GRACE

W.R. Grace & Co.- Conn.
62 Whittemore Avenue
Cambridge, MA 02140-1692

(617) 876-1400

August 26, 1994

Mr. Ronald E. Myers
United States Environmental Protection Agency
Office of Air Quality Planning and Standards
Emission Factors and Methodologies Section
Emission Inventory Branch
Research Triangle Park, NC 27711

Dan. Ref. 2 pt 452-

Dear Mr. Myers:

In reply to your letter dated July 21, 1994, W. R. Grace & Co.-Conn. (Grace) submits the following information.

1. Emission Test Data from two Grace facilities: This information was compiled by Mr. Jay Burrill (Grace Environmental Coordinator) and I refer you to his comments concerning the attached data.

2. Literature from The Vermiculite Association:

   A. 1993-1994 Membership Directory

   B. Brochure: "Vermiculite Its Properties and Uses"

   C. Information on the upcoming Vermiculite Association Annual Conference to be held on October 29-November 2, 1994.

chemical analysis for ore or exfoliated? what would be MC of ore feed to dryer?

3. Literature from Grace:

   A. VCX Vermiculite Ore Concentrate: (Sales Brochure and Material Safety & Data Sheet): This highlights the typical properties and uses for Grace's VCX products. Note: VCX Vermiculite Ore Concentrate is an unexfoliated product.

   B. Agricultural Vermiculite (Sales Brochure and Material Safety & Data Sheet): This highlights the typical properties and uses for Grace's Agricultural Vermiculite. Note: This is an exfoliated product.

   C. Zonolite Industrial Vermiculite (Sales Brochure and Material Safety & Data Sheet): This highlights the typical properties and uses for Grace's Industrial Vermiculite. Note: This is an exfoliated product.

I hope this information will assist you with your project. Grace has provided information pertaining to the vermiculite industry in the form of emission data, industry contacts, and marketing information. Concerning comments on the vermiculite processing and exfoliating operations, Grace feels the information in your attached drafts adequately describes these operations.

Thank you and please call if I can be of further assistance.

Sincerely,

Jeffrey A. Danneker
Product Manager

JAD/d
Attachments

GRACE

Construction Products Division

W.R. Grace & Co. - Conn.
62 Whittemore Avenue
Cambridge, Mass. 02140

(617) 876-1400

August 29, 1994

The attached documents consist of EPA Method 5 emission test conducted on a vermiculite beneficiation mill in Enoree, South Carolina, and a vermiculite exfoliation plant in Dallas, Texas. Both facilities are owned and operated by Grace Construction Products, a unit of W.R. Grace & Co.-Conn. (Grace). The Enoree facility is in operation today, but the Dallas plant was closed in 1991.

Testing at the Enoree facility consisted of sampling the outlet of the wet scrubber controlling emissions from a rotary dryer, and the outlets of baghouses controlling emissions from the dried vermiculite size classification, or screening, operations at the mill. Emissions are reported in the test reports as lb./hr. but are summarized below to show the corresponding rates of emission in lb./Ton of product.

Testing at the Dallas facility consisted of sampling the outlets of baghouses controlling three vermiculite exfoliation furnaces. The furnaces included in the study, were two older Model G furnaces, labeled G-1 and G-2, and one newer Model D-18 furnace. The Model G furnace testing included sampling of oil mist coming from the baghouse exhaust. The vermiculite concentrates used at the Dallas plant contained an oil used in Grace's Enoree vermiculite beneficiation mill process for separation of the vermiculite from the crude ore, and the Model G furnace design at Dallas did not completely combust the oil. The oil was combusted in the Model D-18. Results of the three exfoliation furnace tests is summarized below to show the emission rates in units of lb./Ton of product. The attached data sheets are excerpts from a more broad series of testing, which included other non-vermiculite processes at the Dallas plant, and the page numbers are not consecutive.

Grace Construction Products
Environment, Health & Safety

W.R. Grace & Co.-Conn.
62 Whittemore Avenue
Cambridge, MA 02140-1692

GRACE

FAX

Date: January 13, 1995

Number of pages including cover sheet: 2

To:

	Rick Marinshaw
Phone	**1 (919) 677-0249 x5359**
Fax Phone	**1 (919) 677-0065**
CC:	**W.J. McCaig/Enoree -**
	J. Danneker -

From:

	Jay H. Burrill
Phone	**(617) 498-4481**
Fax Phone	**(617) 498-4947**

REMARKS:

☐ Urgent ☒ For your review ☐ Reply ASAP ☐ Please comment ☐ Hard Copy to Follow

The vermiculite milling process emission factors and associated information we discussed are attached. Please note that process rates are based on dry product throughput. I also clarify that emission factors from our screening plant are based on control by cyclones.

Should you have any questions, please feel free to contact me at the Cambridge, Massachusetts address above, or by telephoning (617) 498-4481.

Jay H Burrill

Emission Factor Data - Enoree, SC Vermiculite Milling Process

SC DHEC Permit Point ID	Sample Location	Emission Lb/hr	Process Rate Ton/hr	Process Rate Basis
01	Rotary Dryer Scrubber Stack, Avg.	17.40	15.9	Dry product output[1]
02	Bagging Baghouse, Est.[2]	0.20	9.0	Dry product output
03	Screening, East Cyclone Stack, Avg.[3]	6.43	[3]	[3]
04	Screening, West Cyclone Stack, Avg.[3]	3.25	15.9	Dry product output
05	Rail Loadout, 2nd Floor, Unit #4 Cyclone Stack, Avg	1.52	60.0	" " "
06	Rail Loadout Baghouse, Est.[2]	0.20	60.0	" " "

← CONCENTRATE BAGGING

AVERAGE H2O DRY 2.5
WET 17.5

15.9 ton/hr / 1.025 = 15.51 bone dry ton/hr

(15.51)(1.175) = 18.23

PT. 05 EMISSIONS CONVEYOR TRANSFER POINT ~~FROM SCREENING TO~~

Notes:

[1]Moisture content of dryer feed = 15 - 20% by weight; dry product output from dryer = 2 - 3%

[2]No stack test data available; estimated from Dallas vermiculite exfoliation process emission data.

[3]Total throughput at the screening plant is 15.9 TPH. Emission rates for the two stacks are combined for annual emission estimates.

