIN

DESCRIPTION

Originally designed as a specialty drilling mud, THERMOGEL is a finer particle size version of IMV Nevada's SEAMUD, suitable for industrial applications that require a finer particle size distribution. THERMOGEL provides superior performance properties in clay based asphalt sealcoats, with particularly improved wet track abrasion, in comparison to bentonite or ball clays.

TYPICAL CHEMICAL ANALYSIS

	%
Silicon (SiO ₂).....	56.0
Aluminum (Al ₂ O ₃).....	4.0
Iron (Fe ₂ O ₃).....	1.0
Magnesium (MgO).....	20.0
Calcium (CaO).....	0.5
Sodium (Na ₂ O).....	1.4
Potassium (K ₂ O).....	1.4
L.O.I. (1000°C).....	15.7

Metals listed are complexed in the mineral structure and do not exist as free oxides

Typical Physical Properties

		<u>Test Method</u>
Particle Size.....	Max 5% +60 Mesh (250 Microns)	IMV 201
% Moisture.....	16% Max	IMV 303 or 304
Loose Bulk Density (lbs./ft ³).....	45-55 lbs/cu. Ft.	IMV 507
Brookfield Viscosity,		

PACKAGING

Available in 50 lb. (3-ply natural bags) & bulk bags. Shipped on 42x42 non returnable Pallets.

Note: The suggestions contained in this Product Bulletin are based on data which is believed reliable. They are offered in good faith, to be applied according to the user's own best judgment. Since operating conditions in the customers plant are beyond our control, IMV Nevada cannot assume responsibility for any risks or liabilities which may result from the use of its products.

Likewise, no patent liability is assumed to any method, manner or use, or any formulas utilized by a consumer
Revised 3/26/08

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7.b

IMV NEVADA

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MATERIAL SAFETY DATA SHEET

Identity:
Sepiolite Clay (CAS #63800-37-3)

Section I

Manufacturer's Name
IMV Nevada

Emergency Telephone Number
800-243-0513
775-372-5341

Address:
HC 70 Box 549
498 E. Invite Rd.
Amargosa Valley, Nevada 89020

Telephone Number for Information
775-372-5341

Date Prepared: 09/08/04
Date Revised: 01/24/08

SECTION II –HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

Hazardous Components: Respirable dust may contain Silica, Crystalline
Quartz (CAS #14808-60-7)

Specific Chemical Identity:

Sepiolite: $H_6Mg_8Si_{12}O_{30} OH_{10} 6 H_2O$ CAS #63800-37-3

Common Names: Sepiolite, Meerschaum, Palygorsite, Clay, a natural mineral extracted from the earth (see trade names, page 5)

OSHA PEL: Classified as a nuisance dust when less than 1% crystalline silica is present,
PEL = 5.00 mg/M³ (respirable)

If greater than 1% crystalline silica, then exposures shall not exceed an 8 hr. time weighted average limit as stated in 29 CFR 1910.1000 Table Z-1-A for air contaminants, specifically:

Silica, Crystalline Quartz (respirable 0.1 mg/M³)

ACGIH TLV: Classified as a nuisance dust when less than 1% crystalline silica,
TLV-TWA = 10 mg/M³ (total dust), 5 mg/M³ (Respirable)

If greater than 1% crystalline silica, the TLV-TWA = 0.1mg/M³ (respirable crystalline quartz). The Threshold Limit Value and Biological Exposure Indices for 1991-1992, American Conference of Governmental Industrial Hygienists.

Other Limits Recommended: National Institute for Occupational Safety and Health (NIOSH). Recommended standard maximum permissible concentration= 0.05 mg/M³ (respirable crystalline quartz) as determined by a full-shift sample up to 10-hour working day, 40 hour work week. See NIOSH Criteria for Recommended Standard Occupational Exposure to Crystalline Silica.

SECTION III –PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point: More than 1000°F **Specific Gravity (H₂O=1)** 1.9-2.4

Vapor Pressure (mm Hg.): None **Melting Point:** None

Vapor Density (AIR=1) None **Evaporation Rate:** None

Solubility in Water: Insoluble in water

Appearance and Odor: Light gray, tan or reddish tan, granular or powder. Earthy odor when wet.

SECTION IV –FIRE AND EXPLOSION HAZARD DATA

Flash Point (method used): non-flammable

Flammable Limits: None **LEL:** None

UEL: None

Extinguishing Media: None Required

Special Fire Fighting Procedures: None

Unusual Fire and Explosion Hazards: None

SECTION V -- REACTIVITY DATA

Stability: Stable

Conditions to Avoid: None

Incompatibility (Materials to Avoid): None

Hazardous Decomposition or Byproducts: None

Hazardous Polymerization: Will Not Occur

SECTION VI – HEALTH HAZARD DATA

Route(s) of Entry: Inhalation? Yes Skin? No Ingestion? No

Health Hazards (Acute and Chronic)

May be harmful if inhaled in sufficient quantities. Prolonged exposure to Sepiolite Clay dust may cause a relatively benign lung disease, though there is a risk of massive fibrosis.

Repeated and prolonged exposure to respirable crystalline quartz which may be contained in Sepiolite Clay dust may cause delayed (chronic) lung injury silicosis. Silicosis is a form of disabling pulmonary fibrosis which can be progressive and may lead to death.

Carcinogenicity: NTP? Yes IARC Monographs? Yes OSHA Regulated? Yes

IARC has reported that there is inadequate evidence for the carcinogenicity of Sepiolite in experimental animals and that there is no data available to evaluate the carcinogenicity of Sepiolite in humans (IARC Class 3).

Sepiolite Clay, like other naturally occurring minerals, may contain crystalline silica. ARC has concluded that there is limited evidence for the carcinogenicity of crystalline silica to humans and sufficient evidence of carcinogenicity of crystalline silica in experimental animals (IARC Class 2A). The NTP has concluded that "silica: Crystalline (respirable)" may reasonably be anticipated to be a carcinogen, based upon evidence for the carcinogenicity of respirable crystalline silica in experimental animals and limited evidence in humans.

Signs and Symptoms of Exposure: undue breathlessness, wheezing, cough and sputum products.

SECTION VI- CONTINUED

Medical Conditions Generally Aggravated by Exposure: Pulmonary function may be reduced by inhalation of respirable crystalline silica that may be in Sepiolite Clay, dust lung scarring produced by such inhalation may lead to progressive massive fibrosis of the lung which may aggravate other pulmonary conditions and diseases and which increases the susceptibility to pulmonary tuberculosis. Progressive massive fibrosis may be accompanied by right heart enlargement, heart failure and pulmonary failure. Smoking aggravates the effects of exposure.

Emergency and First Aid Procedures: For dust in eyes, wash immediately with water. If irritation persists, seek medical attention. For gross inhalation, remove person immediately to fresh air and give artificial respiration as needed, seek medical attention as needed.

SECTION VII – PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be taken in Case Material is Released or Spilled:

Spills: Use dustless methods (vacuum) and place into closable container for disposal, or flush with water. Do not dry sweep. Care should be taken to avoid high aerosol dust concentrations. Wear protective equipment specified below. Spilled material may become very slippery when wet with water, grease, oil, gasoline, or solvents.

Waste Disposal Method: Dispose in accordance with Federal, State and Local regulations.

Precautions to Be Taken in Handling and Storing: Avoid breakage of bagged material or spills of bulk material. See control measures in Section VIII.

Other Precautions: Use dustless systems for handling, storage, and clean up so that airborne dust does not exceed the PEL. Use adequate ventilation and dust collection. Practice good housekeeping. Do not permit dust to collect on walls, floors, sills, ledges, machinery, or equipment. Maintain, clean, and fit test respirators in accordance with OSHA regulations. Maintain and test ventilation and dust collection equipment. Wash or vacuum clothing which has become dusty. See also control measures in Section VIII.

See OSHA Hazard Communication Rule 29 CFR Sections 1910.1200, 1915.99, 1917.28, 1918.90, 1926.59 and 1928.21 and state and local worker or community "right to know" laws and regulations. We recommend that smoking be prohibited in all areas where respirators must be used. **WARN YOUR EMPLOYEES (AND YOUR CUSTOMERS-USERS IN CASE OF RESALE) BY POSTING AND OTHER MEANS OF THE HAZARDS AND OSHA PRECAUTIONS TO BE USED. PROVIDE TRAINING FOR YOUR EMPLOYEES ABOUT THE OSHA PRECAUTIONS.**

See also American Society for Testing and Materials (ASTM) "Standard Practice for Health Requirements Relating to Occupational Exposure to Quartz Dust.

