PROCEEDINGS

A Robust Recycling Program for Roofing Systems in North America

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Addressing the Building Envelope

ABSTRACT

Management of the construction and demolition waste stream is an important environmental issue. With over 3 billion sq. ft. of commercial reroofing each year, the resulting tear-off materials represent an area of special concern.

In order to address this concern, roofing system manufacturers and industry associations have worked with roofing contractors to demonstrate the feasibility of reclamation. In addition, private-sector entrepreneurs have begun to invest in the necessary collection and processing systems to make this option available to many roofers on a regional basis. However, the recycling service is not yet being fully utilized throughout the continent.

Finding a home for the volume of roofing system components that are removed is the fundamental challenge. As more end markets for roofing debris develop, the economics of handling and collection will improve dramatically. This, in turn, will allow recycling companies to offer roofing material recycling services that complement a project's schedule and budget—two necessary elements of a truly robust program.

Detailing experiences from coast to coast in North America, an assessment will be provided on what is working and what still needs to be done.

SPEAKER

ROD A. PFANNENSTIEL — NATIONWIDE FOAM RECYCLING INC. - FRAMINGHAM, MA

ROD PFANNENSTIEL is vice president of Nationwide Foam Recycling Inc. and is based at its corporate headquarters in Framingham, MA. With a business degree from Colorado State University, he leads the efforts to provide recycling services for large commercial roof replacement projects. His endeavors include membership in roofing and construction industry groups such as EPDM Roofing Associations, AIA, RCI, CEIR, and USGBC.

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INTRODUCTION

Management of the construction and demolition waste stream is an important environmental issue. With over 3 billion sq. ft. of commercial reroofing each year, the resulting tear-off materials represent an area of special concern.

In order to address this concern, roofing system manufacturers and industry associations have worked with roofing contractors to demonstrate the feasibility of reclamation. In addition, private-sector entrepreneurs have begun to invest in the necessary collection and processing systems to make this option available to many roofers on a regional basis. However, a robust system is not yet fully in place throughout the continent.

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ROOF MATERIALS TO RECYCLE

Rubber and plastic membranes, foam insulations, stone ballast, and concrete pavers are all recyclable materials generated from tear-off reroofing projects. This paper will focus primarily on EPDM roofing membrane and rigid foam insulation, as together, they represent a substantial portion of the roof waste by weight and are representative of the wider group of materials that can be recycled. The quantities of postconsumer insulation and membrane that have been reported as recycled over the past few years have grown dramatically. EPDM membrane alone has grown from just under 1 million sq. ft. in 2007 to over 5 million sq. ft. in the past three years.[1]

There are several types of rigid foam insulation. Some are considered "thermoset" plastics and are not amenable to standard recycling techniques. Others are "thermoplastic" polymers that can be reground and reformed into new plastic products. Others have reuse potential in nontraditional insulating applications.

ECONOMIES OF SIZE

Commercial flat-roof tear-off projects vary significantly in size from several thousand sq. ft. to a million sq. ft. or larger. The economics of recycling become more favorable when the job is large enough to generate at least one full truckload of material. A full truckload of EPDM membrane may weigh between 25,000 and 30,000 pounds, depending on how well the material is stacked and loaded. Assuming an average density of 0.33 pounds per sq. ft., a project size of 75,000 sq. ft. or larger will generate a minimum of one full truckload of material. A standard truckload of rigid foam takes up 140 cubic yards.

Small projects are more challenging because the costs of transportation to distant markets are nearly as expensive for less-than-truckload (LTL) shipments as for full truckloads. This results in a substantially higher cost per ton for delivered material. This may scuttle the recycling project at the quote stage as the roofing contractor may choose to bid simple disposal if this is less expensive.

Solutions to smaller projects of 75,000 sq. ft. or less that are distant from processing facilities include establishing regional consolidation points, finding nontraditional transportation opportunities (logistics matching), and developing local markets.

COLLECTION TECHNIQUES

Roofing membrane is commonly cut into manageable-size pieces when removed from the roof. Contractors are asked to fold the membranes and place them squarely onto standard wooden pallets. Stacked to a height of 3 ft., a typical pallet of EPDM will weigh approximately 1,500 pounds. PVC and TPO membranes are somewhat lighter as they are rolled rather than folded. A common 48-ft. flatbed trailer can be loaded with a minimum of 22 pallets of membrane.

