



## 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 (m<sup>2</sup>/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:

	<u>Coal Slag</u>	<u>Almandine Garnet</u>
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 <sup>2</sup> /hr	m <sup>2</sup> 15	m <sup>2</sup> 20
<b>Full direct cost \$/m<sup>2</sup></b>	<b>US\$ 16.46</b>	<b>US\$ 11.88</b>

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 <sub>2</sub> )	35%	(non-crystalline)
ferric oxide	(Fe <sub>2</sub> O <sub>3</sub> )	33%	
aluminum oxide	(Al <sub>2</sub> O <sub>3</sub> )	23%	
magnesium oxide	(MgO)	7%	
calcium oxide	(CaO)	1%	
manganese oxide	(MnO)	1%	