1. **Enoree, South Carolina Vermiculite Beneficiation Mill Particulate Emission Test Results, Conducted August, 1991**

Sample Location/Run	Emission, lb./hr.	Process, Ton/hr.	Emission, lb./Ton
Rotary Dryer Stack, Run 1	14.30	16.83	0.85
Rotary Dryer Stack, Run 2	17.43	"	1.04
Rotary Dryer Stack, Run 3	20.48	"	1.22
Rotary Dryer Stack, Avg.	17.40	16.83	1.03
East Stack, Screening, Run 4	6.27	17.12	0.37
East Stack, Screening, Run 5	5.83	"	0.34
East Stack, Screening, Run 6	7.19	"	0.42
East Stack, Screening, Avg.	6.43	17.12	0.38
West Stack, Screening, Run 7	3.06	17.12	0.18
West Stack, Screening, Run 8	2.41	"	0.14
West Stack, Screening, Run 9	4.29	"	0.25
West Stack, Screening, Avg.	3.25	17.12	0.19
Unit #4 Stack, Screening, Run 10	1.02	18.52	0.055
Unit #4 Stack, Screening, Run 11	1.45	"	0.078
Unit #4 Stack, Screening, Run 12	2.10	"	0.11
Unit #4 Stack, Screening, Avg.	1.52	18.52	0.082

DRYER

- FEED or PRODUCTION RATE?
- FUEL

SCREENS

ARE EAST & WEST STACK FROM SAME SCREEN? WITH TOTAL PRODUCTION OF 17.12 or 17.12 x 2

SCREENING OF DRIED ORE?

2. **Dallas, Texas Vermiculite Exfoliation Furnace Particulate Emission Test Results, Conducted April, 1990**

Sample Location/Repetition	Emission, lb./hr.	Process, Ton/hr.	Emission, lb./Ton
G-1 Exhaust, Rep. 1	1.328	1.21	1.10
G-1 Exhaust, Rep. 2	0.759	"	0.627
G-1 Exhaust, Rep. 3	1.160	"	0.959
G-1 Exhaust, Avg., 3 Reps.	1.082	"	0.894
G-2 Exhaust, Rep. 1	2.010	1.21	1.66
G-2 Exhaust, Rep. 2	0.472	"	0.390
G-2 Exhaust, Rep. 3	0.246	"	0.203
G-2 Exhaust, Avg., 3 Reps.	0.909	"	0.751
Model G Exhaust, Avg., 6 Reps.	0.956	1.21	0.790
D-18 Exhaust, Rep. 1	0.274	1.28	0.214
D-18 Exhaust, Rep. 2	0.362	"	0.283
D-18 Exhaust, Rep. 3	0.300	"	0.234
D-18 Exhaust, Avg., 3 Reps.	0.312	1.28	0.244

3. **Dallas, Texas Model G Vermiculite Exfoliation Furnace Oil Mist Emission Test Results, Conducted April, 1990**

Sample Location/Repetition	Emission, lb./hr.	Process, Ton/hr.	Emission, lb./Ton
G-1 Exhaust, Rep. 1	0.236	1.21	0.195
G-1 Exhaust, Rep. 2	0.235	"	0.194
G-1 Exhaust, Rep. 3	0.419	"	0.346
G-1 Exhaust, Avg., 3 Reps.	0.297	"	0.245
G-2 Exhaust, Rep. 1	0.362	1.21	0.299
G-2 Exhaust, Rep. 2	0.524	"	0.433
G-2 Exhaust, Rep. 3	0.867	"	0.717
G-2 Exhaust, Avg., 3 Reps.	0.584	"	0.483
G-2 Exhaust, Avg., 6 Reps	0.441	1.21	0.364

- G-1 & G-2 are separate furnaces with identical process rates?
- Furnace fee?
- Feed or production?

GRACE
Specialty Vermiculite

VCX™

Vermiculite Ore Concentrate

Grace VCX brand vermiculite ore concentrate consists of vermiculite which has been mined and processed at Enoree, SC to provide consistency and high purity. It is available in three product grades, each having a different particle size range.

VCX vermiculite is inorganic; it does not burn and provides excellent heat resistance. In addition, VCX is intumescent, expanding many times in volume when exposed to heat. VCX is chemically inert and exhibits definite cation exchange capabilities.

This combination of properties makes VCX an ideal insulator or flame resistant additive in coatings, plastics and a variety of construction-related and industrial materials.

VCX is used:

- as a raw material to produce exfoliated (expanded) vermiculite products which are marketed as insulation, absorbents, lightweight aggregates/fillers and as components of horticultural products;
- in fire-rated building products, where its expansion under fire conditions compensates for the water-loss of other ingredients, thereby prolonging the products structural integrity;
- in composites subjected to heat or fire, where its intumescent action provides an insulating thermal barrier.

Typical Properties of VCX Vermiculite

Physical Properties

Property	Typical Value
Color	Dark greenish brown to golden brown
Shape	Flake
Angle of Repose	27 – 45°
Solubility	Insoluble in water
Aspect Ratio	20 – 40
Surface Area (a)	0.5 – 1.0 (m^2/gm)
Mohs Hardness	1.5 – 2.0 (Nonabrasive)
Specific Gravity	2.4 – 2.8
Bulk Density	40 – 65 (lbs/ft^3) 640 – 1,041 (kg/m^3)
Refractive Index	α = 1.52 – 1.57 β, γ = 1.54 – 1.61
Moisture Content	6.5% (heated to 250°F, 110°C)
Total Ignition Loss	8.0 – 20.0% (at 2000°F, 1100°C)
pH (in water)	6 – 8
Expansion	≈10X (Volume Change)
Expansion Temperature	1100 – 1800°F (580 – 970°C)
Sintering Temperature	2100 – 2200°F (1150 – 1200°C)
Fusion Point	2200 – 2400°F (1200 – 1300°C)
Cation Exchange Capacity	50 – 100 (m. e./100g)

(a) B. E. T. values obtained by nitrogen adsorption technique

Chemical Formula

$(Mg, Ca, K, Fe^{II})_3 (Si, Al, Fe^{III})_4 O_{10} (OH)_2 \cdot 4H_2O$

Typical Chemical Analysis (b)

Element (b)	% by Weight
SiO_2	36 – 46
MgO	16 – 24
Al_2O_3	11 – 16
Fe_2O_3	8 – 13
K_2O	4 – 6
CaO	1 – 3
TiO_2	1 – 3
MnO	0.1 – 0.2
Cr_2O_3	0.05 – 0.2
Na_2O	0.1 – 0.3
Other	0.0 – 0.5

(b) Elements are expressed as oxides

Typical VCX™ Particle Size

% Weight Retained on each screen

		Vermiculite Grade		
U.S. Screens	mm	VCX 203	VCX 204	VCX 205
8	2.36	—	—	—
12	1.70	0 – 10	—	—
16	1.18	10 – 35	—	—
20	0.85	25 – 40	—	—
30	0.60	20 – 40	—	0 – 1
40	0.425	2 – 14	24 – 40	—
50	0.30	0 – 8	24 – 38	0 – 20
70	0.212	0 – 7	10 – 20	—
100	0.15	—	0 – 15	30 – 76
-100 pan	<0.15	—	—	—

Sales/Product Information

To place an order or to obtain additional information on VCX vermiculite concentrate, contact W.R. Grace & Co.-Conn., 62 Whittemore Ave., Cambridge, MA 02140 USA, or call 1-800-447-2240 (617-876-1400 in MA).