SECTION VIII – CONTROL MEASURES

Respiratory protection (Specify type)

The following chart specifies the types of respirators which may provide protection for respirable crystalline silica that may be contained in Sepiolite Clay dust.

RESPIRATORY PROTECTION FOR CRYSTALLINE SILICA

Condition Particulate Concentration	MINIMUM RESPIRATORY PROTECTION*
Up to 5 x PEL	Any dust respirator
Up to 10 x PEL	Any dust respirator, except single use or quarter-mask respirator. Any fume respirator of high efficiency particulate filter respirator. Any supplied-air respirator. Any self-contained breathing apparatus.
Up to 50 x PEL	Any high efficiency particulate filter respirator with a full face-piece. Any supplied-air respirator with a full face-piece, helmet or hood. Any self-contained breathing apparatus with a full face-piece.
Up to 500 x PEL	A powered air-purifying respirator with a high efficiency particulate filter. A Type C supplied-air respirator operated in pressure demand or other positive pressure or continuous flow mode.
Greater than 550 x PEL or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full face-piece operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied-air respirator with a full face-piece operated in pressure demand or other positive pressure continuous-flow mode and auxiliary self-contained breathing apparatus operated in pressure demand or other positive pressure mode.

***Only NIOSH-approved or MSHA-approved equipment should be used. (See 29 CFR 1910.134).**

Ventilation:

Local Exhaust: Use sufficient local exhaust to reduce the level of dust to the PEL. See ACGGIH "Industrial Ventilation, A manual of Recommended Practice," the latest edition.

Mechanical: See "Other Precautions" under Section VII

Special: See "Other Precautions" under Section VII

Other: See "Other Precautions" under Section VII

Protective gloves: Optional

Eye protection: Wear protective shield (safety glasses) when exposed to dust particles

Other Protective Clothing & Equipment: Optional

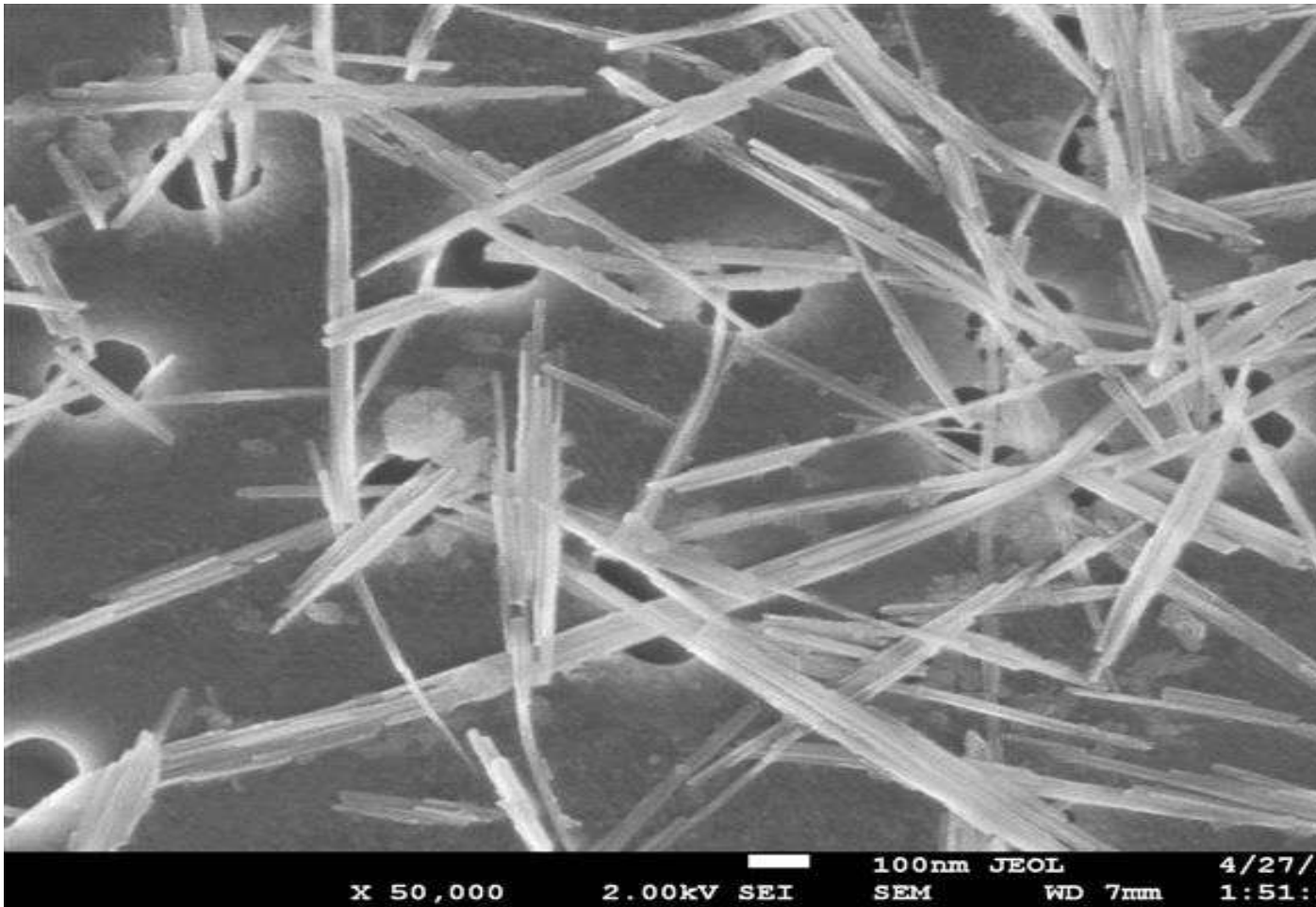
Work/Hygienic Practices: Avoid creating and breathing dust. See "Other Precautions" under Section VII

The information and recommendations contained herein are based upon data believed to be correct. However, no guarantee or warranty of any kind, express or implied, is made with respect to the information contained herein. We accept no responsibility and disclaim all liability for any harmful health effects which may be caused by purchase, resale, and use of exposure to our Sepiolite Clay. Customers-users or Sepiolite Clay must comply with all applicable health and safety laws, regulations and orders.

TRADE NAMES:

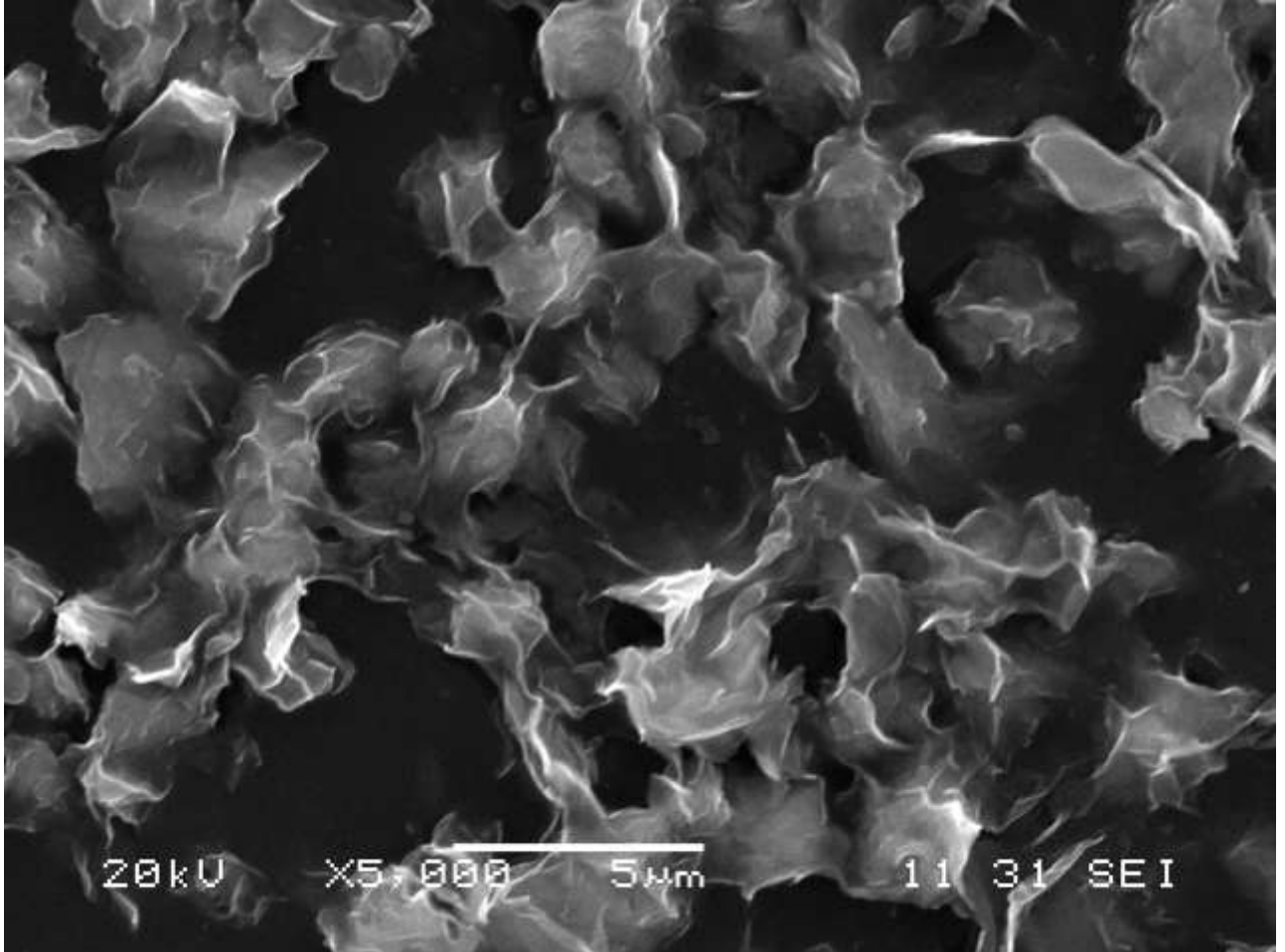
**IGS
SEA MUD
SEPIOGEL-A
SEPIOGEL-R
SEPIOGEL-F
SEPIOGEL-721
THERMOGEL
SEPIOGEL NOODLES
GRANULAR SEPIOLITE
WAHLITE-FG
SEPIOLITE - 1630
SEPIOLITE - 3080**

EXHIBIT 8-A



Sepiolite "ribbons" shown at 50,000 times magnification using SEM (Scanning Electron Microscope). The long **Sepiolite** ribbons are clearly visible. The **Sepiolite** is non-swelling and does not rehydrate when the applied sealcoat is exposed to moisture. The **Sepiolite** ribbons reinforce the applied sealcoat.

EXHIBIT 8-B



Bentonite "platelets" shown at 5,000 times magnification using SEM. (Scanning Electron Microscope) Small bentonite platelets are clearly visible. **Sodium bentonites** are swelling clays that increase in volume when hydrated and decrease in volume as they dry. This may lead to shrinkage and cracking of the applied sealcoat as it dries. **Sodium bentonites** are extremely hydrophilic, (water-loving) swell and rehydrate as the applied sealcoat is exposed to moisture. This results in water sensitivity and poor wear properties in the applied sealcoat.

EXHIBIT 8-C

Test #1. (Performed in manufacturer's laboratory)

Wet Track Abrasion Test

Sample #	Material	Initial Weight	Final Weight	Grams Lost	Grams lost/Sq. Ft.	Average
27	Test w/ Thermogel	351.31g	350.40g	0.91g	4.10 g/ft2	
28	Test w/ Thermogel	331.11g	330.38g	0.73g	3.29 g/ft2	
29	Test w/ Thermogel	337.33g	336.53g	0.80g	3.60 g/ft2	3.66 g/ft2
30	Test Seal w/ Bentonite	327.39g	324.50g	2.89g	13.02 g/ft2	
31	Test Seal w/ Bentonite	342.04g	338.74g	3.30g	14.86 g/ft2	
32	Test Seal w/ Bentonite	324.05g	320.97g	3.08g	13.87 g/ft2	13.92 g/ft2

Procedure:

1. Pour undiluted sample into 3/16" steel template on 30# roofing paper disc
2. Strike of sample even with top of template with minimal manipulation of sample
3. Dry sample to constant weight in 140 degree oven
4. Carefully remove sample from oven and allow to cool to room temperature
5. Weigh the sample on the paper disc
6. Submerge the sample in a water bath at room temperature for 1.5 hours
7. Remove sample from water bath and secure in 9" baking pan in the mixer with c-clamps
8. Cover the sample with 1/4" of room temperature water
9. Attach new rubber hose to abrasion head in mixer
10. Operate the mixer at it's lowest speed for exactly 5 minutes
11. Remove sample from pan and rinse clean with water
12. Place washed sample in 140 degree oven and dry to constant weight
13. Weigh sample and compute grams lost during test
14. Record results

9.



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