A Study Regarding Rigid Foam Insulation Board Waste and Landfills

Landfills across the United States receive millions of cubic feet of rigid foam insulation board each year generated during commercial re-roofing projects. Don't fill your landfill up with air! If you are accepting these materials, you are losing over $32.00 for each and every cubic yard of foam insulation you bury in your landfill.

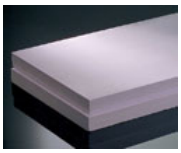
Introduction:

Commercial flat roofs are normally protected by a waterproof membrane as well as a layer of rigid foam insulation made of Isocyanurate (ISO), Extruded Polystyrene (XPS) or Expanded Polystyrene (EPS). During the commercial re-roofing process, this material is normally sent to the local landfill.

Nationwide Foam Recycling (NFR) repurposes all types of commercial flat roof rigid foam insulation (EPS, XPS or ISO) generated during re-roofing events.

This study clearly shows that instructing generators to repurpose foam insulation board with Nationwide Foam Recycling makes more economic and environmental sense for your landfill than receiving and burying the material!

The three types of foam that may arrive at your landfill are shown in the table below.

Isocyanaurate (ISO) Yellow Board	**Extruded Polystyrene (XPS)** Blue, Pink or Green Board	**Expanded Polystyrene (EPS)** White Bead Board
		
Typical Density: 2 lbs per cubic foot	Typical Density: 2 lbs per cubic foot	Typical Density: 1 lb per cubic foot
Compressive Strength Range: 20 – 25 psi	Compressive Strength Range: 15 – 100 psi	Compressive Strength Range: 10 – 25 psi
Maximum achievable compression from typical heavy compaction equipment: 38 – 73% by volume	Maximum achievable compression from typical heavy compaction equipment: 19 – 37% by volume	Maximum achievable compression from typical heavy compaction equipment: 20 - 45% by volume

There are many reasons to repurpose this material with NFR rather than receive and process it at your landfill:

Lost Revenue:

Each cubic yard of landfill space generates a certain amount of revenue for your landfill. Historically, landfill compaction rates for trash were 800 - 1000 pounds/cubic yard. More recently, with better equipment, landfill operators have achieved compaction rates of 1200 - 1400 pounds/cubic yard. Some landfills have even achieved compaction rates of up to 1600 pounds/cubic yard due to larger equipment. **For our analysis we shall use a 1400 pounds/cubic yard compaction rate for a typical modern day landfill.**

Most landfills continue to charge a per ton tip fee to receive waste regardless of the material, including rigid foam insulation. This certainly applies to rigid foam insulation mixed in with typical trash and C & D loads.

A national survey of landfills in all fifty states completed in late 2013 shows tip fees charged to be as low as $5 per ton and as high as $142 per ton, resulting in a national average of $50/ton. **For our analysis we shall use a landfill tip fee of $50/ton.**

In a typical landfill, the compressive force a material faces due to the weight of the material above is dependent upon how deep in the landfill the material is entombed (this would be the forces upon the material absent the use of compaction equipment).

The 1400 lbs per cubic yard of compacted trash computes to 0.03 lbs per cubic inch. Using various depths we can determine the amount of weight of compacted trash above being exerted on the bottom square inch by multiplying the depth in feet x 12 inches per foot x 0.03 lbs of compacted trash per cubic inch:

Depth in feet	Depth in inches	Pounds Exerted on the bottom square inch (psi)
25	300	9
50	600	18
75	900	27
100	1200	36
125	1500	45
150	1800	54
175	2100	63
200	2400	72

So without taking into account the ability for the landfill compaction equipment to compact the foam prior to burying, rigid foam insulation board with a compressive strength of 25 psi will not compact at all until it is buried at least 75 feet deep!

In order to gauge the improvement in compaction of rigid foam insulation due to the use of modern landfill compaction equipment, NFR's materials laboratory performed tests to gauge the maximum compression of a typical sheet of rigid foam insulation. This was accomplished using various pieces of heavy equipment similar to those used at landfills to compact trash. We were able to achieve a range of 19 - 73% maximum compression by volume depending on the type of equipment used as well as the type of foam compacted. It should be noted that this range should be considered the theoretical maximum, under perfect compaction conditions which is not the case in most landfills. **For our analysis we shall use an average maximum rigid foam insulation compaction rate of 50%.**

Uncompacted rigid foam insulation densities range from 1 to 2 lbs per cubic foot. **Here we will use the more conservative 2 lbs per cubic foot,** which equates to 54 pounds per cubic yard.

Assuming maximum compression of 50% by volume, this equates to 54 pounds/cubic yard x 2 = 104 pounds/cubic yard

The revenue generated is therefore:

104 lbs/cubic yard [divided by 2000 lbs/ton] x $50/ton = $2.60 per cubic yard of landfill space.

This compares unfavorably to the same cubic yard of landfill space not containing compressed rigid foam insulation:

1400 lbs/cubic yard [divided by 2000 lbs/ton] x $50/ton = $35 per cubic yard of landfill space.

Accepting rigid foam insulation at your landfill is costing your operation over $32 for each and every cubic yard of landfill space – space that is incredibly difficult to permit and build.

Shortened Lifespan:

The inclusion of rigid foam insulation in a landfill will shorten its lifespan. Across the United States close to 50,000 tractor trailer loads of rigid foam insulation are wasted each year. This amounts to 7,100,000 cubic yards of landfill space uncompressed and 3,550,000 cubic yards of landfill space assuming perfect 50% compression. This is space that is extremely difficult to build given the many barriers to entry including permits, capital costs, nimby, etc....

Operational Issues:

Rigid foam insulation is a very difficult material to process at a landfill or transfer station. The material is extremely light so it is more expensive to transport, process and bury than trash and it does not retain its daily cover very well. This drives up the transportation and processing costs per ton dramatically. Broken into smaller pieces during an attempt to compact the material, the now broken pieces of very light rigid foam insulation have a tendency to blow all over the landfill and in many cases beyond causing issues with regulators, abutters and wildlife.

Recycling Issues:

Most states have very aggressive recycling goals spelled out over the next five years. As such, local, state and federal regulations requiring recycling are becoming more and more commonplace across the United States. Over the years many construction related materials have been banned from landfills in favor of recycling. As a highly recyclable material, a future ban of foam insulation is not out of the question. Our experience has shown that a typical generator of rigid foam insulation board is very willing to compel their contractor to recycle the material rather than landfill it. Most contractors are prepared to recycle especially when convinced to do so by their customer. Once landfill operators are shown the math, it becomes obvious that accepting and landfilling rigid foam insulation board makes no sense. The recycling of rigid foam insulation board is on the rise across the country.

For all of the above reasons, landfills and transfer stations should refrain from receiving and processing rigid foam insulation board.

The good news is that Nationwide Foam stands ready to remove, transport and repurpose this material from contractor's job sites nationwide. Our service is easy to implement and results in rigid foam insulation board never making it through the gate at a landfill like yours.

Nationwide Foam's recycling program saves money, meets or exceeds recycling rules and regulations and helps generators of this waste to meet their environmental goals. Truly a win, win, win!

Questions about this publication may be addressed to:

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