Roofing insulation is a challenging material to collect and transport for recycling. Its lightweight nature is positive from the perspective of fuel economy but negative when looked at from a cost-per-ton basis. Thermoplastic end markets are often distant from the many points of roofing scrap generation.

BUILDING MARKETS

Postindustrial EPDM scrap—i.e., trim scrap generated by manufacturers during production—is commonly recycled with ready demand. This is also true for postconsumer EPDM products such as automotive window casings, moldings, and gaskets. However, postconsumer EPDM roofing membrane has not been commonly recycled in the past due to concerns about cross contamination with ballast stone, metal fasteners, patching glue, adhered insulation, polyester reinforcing fiber, and dirt.

In order to minimize these contaminants, roofing contractors are asked to sweep the membrane free of ballast and loose dirt, remove metal fasteners, and avoid excessively glued/patched areas. Fully adhered roofs—i.e., those that are glued down as opposed to ballasted with stone or metal fasteners—are not currently collected for recycling.

The role of the recycling collector is to bring postconsumer EPDM to market in sufficient quantity and with sufficient quality to demonstrate its value as a reliable and economic feedstock for industry.

Current markets for postconsumer EPDM membrane include roofing membrane manufacturers, rubber mulch producers, and energy production.

Membrane manufacturers are uniquely positioned to positively impact market demand by integrating some portion of recovered membrane back into their new products. Recent demonstrations suggest that the use of recovered scrap membrane is technically feasible.[2] Economic evaluations of this "closed-loop" recycling market are under way and ongoing.[3]

It is important to recognize that while closed-loop recycling markets are the "ideal," manufacturers take a very conservative approach to using postconsumer materials in their feedstock mix for new products. Controlling cost and quality, and securing a reliable supply of postconsumer scrap are all important considerations when faced with deciding on using postconsumer scrap compared with reliable supplies of virgin material. Consequently, only small quantities of postconsumer roofing scrap are currently used by manufacturers to make their new products. In order to meet the public's demand for more recycling and less landfilling, it is necessary to develop a wide range of recycling opportunities. This type of "entrepreneurial recycling" is focused on finding beneficial uses, such as the reuse of rubber membranes as weed barriers, recycling EPS insulation into picture frames, and grinding TPO membranes for use in making walkway pads. This broad-based approach, including both closed-loop and entrepreneurial recycling, is making important inroads toward establishing a robust and reliable recycling infrastructure for roofing scrap.

ROLE OF THE ARCHITECT AND ENGINEER IN INFRATRUCTURE DEVELOPMENT

Architects and engineers can positively impact the development of new systems for recycling construction-related materials. When designing procurement specifications for reroofing projects, the architect or engineer can specify that contractors include recycling of various materials as part of their bid. The following provides sample language appropriate for specifying EPDM recycling:

- Verify that membrane is not fully adhered, reinforced, or felt-backed.
- Remove ballast, metal fasteners, wood blocking, or any non-EPDM materials.
- Sweep surface to remove loose dirt and debris.
- Cut EPDM into linear lengths such that overlapped seams can be removed and disposed.
- Roll or fold EPDM, stack squarely onto wood pallets to a height of 3 ft., and secure with rope or stretch wrap.
- Store pallets on site to achieve minimum load size.
- Contractor shall load material on truck provided by others.

Architects are unfamiliar with the methods of recycling roofing materials and the cost implications of doing so. They are understandably cautious when presented with the opportunity to specify these items.

Recycling contractors can assist architects to better understand this option by clearly describing the process and providing preliminary cost quotes to allow an assessment of the cost-effectiveness as compared with normal disposal. If the architect is satisfied that recycling is practical and cost-effective, he or she is more likely to specify the method.

School systems, government agencies, and businesses are all indicating their interest in specifying recycling services in their construction projects.

REFERENCES

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2. Ed Kane, "EPDM Group Champions Recycling," www.RSIMAG.com, 2008.
3. Private client.