Safety, Storage & Handling

The best available information on safe handling, storage, and personal protection has been gathered on this product and is available upon request. It is recommended that all users and specifiers acquaint themselves with this information. Contact W.R. Grace & Co.-Conn. at the above location for details.

GRACE
Specialty Vermiculite

VCX-105 Printed in U.S.A. 12/92 FA/GPS/250

AGRICULTURAL VERMICULITE

GRACE
Specialty Vermiculite

Grace Agricultural Vermiculite is a highly refined mineral. It consists of fine inorganic vermiculite granules which are dry, soft and talc-like. Because of its unique properties, listed below, Agricultural Vermiculite is commonly used as a nutrient carrier, bulking agent and blending agent.

Agricultural Vermiculite offers the following benefits:

- **Highly Absorbent**

Absorbs 3-5 times its own weight in most additives;

- **Inorganic**

Free from biological contaminants such as bacteria, yeasts, molds or enzymes which could degrade quality and nutritional performance of feed;

- **Excellent Dispersant**

Contains millions of small granules which increase dispersion of feed additives;

- **Anticaking Agent**

Reduces caking action in feeds containing hydroscopic components such as urea, black strap molasses, fish solubles and choline chloride;

- **Long Shelf Life**

Chemically inert granules will not oxidize or decompose over time

- **Lightweight**

Weighs 6.5-7.0 lbs/ft^3;

- **Bulking Agent**

Allows for reduction of caloric intake in a feed mix;

- **Pelletizing Aid**

Can be effectively compressed for feed pelletizing;

- **Effective Carrier**

Excellent carrier for liquid and solid fertilizers, chemicals, plant nutrients, etc.

Typical Properties of Agricultural Vermiculite

Physical Properties

Property	Typical Value
Color	Lt. to Dk. Brown
Shape	Accordion-shaped
Moisture Content (%), heated to 110°C	0.0-0.2
pH (in water)	7.0
Cation Exchange Capacity (m.e./100 gms)	50-90

Chemical Analysis

Element	% by Weight
SiO_2	38-46
MgO	16-35
Al_2O_3	11-16
Fe_2O_3	8-13
K_2O	4-6
CaO	1-3
TiO_2	1-3
MnO	0.1-0.2
Cr_2O_3	0.05-0.2
Na_2O	0.1-0.3
Other	0.0-0.5

Chemical Formula

$(Mg,Ca,K,Fe^{II})_3\ (Si,Al,Fe^{III})_4\ O_{10}(OH)_2 \cdot 4H_2O$

Grace Agricultural Vermiculite is available in two product grades, Grade #3 and Grade #4, differentiated primarily by average particle size and bulk density.

Typical Surface Area, Bulk Density, Heavy Particles and Absorption

Property	Vermiculite Grade 3	4
Bulk Density (lbs/ft^3)	6.5	7.0
(g/ml)	0.11	0.11
Surface Area [a] (m^2/g)	8	9
Heavy Particles	5.0% max.	5.0% max.
Water Absorption—Average Volume Retained (Gal/ft^3)	4.7	5.6

Notes:
(a) Nitrogen Absorption Method

Screen Analysis of Agricultural Vermiculite—Typical Cumulative % Retained

	Aperture (in.)	0.13	0.09	0.07	0.05	0.02	0.02	0.012	0.006
	Aperture (mm)	3.36	2.38	1.68	1.19	0.59	0.42	0.30	0.15
	U.S. Mesh	6	8	12	16	30	40	50	100
Grade	Tyler Mesh	6	8	10	14	28	35	48	100
3		—	0-10	—	—	70-100	—	—	—
4		—	—	—	0-5	—	—	60-98	90-100

Sales/Product Information

To place an order or to obtain additional information on Agricultural Vermiculite, contact W.R. Grace & Co.-Conn., 62 Whittemore Ave., Cambridge, MA 02140 or call 1-800-342-2017 or 617-876-1400, Ext. 3802.

Safety, Storage & Handling

The best available information on safe handling, storage, personal protection, health and environmental considerations has been gathered on this product and is available upon request. It is recommended that all users and specifiers acquaint themselves with this information. Contact W.R. Grace & Co.-Conn. at the above location for details.

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Specialty Vermiculite

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ZONOLITE® INDUSTRIAL VERMICULITE

Grace's thermally expanded industrial grade vermiculite has a multitude of uses as a specialty raw material. Zonolite vermiculite's versatility is due to its unique combination of properties which include low bulk density, heat and fire resistance, a large surface area for superior absorbency and chemical inertness.

Zonolite vermiculite is used as an:

- **Insulating Aggregate** for
  - refractory brick & castables
  - U.L. rated doors, safes and cabinets
  - ladle insulation
  - metallurgical processing
- **General Purpose Filler** for
  - industrial composites
  - friction materials
  - lightweight concrete
- **Carrier & Bulking Agent** for
  - lightweight fertilizers
  - animal feeds
- **Absorbent** for
  - chemical packaging
  - spill clean-up
  - cushioning fragile items

Typical Properties of Zonolite® Vermiculite

Physical Properties

Property	Typical Value
Color	Lt. to Dk. Brown
Shape	Accordion-shaped
Moisture Content (%), heated to 110°C	0-2.5%
pH (in water)	7.0
Combustibility	Noncombustible
Sintering Temperature	2100-2200°F (1150-1200°C)
Fusion Point	2200-2400°F (1200-1320°C)
K Factor, 75°F (BTU-in/hr. ft²°F) 870°F (BTU-in/hr. ft²°F)	0.44 1.16
Cation Exchange Capacity (m.e./100 gms)	50-90

Chemical Analysis

Element	% by Weight
SiO_2	38-46
MgO	16-24
Al_2O_3	11-16
Fe_2O_3	8-13
K_2O	4-6
CaO	1-3
TiO_2	1-3
MnO	0.1-0.2
Cr_2O_3	0.05-0.2
Na_2O	0.1-0.3
Other	0.0-0.5

Chemical Formula

$(Mg, Ca, K, Fe^{II})_3 (Si, Al, Fe^{III})_4 O_{10} (OH)_2 \cdot 4H_2O$

Screened Analysis of Zonolite Vermiculite — Typical Cumulative Percent Retained[a]

	Aperture (in.)	0.13	0.09	0.07	0.05	0.02	0.02	.012	.006
	Aperture (mm)	3.36	2.38	1.68	1.19	0.59	0.42	0.30	0.15
	U.S. Mesh	6	8	12	16	30	40	50	100
Grade	Tyler Mesh	6	8	10	14	28	35	48	100
3		—	0-10	—	—	70-100	—	—	—
4		—	—	—	0.5	—	—	60-98	90-100
5		—	—	—	—	—	11-42	33-75	65-100

(a) Zonolite vermiculite can be produced to conform to ASTM Material Designation C-516

Zonolite® Vermiculite

Zonolite Industrial Vermiculite absorbs many liquids. It is distinguished from most common chemical carriers because of its low bulk density and high surface area. Moreover, Zonolite has a unique structure which enables absorption interstitially, or between the layers of the vermiculite particles, as well as on the surface of the particle.

Surface Area & Bulk Density

Property	Zonolite Vermiculite Grade 3	4	5
Bulk Density lbs/ft³	6.7	7.0	9.85
g/ml	0.11	0.11	0.158
Surface Area[b] m²/g	8	9	11

Note:
(b) Nitrogen Absorption Method

Typical Absorption Capabilities

	Average Volume Retained (Gal./ft³)			Absorption by Weight (%)[c]		
Zonolite Grade	3	4	5	3	4	5
Water	4.7	5.6	7.3	530	500	410
Kerosene	4.1	6.1	7.3	360	460	410
SAE40 Motor Oil	5.3	5.9	7.0	520	530	440
Light Parafin Oil	5.7	6.3	6.7	540	520	420

Note:
(c) Grams liquid/grams Zonolite x 100

Sales/Product Information

To place an order or to obtain additional information on Zonolite Industrial Vermiculite, contact W.R. Grace & Co.-Conn., 62 Whittemore Ave., Cambridge, MA 02140 or call 1-800-342-2017 X3802.

Safety, Storage & Handling

The best available information on safe handling, storage, personal protection, health and environmental considerations has been gathered on this product and is available upon request. It is recommended that all users and specifiers acquaint themselves with this information. Contact W.R. Grace & Co.-Conn. at the above location for details.

GRACE
Specialty Vermiculite

V-1A Printed in U.S.A. 12/92 FA/GPS/1M

MSDS PREPARED BY: Environmental Health Dept. Construction Products Div.
W.R.Grace & Co.-Conn.
62 Whittemore Ave.
Cambridge, MA 02140

W. R. Grace & Co. of Canada Ltd.
294 Clements Rd. West
Ajax, Ontario, L1S 3C6

Telephone Number for Information and Emergency Response
In USA: (617) 876-1400
In Canada: (416) 683-8561

MSDS Number: Z-01348 000USA Cancels MSDS # Z-01334 Date: 03/29/1993

SECTION 1 - PRODUCT IDENTIFICATION

Trade Names and Synonyms: **VCX-203,204,205,294, MOLTEN STEEL INSUL, VERM. CONC. ENOREE GRADES, VERXSPAND**

(SEE SECTION 12 FOR ADDITIONAL PRODUCT IDENTIFICATION)

Chemical Names and Family: Enoree, South Carolina Vermiculite Concentrate; Magnesium-Aluminosilicate Mineral

Product Use: Various Industrial Uses

Formula: $(Mg,Ca,K,Fe^{II})_3 (Si,Al,Fe^{III})_4 O_{10}(OH)_2 \cdot 4(H_2O)$

CAS# (Chemical Abstract Service): 01318-00-9

Transportation Hazard Classification

United States DOT		Canadian Regulations
PROPER SHIPPING NAME:	Not Applicable	TDG CLASS: Nonhazardous
HAZARD CLASS:	Nonhazardous	
IDENTIFICATION #:	Not Applicable	
LABEL(s) REQUIRED:	Not Applicable	

Surface Freight Classification: Crude Vermiculite Ore

NPCA-HMIS Hazard Index:

- o Health: 1
- o Flammability: 0
- o Reactivity: 0
- o Personal Protection: E (See Section 8)

SECTION 2 - HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

INGREDIENT (Chemical Name, CAS#, & Common Name)	% By Wt.	TOXICITY DATA LD_{50}, LC_{50} etc. (See Section IX for Exposure Limits)
Not Applicable		

SECTION 3 - PHYSICAL DATA/CHEMICAL CHARACTERISTICS

Boiling Point: Not Applicable

Specific Gravity(H_2O=1) SPECGRAV

Vapor Pressure (mm Hg.) Not Applicable

% Volatiles Not Applicable

Vapor Density(AIR = 1) Not Applicable

Evaporation Rate (Butyl Acetate = 1) Not Applicable

Solubility in Water: Negligible

pH 7.0 (In water)

Bulk Density (#/cu. ft): 40-65

Appearance and Odor: Brown to golden brown in color. Flake shaped. No odor.

Odor Threshold:
None Established

SECTION 4 - FIRE AND EXPLOSION HAZARD DATA

Flash Point: None

Method Used: Not Applicable

Flammable Limits:
LEL NA UEL NA

N.F.P.A. Rating: Not Applicable

Extinguishing Med
Not Applicable

Special Fire Fighting Procedures
None

Unusual Fire and Explosion Hazards
None

SECTION 5 - REACTIVITY DATA

Stable under normal conditions (yes or no): YES

Conditions or Materials to avoid (which may react or cause instability):
None Known

Hazardous Decomposition or Byproducts:
None Known

Hazardous Polymerization:
Will not occur

Conditions to Avoid:
None Known

SECTION 6 - HEALTH HAZARD DATA & TOXICOLOGICAL PROPERTIES

Routes of Exposure:

Inhalation:
Dust that may be released in handling may cause symptoms typical of nuisance dusts, including coughing, sneezing, and minor upper respiratory irritation.

Skin and Eye:
Direct eye contact may cause minor physical or mechanical irritation. Skin contact not expected to cause any harmful effects.

Ingestion:
Not considered harmful by ingestion.

Carcinogenicity According to NTP, IARC and OSHA:
Not a carcinogen as provided to our customer. (See Section 8 for information regarding Tremolite and Quartz.)

SECTION 7 - EMERGENCY AND FIRST AID PROCEDURES

EYE:	In case of eye contact, do not rub eyes. Flush with plenty of water while holding eyelids apart. If irritation, blinking or tearing occur and persist, consult a physician.
INGESTION:	Adverse health effects are not expected if swallowed. Consult a physician if symptoms develop.
INHALATION:	If inhaled, get fresh air. If symptoms persist, consult a physician.

SECTION 8 - PREVENTIVE & CONTROL MEASURES

Warning Statements:
CAUTION! MAY CAUSE SLIGHT IRRITATION.

... Product contains Vermiculite CAS# 1318-00-9 and other associated minerals, including Quartz CAS# 14808-60-7. (See information in in Work/Hygienic Practices Section of MSDS for additional information.)
... Eye contact may cause minor physical irritation.
... Inhalation of dust may cause upper respiratory irritation with coughing and sneezing.

Precautionary Measures:
... Avoid contact with eyes.
... Avoid creating dust.
... Equip hoppers with dust covers where applicable.
... Provide adequate ventilation and respiratory protection if necessary.

Respiratory Protection:
A NIOSH Type TC-21C-XXX dust respirator may be desirable if dust is created in handling and is required at or above the Permissible Exposure Limit (PEL) for Nuisance Particulates. Consult MSDS Section 9 for exposure limits.

Ventilation:

Local Exhaust:	Not generally required, but should be used where available.
Mechanical:	Not generally required, but should be used where available.
Special:	None
Other:	None

SECTION 8 - PREVENTIVE & CONTROL MEASURES CONTINUED

Skin Protection:
Not generally required.

Eye Protection:
Goggles recommended.

Other Protective Clothing or Equipment:
Normal work clothes.

Work/Hygienic Practices:

SUPPLEMENTAL INFORMATION
Vermiculite Concentrate

Vermiculite: Vermiculite is processed from ore produced at the Kearney Mine & Mill in Enoree, S.C. The natural geologic formation in South Carolina contains other mineral components in addition to vermiculite. One of these is tremolite, predominantly in a non-fibrous form. It is important to note, that tremolite occurs naturally in two forms: Fibrous (asbestiform) and Massive (non-fibrous, non-asbestiform).

OSHA includes fibrous tremolite in its definition of asbestos and the Permissible Exposure Limits (PEL) established by OSHA apply only to airborne (asbestiform) fibers. In June of 1992 OSHA revised its asbestos standard to exclude non-asbestiform tremolite, concluding that there is insufficient evidence to support regulating non-asbestiform tremolite as a significant health risk.

It has been our experience that air samples taken while handling South Carolina Vermiculite Concentrate show airborne dusts to be essentially non-asbestiform. These samples further show that any fiber determination is below the limits of statistically reliable quantification based on the analytical method used.

Quartz: Section 8 of this MSDS indicates that this product can contain quartz (Crystalline Silica). Quartz is a naturally occurring mineral that is commonly contained in materials that are mined from the earth's surface such as sand, limestone, clay and gypsum. Quartz is represented by the combined fractions of non-respirable sized particles and of respirable sized particles (less than ten microns in aerodynamic diameter).

Respirable sized quartz has been tied to more serious health effects (silicosis and lung cancer). Grace has not been able to detect any respirable sized quartz in Vermiculite Concentrates based on industrial hygiene sampling of workers at Grace production facilities. We believe the highest potential for exposure exists at our production facilities due to the high volume of product produced and handled. In addition a wet sieving analysis combined with x-ray diffraction analysis has been conducted on Vermiculite Concentrates. Results indicate that respirable quartz is not present above the 0.1% by weight

limit established by the Occupational Safety and Health Administration (OSHA) for carcinogens.

Nonetheless, it may be possible to reduce particle size during aggressive processing at which time the more severe health effects associated with exposure to Respirable sized quartz may become a concern. 0272f

SECTION 9 - HAZARDOUS INGREDIENTS EXPOSURE LIMITS - U.S. Only

INGREDIENT:	Exposure Limits OSHA	ACGIH	OTHER
RESPIRABLE DUST* CAS# NA	PEL/TWA: 5 mg/m ^{3}	----	----
TOTAL DUST* CAS# NA	PEL/TWA: 15 mg/m^3	TLV/TWA: 10 mg/m^3	None Established

SECTION 10 - SPILL & DISPOSAL INFORMATION - U.S. Only

Observing the above precautions, sweep up or shovel spilled material and place in suitable containers for recycle or disposal. Dampen with water spray or use methods to clean spill which avoid creating dust. Discard empty packaging promptly. Avoid excessive handling of empty packaging, which may result in unnecessary release of airborne particles.

According to EPA (40 CFR 261.3) waste of this product is not defined as hazardous. Dispose of all waste in accordance with federal, state, and local regulations.

SECTION 11 - GOVERNMENT REPORTING INFORMATION - U. S. Only

SARA Title III Reporting Information
Tier I & II Hazard Categories: NOT APPLICABLE

Contains Extremely Hazardous-SARA III Section 302 Ingredient: NO
Comments:

Contains Toxic Chemical Release-SARA III Section 313 Ingredient: NO
Comments:

Other Government Reporting Requirements:

Not Applicable

Non-Hazardous Ingredient Disclosure:
Not Applicable

SECTION 12 - PRODUCT IDENTIFICATION/TRADENAME ADDENDUM

The information contained in this Material Safety Data Sheet is applicable to the following products:
VCX-203, VCX-204, VCX-205, Molten Steel Insulation,
VCX, Vermiculite Concentrate Enoree Grade, VERXSPAND

MSDS PREPARED BY: Environmental Health Dept. Construction Products Div.
W.R.Grace & Co.-Conn.
62 Whittemore Ave.
Cambridge, MA 02140
W. R. Grace & Co. of Canada Ltd.
294 Clements Rd. West
Ajax, Ontario, L1S 3C6
Telephone Number for Information and Emergency Response
In USA: (617) 876-1400
In Canada: (416) 683-8561

MSDS Number: Z-01320 000USA Cancels MSDS # H-88130 Date: 03/16/1992

SECTION 1 - PRODUCT IDENTIFICATION

Trade Names and Synonyms: AGRICULTURAL VERMICULITE, TERRA-LITE® VERMICULITE, HORTICULTURAL VERMICULITE

(SEE SECTION 12 FOR ADDITIONAL PRODUCT IDENTIFICATION)

Chemical Names and Family: Expanded Vermiculite (Enoree, South Carolina Source) Magnesium-Aluminosilicate Mineral

Product Use: Insulating, Absorbing and Cushioning Material

Formula: $(Mg,CA,K,Fe^{II})_3(Si,Al,Fe^{III})_4O_{10}(OH)_2.H_2O$

CAS# (Chemical Abstract Service): 01318-00-9

Transportation Hazard Classification

United States DOT

PROPER SHIPPING NAME: Not Applicable
HAZARD CLASS: Nonhazardous
IDENTIFICATION #: Not Applicable
LABEL(s) REQUIRED: Not Applicable

Canadian Regulations

TDG CLASS: Nonhazardous

Surface Freight Classification: Vermiculite, Other than crude

NPCA-HMIS Hazard Index:

- Health: 1
- Flammability: 0
- Reactivity: 0
- Personal Protection: E (See Section VIII)

SECTION 2 - HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

INGREDIENT (Chemical Name, CAS#, & Common Name)	% By Wt.	TOXICITY DATA LD_{50}, LC_{50} etc. (See Section IX for Exposure Limits)
Not Applicable		

SECTION 3 - PHYSICAL DATA/CHEMICAL CHARACTERISTICS

Boiling Point: Not Applicable

Specific Gravity (H2O = 1) Not Applicable

Vapor Pressure (mm Hg.) Not Applicable

% Volatiles Not Applicable

Vapor Density(AIR = 1) Not Applicable

Evaporation Rate (Butyl Acetate = 1) Not Applicable

Solubility in Water: Negligible

pH Not Applicable

Bulk Density (#/cu. ft): 4-10 PCF

Appearance and Odor: Brown or gray free flowing aggregate with slight earthy odor.

Odor Threshold:
None Determined

SECTION 4 - FIRE AND EXPLOSION HAZARD DATA

Flash Point: None

Method Used: Not Applicable

Flammable Limits:
LEL NA UEL NA

N.F.P.A. Rating: Not Applicable

Extinguishing Media

Not Applicable

Special Fire Fighting Procedures

None

Unusual Fire and Explosion Hazards

None

SECTION 5 - REACTIVITY DATA

Stable under normal conditions (yes or no): YES

Conditions or Materials to avoid (which may react or cause instability):

None Known

Hazardous Decomposition or Byproducts:

None Known

Hazardous Polymerization:

Will not occur

Conditions to Avoid:

None Known

SECTION 6 - HEALTH HAZARD DATA & TOXICOLOGICAL PROPERTIES

(Include all known acute and chronic effects, signs, and symptoms of exposure and medical conditions generally aggravated by exposure)

Routes of Exposure:

Inhalation:
Dust that may be released in handling may cause symptoms typical of nuisance dusts, including coughing, sneezing and minor upper respiratory irritation.

Skin and Eye:
Direct eye contact may cause minor physical or mechanical irritation. Skin contact is not expected to cause any harmful effects.

Ingestion:
Not considered harmful by ingestion.

Carcinogenicity According to NTP, IARC and OSHA:
Not Applicable (See Section 8 for information regarding Quartz).

SECTION 7 - EMERGENCY AND FIRST AID PROCEDURES

EYE:	In case of eye contact, do not rub eyes. Flush with plenty of water while holding eyelids apart. If irritation, blinking or tearing occur and persist, consult a physician.
SWALLOWED:	Adverse health effects are not expected if swallowed. Consult a physician if symptoms develop.
INHALATION:	If inhaled, get fresh air. If symptoms persist, consult a physician.

SECTION 8 - PREVENTIVE & CONTROL MEASURES

Warning Statements:
CAUTION! MAY CAUSE SLIGHT IRRITATION.
... Product contains Vermiculite (CAS# 1318-00-9) and other associated minerals, including Quartz CAS# 14808-60-7. (See information in Work/Hygienic Practices Section of MSDS for additional information)
... Eye contact may cause minor physician irritation.
... Inhalation of dust may cause upper respiratory irritation with coughing and sneezing.

Precautionary Measures:
... Avoid contact with eyes.
... Avoid creating dust.
... Equip hoppers with dust covers where applicable.
... Provide adequate ventilation and respiratory protection if necessary.

Respiratory Protection:
A NIOSH (Type TC-21C-XXX) dust respirator may be desirable if dust is created in handling and is required at or above the Permissible Exposure Limit (PEL) for Nuisance Particulates. Consult MSDS Section 9 for exposure limits.

Ventilation:

Local Exhaust:	Not generally required, but should be used where applicable.
Mechanical:	Not generally required, but should be used where applicable.
Special:	None
Other:	None

Skin Protection:
Not generally required.

Eye Protection:
Goggles recommended.

Other Protective Clothing or Equipment:
Normal work clothes.

SECTION 8 - PREVENTIVE & CONTROL MEASURES CONTINUED

Work/Hygienic Practices:

Observe precautions noted above.

Section 8 of this MSDS indicates that this product can contain quartz (Crystalline Silica). Quartz is a naturally occurring mineral that is commonly contained in materials that are mined from the earth's surface such as sand, limestone, clay and gypsum. Quartz is represented by the combined fractions of non-respirable sized particles and of respirable sized particles (less than ten microns in aerodynamic diameter).

Respirable sized quartz has been tied to more serious health effects (silicosis and lung cancer). Grace has not been able to detect any respirable sized quartz in Industrial Vermiculite based on industrial hygiene sampling of workers at Grace production facilities. We believe the highest potential for exposure exists at our production facilities due to the high volume of product produced and handled.

In addition a wet sieving analysis combined with x-ray diffractometry has been conducted on Industrial Vermiculite. Results indicate that respirable quartz is not present above the 0.1% by weight limit established by the Occupational Safety and Health Administration (OSHA) for carcinogens. OSHA states that if the hazardous substance is contained in the product below 0.1% by weight and if exposures do not exceed permissible exposure limits then the hazards do not apply.

Results of monitoring and analysis are available upon request.
1290f

SECTION 9 - HAZARDOUS INGREDIENTS EXPOSURE LIMITS - U.S. Only

INGREDIENT:	Exposure Limits OSHA	ACGIH	OTHER
RESPIRABLE DUST* CAS# NA	PEL/TWA: 5 mg/m ^{3}	—	—
TOTAL DUST* CAS# NA	PEL/TWA: 15 mg/m^3	TLV/TWA: 10 mg/m^3	None Established

SECTION 10 - SPILL & DISPOSAL INFORMATION - U.S. Only

Observing the above precautions, sweep up or shovel spilled material and place in suitable containers for recycle or disposal. Dampen with water spray or use other methods to clean spill which avoid creating dust. Discard empty packaging promptly. Avoid excessive handling of empty packaging, which may result in unnecessary release of airborne particulates.

According to EPA (40 CFR 261.3) waste of this product is not defined as hazardous. Dispose of all waste in accordance with federal, state and local regulations.

MSDS PREPARED BY: Environmental Health Dept. Construction Products Div.
W.R.Grace & Co.-Conn.
62 Whittemore Ave.
Cambridge, MA 02140

W. R. Grace & Co. of Canada Ltd.
294 Clements Rd. West
Ajax, Ontario, L1S 3C6

Telephone Number for Information and Emergency Response
In USA: (617) 876-1400
In Canada: (416) 683-8561

MSDS Number: Z-01344 000USA Cancels MSDS # Z-01311 Date: 03/17/1993

SECTION 1 - PRODUCT IDENTIFICATION

Trade Names and Synonyms: (SEE SECTION 12 FOR ADDITIONAL PRODUCT IDENTIFICATION)
ZONOLITE® INDUSTRIAL VERMICULITE

Chemical Names and Family: Expanded Vermiculite (Enoree, South Carolina Source): Magnesium-Aluminosilicate Mineral.

Product Use: Insulating, Absorbing and Cushioning Material

Formula: $(Mg,Ca,K,Fe^{II})_3(Si,Al,Fe^{III})_4O_{10}(OH)_2.H_2O$

CAS# (Chemical Abstract Service): 01318-00-9

Transportation Hazard Classification

United States DOT		Canadian Regulations
PROPER SHIPPING NAME:	Not Applicable	TDG CLASS: Nonhazardous
HAZARD CLASS:	Nonhazardous	
IDENTIFICATION #:	Not Applicable	
LABEL(s) REQUIRED:	Not Applicable	

Surface Freight Classification: Vermiculite, Other Than Crude

NPCA-HMIS Hazard Index:
- o Health: 1
- o Flammability: 0
- o Reactivity: 0
- o Personal Protection: E (See Section 8)

SECTION 2 - HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

INGREDIENT (Chemical Name, CAS#, & Common Name)	% By Wt.	TOXICITY DATA LD_{50}, LC_{50} etc. (See Section 9 for Exposure Limits)
Not Applicable		

SECTION 3 - PHYSICAL DATA/CHEMICAL CHARACTERISTICS

Boiling Point: Not Applicable

Specific Gravity(H_2O=1) SPECGRAV

Vapor Pressure (mm Hg.) None

% Volatiles Not Applicable

Vapor Density(AIR = 1) None

Evaporation Rate (Butyl Acetate = 1) Not Applicable

Solubility in Water: Negligible

pH Not Applicable

Bulk Density (#/cu. ft): 4-10 PCF

Appearance and Odor: Brown or gray free-flowing aggregate. Earthy odor.

Odor Threshold:
None Established

SECTION 4 - FIRE AND EXPLOSION HAZARD DATA

Flash Point: None

Method Used: Not Applicable

Flammable Limits:
LEL NA UEL NA

N.F.P.A. Rating: Not Applicable

Extinguishing Med

Not Applicable

Special Fire Fighting Procedures

None

Unusual Fire and Explosion Hazards

None

SECTION 5 - REACTIVITY DATA

Stable under normal conditions (yes or no): YES

Conditions or Materials to avoid (which may react or cause instability):

None Known

Hazardous Decomposition or Byproducts:

None Known

Hazardous Polymerization:

Will not occur

Conditions to Avoid:

None Known

SECTION 6 - HEALTH HAZARD DATA & TOXICOLOGICAL PROPERTIES

Routes of Exposure:

Inhalation:
Dust that may be released in handling may cause symptoms typical of nuisance dusts, including coughing, sneezing, and minor upper respiratory irritation.

Skin and Eye:
Direct eye contact may cause minor physical or mechanical irritation. Skin contact not expected to cause any harmful effects.

Ingestion:
Not considered harmful by ingestion.

Carcinogenicity According to NTP, IARC and OSHA:
Not Applicable (See Section 8 for information regarding Quartz.)

SECTION 7 - EMERGENCY AND FIRST AID PROCEDURES

In case of EYE contact, do not rub eyes. Flush with plenty of water while holding eyelids apart. If irritation, blinking or tearing occur and persist, consult a physician.

Adverse health effects are not expected if SWALLOWED. Consult a physician if symptoms develop.

If INHALED, get fresh air. If symptoms persist, consult a physician.

SECTION 8 - PREVENTIVE & CONTROL MEASURES

Warning Statements:
CAUTION! MAY CAUSE SLIGHT IRRITATION.

... Product contains Vermiculite CAS# 1318-00-9 and other associated minerals, including Quartz CAS# 14808-60-7. (See information in Work/Hygienic Practices Section of MSDS for additional information.)
... Eye contact may cause minor physical irritation.
... Inhalation of dust may cause upper respiratory irritation with coughing and sneezing.

Precautionary Measures:
... Avoid contact with eyes.
... Avoid creating dust.
... Equip hoppers with dust covers where applicable.
... Provide adequate ventilation and respiratory protection if necessary.

Respiratory Protection:
A NIOSH Type TC-21C-XXX dust respirator may be desirable if dust is created in handling and is required at or above the Permissible Exposure Limit (PEL) for Nuisance Particulates. Consult MSDS Section 9 for exposure limits.

Ventilation:

Local Exhaust:	Not generally required, but should be used where available.
Mechanical:	Not generally required, but should be used where available.
Special:	None
Other:	None

SECTION 8 - PREVENTIVE & CONTROL MEASURES CONTINUED

Skin Protection:
Not generally required.

Eye Protection:
Goggles recommended.

Other Protective Clothing or Equipment:
Normal work clothes.

Work/Hygienic Practices:

Observe precautions noted above.

Section 8 of this MSDS indicates that this product can contain quartz (Crystalline Silica). Quartz is a naturally occurring mineral that is commonly contained in materials that are mined from the earth's surface such as sand, limestone, clay and gypsum. Quartz is represented by the combined fractions of non-respirable sized particles and of respirable sized particles (less than ten microns in aerodynamic diameter).

