

The Full Cost of Abrasive Blast Cleaning

Bengal Bay Garnet is an efficient and *cost effective* substitute for silica sand and mineral slag in most blast cleaning operations. The high specific gravity and tough, durable grains allow reduced material usage and minimum dust levels. Many users recycle the hard almandine garnet grain **up to eight times** for added benefit.

The cost of abrasive blast cleaning is the sum of the material, labor and equipment costs incurred to complete the project. Other cost items such as the cost of containment, environmental monitoring, cleanup and disposal should also be added to the direct costs to obtain the total cost.

The following formula can be used to calculate the total cost:

$$\text{Full Cost} = \frac{\text{abrasive} + \text{labor} + \text{equipment} + \text{other costs}}{\text{productivity}}$$

$$= \frac{A \times (B + E) + C + D + \text{other costs}}{X} = \text{Full costs in } \$/\text{m}^2$$

- A = rate of usage (MT/hr)
- B = cost of abrasive (\$/MT)
- C = labor cost (\$/hr)
- D = equipment cost (\$/hr)
- E = disposal cost (\$/MT)
- X = productivity (m²/hr)

“other costs” can be calculated and added as desired.

There are numerous examples to show that use of the lowest “cost” blasting material does not always yield the *lowest total cost*. Similarly, there are numerous examples to show that **indirect blasting costs** associated with environmental compliance often far exceed more familiar direct charges.

Equally important, the **full cost** of blasting can be shown to depend more on productivity than on the initial cost of the materials used. Consider the following example:

	Coal Slag	Almandine Garnet
Abrasive cost \$/MT	\$ 51.00	\$280.00
Usage rate per nozzle MT/hr	0.65	0.30
Fully burdened labor cost \$/hr	\$ 57.00	\$ 57.00
Equipment expense \$/hr	\$ 45.00	\$ 45.00
Disposal of used abrasives \$/MT	\$172.00	\$172.00
Measured productivity m ² /hr	m ² 15	m ² 20
Full direct cost \$/m²	US\$ 16.46	US\$ 11.88

In addition, the facility owner enjoyed significant savings associated with reduction in the total amount of abrasive used for the project. The almandine garnet used on the project was found to be relatively undamaged, and about 85% of the material was suitable for collection and reuse.

Environmental Analysis

Consumers of most industrial products are responsible under civil and criminal codes — both state and federal — for the safe handling and disposal of waste streams. The financial penalties for noncompliance can be substantial. Multiple violations often carry *criminal penalties* and prison terms.

The laws regulating hazardous waste vary from state to state, and most problems commonly arise as a result of *contamination* during use. Abrasive blast and filtration media may contribute metallic ions that could increase the financial risk and potential liability to the user.

In the United States, the **Toxicity Characteristic Leaching Procedure** (the TCLP test) defines whether a waste stream is to be classified as a “hazardous” material requiring special handling.

Bengal Bay Garnet products contain no heavy metals that would expose the user to undue environmental or industrial hygiene risk. The table below shows the results of the TCLP test on a reference production sample of Bengal Bay Garnet material.

Copies of the laboratory report are available upon request.

Report of Analysis Toxicity Characteristic Leaching Procedure

Element	TCLP Limit <u>mg/l</u>	Actual <u>mg/l</u>
arsenic	5.0	< 0.1
barium	100	< 2.0
cadmium	1.0	< 0.02
chromium	5.0	< 0.05
lead	5.0	< 0.5
mercury	0.2	< 0.001
selenium	1.0	< 0.10
silver	5.0	< 0.05

Technical Data and Physical Characteristics

Garnet type: WGI Heavy Minerals Incorporated produces almandine variety garnet at its mine in southeastern India.

General description: Almandine garnet is a chemically inert nonmetallic mineral that is quite common in the natural environment. It is found in trace amounts in most river and beach sands and is known for its hardness and durability. The high levels of hardness and toughness make almandine garnet ideal for many abrasive applications. Its high specific gravity as well as its chemical and abrasive resistance make almandine garnet ideal for filtration. Almandine garnet is also a popular semi-precious gem and is the birthstone for January.

Packaging options: Packaging is available to customers specifications. Standard packaging includes 25 kg and 1 metric ton bags.

Grain shape: Blocky, sub-angular to sub-rounded grains (uncrushed)

Certifications and approvals: California Air Resource Board, MIL-A-22262B(SH) and QPL-22262.

Water solubility: Insoluble under standard conditions. (20°C, distilled water)

Hardness: 7.5 - 8.0 per Moh's scale

Specific gravity: 4.0 - 4.1

Acid solubility: < 1%

Melting point: 1,315°C

Chloride content: < 25 PPM

Free silica content: < 0.5%

Available sizes: #8/12 - #120 mesh (U.S. standard screen)

Color: Deep red, reddish brown

Typical chemical analysis (copies available upon request):

silicon dioxide	(SiO ₂)	35%	(non-crystalline)
ferric oxide	(Fe ₂ O ₃)	33%	
aluminum oxide	(Al ₂ O ₃)	23%	
magnesium oxide	(MgO)	7%	
calcium oxide	(CaO)	1%	
manganese oxide	(MnO)	1%	

Material Safety Data Sheet

(complies with 29 CFR 1910.1200)

IDENTITY (as used on label and list)

