

A Full-Scale Research Project to Evaluate Industry Concerns Regarding Roof Re-Cover Over Wet Insulation

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EXTENDED ABSTRACT

A recent roofing industry survey regarding insulation reuse in low-slope roofing indicates that the issues of moisture concentration, amount of roof area that is wet, structural integrity of the insulation, and thermal performance loss are the major concerns regarding re-covering over an existing roofing system that contains wetted insulation. To address these concerns and to develop data on insulation reuse criteria, a consortium made up of SPRI and its member companies, the Roof Consultants Institute (RCI), and the Oak Ridge National Laboratory (ORNL), have undertaken a project to re-cover a failed roofing system containing moisture and to monitor the performance of that roofing system after the reroofing.

The Municipal Building in Pembroke, Virginia, was selected for this reroofing project. The roof of this building was composed of an aggregate-surfaced four-ply organic felt asphalt BUR over 2 in. (51 mm) thick wood fiberboard insulation spot mopped to a 22-gauge manufacturer-primed Type-B metal deck. The building owner informed us that the roof was approximately 27 years old and had been leaking for more than 10 years.

The reroofing was performed during the first week of April 1995. After brooming off any loose aggregate, 0.5 in. and 3 in. (13 mm and 76 mm) thick extruded polystyrene (XEPS) foam were mechanically attached to the lower and upper roofs, respectively, using fasteners with a compliance-grade base coating that meets the minimum requirements of FM 4470. On each roof plane, approximately half of the roof area was covered with a black or white ethylene/propylene-based single-ply membrane.

During reroofing, instrumentation was embedded into the roofing system to monitor the interior and exterior environmental conditions of the roofing system. The roof has been periodically visually examined and scanned nondestructively for moisture content. In addition, core samples of the existing and re-cover insulation material and fasteners have been

removed twice after the roof was re-covered. These core samples have been tested for pullout strength, corrosion, thermal performance, compressive strength, and moisture content. In addition, the reflectance of the membranes is also being monitored.

During the first yearly inspection, several fasteners removed from the wettest portion of the roof exhibited significant corrosion. In October 1996, three additional fastener types were added to this portion of the roof to assess their corrosion resistance.

The following observations have been gathered to date. The roof will continue to be monitored and yearly visits to the building are planned for inspection and sampling purposes.

- The reroofing of the Pembroke Municipal Building has solved the building owner's short-term requirements of making the roofing system weathertight. Only one minor flashing-related leak has been reported since the re-cover was performed in April 1995.
- Fasteners with base coatings that meet the minimum requirements of FM 4470 appear to be insufficiently protected when reroofing over wetted wood fiberboard insulation. Appreciable corrosion of the fasteners was found after just one year of service. Fasteners with heavy mill coatings or fabricated from stainless steel appear to resist corrosion in the same environment.
- The re-cover system is functioning properly after three years of service. No moisture has been detected in the re-cover insulation material, and the XEPS has maintained its thermal efficiency and compressive properties.
- The wood fiberboard insulation initially contained a wide range of moisture. The thermal performance and the compressive properties were significantly reduced due to this contamination. Upon drying, these properties increased but not to their original levels. Criteria for reuse are unavailable and are sorely needed.

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- The solar reflectance of the white membrane decreased with time and improved when cleaned. The black membrane has not exhibited any significant changes in solar reflectance after three years of exposure.
- The original roofing system is drying. After three years, more than 90% of the original roof insulation is below saturation. The computer model used to simulate the moisture performance of the roofing system underestimates the drying of the wet insulation under the white membrane and predicts the drying of the damp insula-

tion under the black membrane. The reasons for variances between the experimental and modeling data are the limited accuracy of the moisture survey instrument and the underestimation of the metal deck permeance due to rusting.

Pass/fail criteria are sorely needed to determine whether insulation materials can provide an adequate substrate for a re-cover roofing system. With these criteria, protocols to assess the advisability of roof re-cover can be developed.