Respirable sized quartz has been tied to more serious health effects (silicosis and lung cancer). Grace has not been able to detect any respirable sized quartz in Industrial Vermiculite based on industrial hygiene sampling of workers at Grace production facilities. We believe the highest potential for exposure exists at our production facilities due to the high volume of product produced and handled.

In addition a wet sieving analysis combined with x-ray diffractometry has been conducted on Industrial Vermiculite. Results indicate that respirable quartz is not present above the 0.1% by weight limit established by the Occupational Safety and Health Administration (OSHA) for carcinogens. OSHA states that if the hazardous substance is contained in the product below 0.1% by weight and if exposures do not exceed permissible exposure limits then the hazards do not apply.

Results of monitoring and analysis are available upon request.

1257f

SECTION 9 - HAZARDOUS INGREDIENTS EXPOSURE LIMITS - U.S. Only

INGREDIENT:	Exposure Limits OSHA	ACGIH	OTHER
RESPIRABLE DUST* CAS# NA	PEL/TWA: 5 mg/m ^{3}	----	----
TOTAL DUST* CAS# NA	PEL/TWA: 15 mg/m^3	TLV/TWA: 10 mg/m^3	None Established

SECTION 10 - SPILL & DISPOSAL INFORMATION - U.S. Only

Observing the above precautions, sweep up or shovel spilled material and place in suitable containers for recycle or disposal. Dampen with water spray or use other methods to clean spill which avoid creating dust. Discard empty packaging promptly. Avoid excessive handling of empty packaging, which may result in unnecessary release of airborne particulates.

According to EPA (40 CFR 261.3) waste of this product is not defined as hazardous. Dispose of all waste in accordance with federal, state, and local regulations.

SECTION 11 - GOVERNMENT REPORTING INFORMATION - U. S. Only

SARA Title III Reporting Information
Tier I & II Hazard Categories: NOT APPLICABLE

Contains Extremely Hazardous-SARA III Section 302 Ingredient: NO
Comments:

Contains Toxic Chemical Release-SARA III Section 313 Ingredient: NO
Comments:

Other Government Reporting Requirements:

Not Applicable

Non-Hazardous Ingredient Disclosure:
None

SECTION 12 - PRODUCT IDENTIFICATION/TRADENAME ADDENDUM

The information contained in this Material Safety Data Sheet is applicable to the following products:
Zonolite® Industrial Vermiculite, Industrial Vermiculite

"THE DATA INCLUDED HEREIN ARE PRESENTED ACCORDING TO W. R. GRACE & CO.-CONN's PRACTICES CURRENT AT THE TIME OF PREPARATION HEREOF, ARE MADE AVAILABLE SOLELY FOR THE CONSIDERATION, INVESTIGATION AND VERIFICATION OF THE ORIGINAL RECIPIENTS HEREOF AND DO NOT CONSTITUTE A REPRESENTATION OR WARRANTY FOR WHICH GRACE ASSUMES LEGAL RESPONSIBILITY. IT IS THE RESPONSIBILITY OF A RECIPIENT OF THIS DATA TO REMAIN CURRENTLY INFORMED ON CHEMICAL HAZARD INFORMATION, TO DESIGN AND UPDATE ITS OWN PROGRAM AND TO COMPLY WITH ALL NATIONAL, FEDERAL, STATE AND LOCAL LAWS AND REGULATIONS APPLICABLE TO SAFETY, OCCUPATIONAL HEALTH, RIGHT-TO-KNOW AND ENVIRONMENTAL PROTECTION."

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
P. O. Box 8468
Harrisburg, PA 17105-8468

September 1, 1994

Bureau of Air Quality Control 717-772-4978

Mr. Ronald E. Myers
Emission Factors and Methodologies Section
Emission Inventory Branch
Office of Air Quality Planning and Standards
U.S. Environmental Protection Agency
Research Triangle Park, NC 27711

Dear Mr. Myers:

We received your request for comments on the draft Section 11.28, Vermiculite Processing. No vermiculite processing or exfoliating operations are found in Pennsylvania. Therefore, we have no information to help in your development of emission factors.

Thank you for the opportunity to submit input and comments in your updating efforts.

Sincerely,

James M. Salvaggio
Director
Bureau of Air Quality Control

Source category: Vermiculite
Plant name : W.R. Grace & Co.
Test date : 8/27-29/91
Process : Drying/classification
FILENAME: VERM_R13.WQ1

Date: 01/16/95
Location: Enoree, SC
Ref. No.: 13/11
Process rate basis: feed/production

Source	Type of control	Pollutant	Run No.	Emission rate, lb/hr	Process rate, ton/hr	Emission factor kg/Mg	Emission factor lb/ton	Volumetric flow rate, DSCFM	Concen. gr/DSC
Rotary dryer	wet scrubber	BASED ON PRODUCTION RATE							
		filt. PM	1	14.30	15.9	0.45	0.90		
		filt. PM	2	17.43	15.9	0.55	1.1		
		filt. PM	3	20.48	15.9	0.64	1.3		
		AVERAGE				0.55	1.1	RATING:	B
		BASED ON FEED RATE (a)							
		filt. PM	1	14.30	18.23	0.39	0.78		
		filt. PM	2	17.43	18.23	0.48	0.96		
		filt. PM	3	20.48	18.23	0.56	1.1		
		AVERAGE				0.48	0.95	RATING:	B
Screening (East stack)	cyclone	filt. PM	1	6.27					
		filt. PM	2	5.83					
		filt. PM	3	7.19					
				6.43					
(West stack)		filt. PM	1	3.06					
		filt. PM	2	2.41					
		filt. PM	3	4.29					
				3.25					
		TOTAL FOR SCREENING OPERATION							
		filt. PM	1	9.33	15.90	0.29	0.59		
		filt. PM	2	8.24	15.90	0.26	0.52		
		filt. PM	3	11.48	15.90	0.36	0.72		
						0.30	0.61	RATING:	B
Dry concentrate loading		filt. PM	1	1.02	60.00	0.0085	0.017		
		filt. PM	2	1.45	60.00	0.012	0.024		
		filt. PM	3	2.10	60.00	0.018	0.035		
						0.013	0.025	RATING:	B

Notes:
1. Factors downrated to B because of lack of detail on process rates, description.
2. Dryer feed rates based on production rate of 15.0 ton/hr and moisture contents of 17.5% (in) and 2.5% (out):15.9/1.025*1.175 = 18.23.