Bengal Bay Garnet® Abrasive Grains and Powders, Kerf-Jet®, Eco-Jet

SECTION I – Company Identification

Manufacturer

Transworld Garnet India Pvt. Ltd., Tuticorin, India

Supplier (Street, City, State, Zip Code)

WGI Heavy Minerals Incorporated
810 Sherman Avenue, Coeur d'Alene, ID 83814

Emergency Telephone Number

(208) 666-6000

Product Information

(208) 666-6000
W.W. Meyerholtz August 2012

SECTION II – Chemical Identity and Information on Ingredients

Chemical Identity

Bengal Bay®, Kerf-Jet®, and Eco-Jet garnet are a natural mixture of predominantly

ALMANDINE GARNET $\text{Fe}_3\text{Al}_2(\text{SiO}_4)_3$ (CAS No.: 1302-62-1)

which is a non-hazardous substance, along with trace quantities of other minerals, including pyrope garnet, ilmenite and quartz (crystalline silica). Crystalline silica, when broken down to respirable size and inhaled may cause silicosis and cancer.

SECTION III – Physical and Chemical Characteristics

Melting Point

Circa 1315°C

Specific Gravity ($\text{H}_2\text{O} = 1.0$)

4.0 – 4.1

Solubility in Water

Insoluble

Appearance and Odor

Deep red, pink, reddish brown; no odor

SECTION IV – Fire and Explosion Hazard Data

Flash Point (method used)

Non-flammable solid. Non-explosive.

Flammable Limits

not applicable (na)

LEL

na

UEL

na

Extinguishing Media

Use extinguishing media appropriate for the surrounding fire.

Special Fire Fighting Procedures:

None. Address surrounding fire.

Unusual Fire and Explosion Hazards:

None.

SECTION V – Reactivity Data

Stability () Unstable (x) Stable - INERT

Hazardous Decomposition or Byproducts: None known

Hazardous Polymerization () May Occur (x) Will Not Occur

Incompatibility (materials to avoid): None known

Conditions to Avoid: None known. Almandine Garnet is an inert, stable solid needing no special handling in normal use.

SECTION VI -- Health Hazard Data

Route(s) of Entry:

Inhalation
Possible

Skin
None

Ingestion
None

Health Hazards (acute and chronic due to overexposure):

Inhalation: Dust may cause irritation of nasal and respiratory tract or coughing.

Eyes: Dust may cause irritation.

Skin: May cause abrasions. Dust may cause irritation.

Ingestion: No known effects, however ingestion not recommended.

SECTION VI – Health Hazard Data (continued)

Hazardous Ingredients: The product as supplied contains trace amounts of crystalline silica (quartz) which can break down in use to respirable size. Crystalline silica dust of respirable size is listed as a carcinogenic substance that may cause silicosis and cancer when inhaled. Exposure to crystalline silica dust along with other dust is regulated by OSHA and ACGIH limits:

Substance (as shipped)	WT. %	OSHA/ACGIH LIMIT IN USE*	
Nuisance Dust	n/a	Total Dust -	15 mg/m ³
		Respirable Dust -	5 mg/m ³
Crystalline Silica	<1.0%	Respirable Dust -	0.10 mg/m ³

*If these levels are exceeded, adequate respiratory protection must be employed.

Medical Conditions Generally Aggravated by Exposure: Chronic bronchitis, emphysema and other lung diseases may be aggravated by exposure to nuisance dust.

Emergency and First Aid Procedures:

Eye Contact: Wash eyes with water to flush out dust particles.

Skin Contact: Wash affected area with soap and water.

Inhalation: Remove from dust and move to fresh air. Obtain medical assistance, if required.

Ingestion: Obtain medical assistance, if needed.

Radioactivity: This product contains very low levels of naturally occurring radioactive elements of the uranium and thorium series, as do many mineral products. Primary exposure potential is internal via inhaled dust. This material is exempt from NRC regulations for source material per 10 CFR 40 since it is below 0.05% uranium/thorium by weight.

SECTION VII – Precautions for Safe Handling and Use -----

If Material is Released or Spilled:

NO SPECIAL PRECAUTIONS ARE NECESSARY. Sweep or vacuum material for disposal or recovery.

Prevent generation of dust during clean up.

Waste Disposal Methods:

Follow local, state and federal guidelines for disposal of inert solid waste.

MATERIAL CONTAMINATED IN USE MAY REQUIRE SPECIAL HANDLING.

Precautions in Handling and Storage:

None --- Use good housekeeping practices to reduce dust; use approved hand, eye and respiratory protection if required during handling and use of the material.

Other Precautions:

Use material only for the purposes intended and incorporate methods of dust control to maintain airborne dust within federal or local TLV limits.

SECTION VIII – Control Measures -----

Respiratory Protection: Use NIOSH/MSHA approved filters, respirators or masks if required and air supplied hoods for blasters.

Ventilation: Provide adequate ventilation using general mechanical and/or local exhaust systems to meet TLV limits for dust exposure.

Protection Gloves: Leather, or equivalent, if needed.

Eye Protection: Approved safety glasses with side shields are recommended.

Other Protective Clothing or Equipment: Hearing protection when working near blast cleaning operations.

Work/Hygienic Practices: Maintain a clean and safe work environment and monitor work practices.

SECTION IX – Special Precautions and Comments

The information provided is believed to be accurate and represents the best information currently available to WGI. However, WGI makes no warranty of merchantability or other warranties, express or implied, with respect to such information and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes