

On-Site Beneficial Use of Scrap Wallboard in Georgia Residential Construction

As tipping fees have risen, interest has increased in finding alternative uses for construction wastes. Many homebuyers are also looking for environmentally sensitive building practices. This includes the recycling and reuse of construction debris rather than disposal.



One of the largest waste components in residential construction is gypsum wallboard. The National Association of Home Builders Research Center (NAHBRC) estimates scrap wallboard is 26% by weight of new home construction waste. For a 2,000 square-foot home, this equates to about 1.5 tons of material or about half a dump truck load. In many cases, scrap wallboard can be ground and beneficially applied on the construction site, rather than transported to the landfill.

Wallboard is primarily composed of gypsum (calcium sulfate) with a thin paper backing. Chemical analysis of ground scrap wallboard indicate it is very similar to mined gypsum (**Table 1**). Gypsum has long been used in agriculture as a conditioner to improve the physical characteristics of certain soils and a source of both calcium and sulfur for plant needs. The ground wallboard typically has more potassium and magnesium (nutrients needed for plant growth) than agricultural gypsum.

Studies of gypsum application in Georgia have shown it can be used to reduce crusting of the soil

surface and increase water infiltration. Soils with clay and low amounts of calcium in the soil surface often benefit from gypsum application. In these soils, the use of ground scrap wallboard on residential construction sites can help reduce runoff and erosion by improving water infiltration.

Gypsum is a source of calcium and sulfur. Most ornamental plants and turfgrasses need these nutrients, and due to our high rainfall in Georgia, most of our soils are low in these elements. Gypsum **cannot** be used to raise the soil pH like lime. The calcium in gypsum does act to reduce aluminum toxicity in the subsoil. In many cases, this allows plants to root more deeply and can improve their drought resistance. Because gypsum does not dissolve quickly, salt build-up is not a problem for plants when it is applied at the recommended rates.

Table 1. A comparison of the nutrient content of ground scrap wallboard and agricultural gypsum. Data adapted from Korcak, 1996.

Constituent (lbs/ton)	Ground Wallboard	Agricultural Gypsum
Calcium	444 - 456	534 - 570
Sulfur	320 - 328	402 - 424
Phosphorus	0.4 - 0.6	0.4
Potassium	1	0.1 - 0.2
Magnesium	11	3.0 - 3.8
Iron	4.24 - 4.82	0.94 - 1.61
Manganese	0.2 - 0.3	0.07 - 0.10
Boron	0.03 - 0.04	0.17 - 0.19
Sodium	1.8	1.8 - 2.0



Ground wallboard contains some metals, but the amounts are low compared with the metal concentration limits in the U.S. EPA Part 503 regulations for land application of municipal biosolids or sewage sludge (**Table 2**). These Part 503 metal limits apply only to the land application of biosolids and are used only as a point of reference. The paper backing on residential wallboard is not a source of metals based on samples of ground wallboard that were analyzed with and without paper backing.

In summary, there are many potential benefits to reusing ground scrap wallboard onsite, and there are few environmental or plant growth problems when it is applied according to recommendations.

Table 2. A comparison of the metal content of ground wallboard and agricultural gypsum with the U.S. EPA Part 503 pollutant concentration limits. Data adapted from Korcak, 1996 and UGA analysis of ground wallboard.

Constituent (ppm)	Ground Wallboard	Agricultural Gypsum	Part 503 Table 3 ¹
Aluminum	1,180 - 1,320	152 - 190	NR ³
Arsenic	3.8 - 6.7	0.28 - 0.45	41
Barium	25.8 - 29.6	7.7 - 9.4	NR
Cadmium	0.4 - 1.0	0.05 - 1.0	39
Chromium	16.7 - 18.8	8.0 - 11.6	NR
Cobalt	4.1 - 4.8	4.0 - 4.9	NR
Copper	10.2 - 12.2	7.7 - 8.1	1,500
Lead	28.20	N/A ²	300
Mercury	<0.01	N/A	17
Nickel	3.8 - 6.7	0.7 - 1.0	420
Strontium	850 - 880	1,030 - 1,070	NR
Zinc	18.0 - 19.5	6.7 - 8.2	2,800

¹ U.S. EPA Part 503 Regulations, Table 3 - Pollutant Concentrations below which there are no restrictions for land application of biosolids.

² N/A - Not Available

³ NR - Not Regulated



Potential Benefits of Wallboard

- ◆ Improves water infiltration and decreases potential erosion
- ◆ Provides nutrients for plants
- ◆ Can reduce aluminum toxicity in some subsoils
- ◆ Can help protect soil organic matter
- ◆ Saves tipping fees and transportation costs
- ◆ Saves landfill space

Potential Problems with Wallboard

- ◆ Nutrient imbalance if overapplied
- ◆ Source separation
- ◆ Storage/scheduling
- ◆ Dust during grinding
- ◆ Paper fragments on surface if not incorporated

Guidelines for Use

When you are planning to apply ground scrap wallboard on your building site, you should follow the steps listed below.

1. Determine the application rate.

First, have the soil tested. You should have a routine soil test performed on soil where ground scrap wallboard will be applied. Your County Extension Agent can supply you with bags for soil sample collection and detailed information on how to take a proper soil sample. A routine analysis will tell you the soil pH, and the amounts of phosphorus, calcium, potassium, magnesium, and zinc available for plants to use.

The application rate for the ground scrap wallboard is based on the amount of silt and clay that is typically present in the soil surface. Soils in the Piedmont,

Mountains, and Ridge and Valley have more silt and clay than those in the Coastal Plain; consequently, higher rates of ground wallboard gypsum can be applied (**Table 3**). Research has shown that nutrient imbalances due to gypsum application do not generally develop in soils high in silt and clay. High rates of gypsum application can sometimes cause a problem with magnesium in sandy soils.

Table 3. Recommended rates of ground scrap wallboard application. *Note: These weights are for dry ground wallboard.*

Region	Recommended Rates
Piedmont, Mountains, and Ridge and Valley	250 lbs/1000 ft ²
Coastal Plain	50 lbs/1000 ft ²

2. Determine if there is enough land at the site to apply all the wallboard.

Method 1: *To estimate the amount of land needed.*

Table 4 provides general guidelines for the area needed to land apply wallboard for a particular size house. This table should **only** be used to get a general idea if land application will work for your site. In reality, the amount of scrap wallboard produced and the area available for application will vary greatly depending on the type of house built, its footprint, and the site.

Table 4. Guidelines for area needed for on-site reuse of scrap wallboard¹.

House Size (ft ²)	Scrap Wallboard (lbs)	Area Needed for Application (ft ²)	(acre)
1,500	2,250	9,000	0.20
2,000	3,000	12,000	0.30
2,500	3,750	15,000	0.35
3,000	4,500	18,000	0.40
3,500	5,250	21,000	0.50
4,000	6,000	24,000	0.55

¹Assumes typical application rate of 250 lbs/1,000ft²

Method 2: *To calculate the actual amount of land needed.*

To determine if you have enough land available to apply wallboard for each project, multiply the number of square feet in the house by 1.5 lbs. Divide this number by the appropriate number of pounds for your region in **Table 3** and multiply by 1000 (*See the worksheet on Page 4 for assistance*). This is the number of square feet you need to apply all your ground wallboard. Then, compare this number to the area you have for application (lawns, plant beds, and gardens). Be sure not to include the footprint of the house and impervious areas such as the driveway in your area for application.

Example:

A 2,500 square-foot house is being built on a three-quarter acre lot (32,670 ft²). Approximately 5,000 ft² of the lot will be occupied by the house and impervious areas. This means 27,670 ft² of land is available for ground scrap wallboard application. Using 1.5 lbs per square foot, construction will generate about 3,750 lbs of wallboard. Using a typical application rate (**Table 3**) of 250 lbs/ 1000 ft², you will need 15,000 ft² of land for application. Because 27,670 ft² is available for application, all of the scrap wallboard generated can be land applied.

Proceed with the following steps, if you have enough land to apply the wallboard from a specific site.

3. Segregate scrap wallboard.

Place all the clean scrap wallboard in one location that will be accessible to the grinder. Moisture resistant or fire retardant wallboard should not be used because guidelines for land application of these products are not available at this time. Wallboard from demolition or that has been painted or wallpapered should not be used.

4. Grind the wallboard scraps.

Clean wallboard scraps should be ground with equipment that has a two-inch screen to make sure the paper is shredded and there are no large chunks of wallboard. Controlling dust during grinding is important. If ground wallboard will be stored before application, cover the pile with a tarp to keep the material dry and easy to handle.

Worksheet to calculate the amount of land needed to apply ground wallboard from a building site.

Step 1: Area needed to apply wallboard.

Formula: [Size of the house (ft²) x 1.5 lbs/ft²] ÷ [Recommended application rate (lbs/ft²) (Table 3)] * 1000

Your Numbers: [_____ ft² x 1.5 lbs/ft²] ÷ [_____ lbs/ft²] * 1000 = _____ ft²

Step 2: Existing area to apply wallboard.

Formula: Size of the lot (ft²) - Size of impervious area (ft²) (Driveways, etc.)

Your Numbers: _____ ft² - _____ ft² = _____ ft²

Step 3: Compare. The number in Step 1 is the amount of area needed to apply ground wallboard from a site. If the number calculated in Step 1 is less than or equal to the number from Step 2, you have enough land to apply all the ground wallboard from your building site.

5. Apply the ground wallboard.

Apply fertilizer and high magnesium dolomitic lime to the soil according to the recommendations from your soil test results. The ground wallboard should be evenly spread over the soil at or less than the recommended rate. Photographs at the right illustrate an even application at the recommended rate. The ground wallboard should be tilled or mixed into four to 12 inches of soil. **Beneficial reuse does not include digging holes and burying the wallboard.**

Application Rates



♦ 250 lbs/1000 ft²



♦ 50 lbs/1000 ft²

Useful Facts

- ♦ A skid loader bucket will hold about 1 yd³.
- ♦ A front end loader will hold 2-3 yd³.
- ♦ Dry ground scrap wallboard weighs about 400 lbs/yd³.
- ♦ At a rate of 250 lbs/1000 ft², one skid loader bucket would cover 1,600 ft² (40ft x 40ft). This is an area slightly smaller than a volleyball court.
- ♦ At a rate of 250 lbs/1000 ft², about one-third of a skid loader bucket would cover the goal box on a soccer field.

References

- Korcak, R. 1996. Scrap Construction Gypsum Utilization. Final Report. USDA-ARS, Beltsville, MD
- USEPA 1993. 40 CFR Part 503 - Standards for the use and disposal of sewage sludge: final rule. Federal Register 58:9248-9415.

This document was supported by the University of Georgia, College of Agricultural and Environmental Sciences, Cooperative Extension Service, and the Engineering Outreach Service along with the Pollution Prevention Assistance Division. This publication was written by:

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