

Product Information Bulletin 201

NRC Below Grade Research Project

Product Information Bulletin

EPAC/NRC Two-Year EPS Insulation Research Program

The Expanded Polystyrene Association of Canada (EPAC) conducted a joint research project with the National Research Council of Canada/Institute for Research in Construction (NRC/IRC) to evaluate the durability performance of expanded polystyrene (EPS) insulation installed in an exterior below-grade application as part of the Exterior Insulation Basement Systems (EIBS) project.¹ EPS insulation thermal performance, site weather conditions and soil moisture content were instrumented and monitored throughout the project.

The in-situ thermal performance of EPS insulation exposed to soil backfill when installed as exterior insulation on a basement wall was monitored over a 30-month exposure period using thermal couples attached to the EPS insulation and concrete basement wall. The monitoring of in-situ thermal performance detected the presence of water at the outer surface of the EPS insulation during periods of heavy rain and major thaws; however, the surface of the concrete basement wall showed no evidence of water penetration through most of the height of the wall. The monitoring also showed the thermal performance of the EPS insulation remained stable and was not adversely affected by the water movement.

In addition, material properties were determined for EPS insulation removed after the 30-month exposure. Testing confirmed that all types of EPS insulation in the research program retained their specified thermal and mechanical properties even after being subjected to in-situ freeze-thaw cycling. The moisture content of EPS insulation removed after the 30-month exposure was in the range of 0.01 to 0.96% by volume.

The research project identified the following key EPS insulation performance attributes:

- The average moisture content of EPS insulation directly exposed to high moisture content soil conditions was found to be less than 0.5% by volume at the end of the exposure.
- In-situ thermal performance of the EPS insulation remained constant – i.e. there was no loss in thermal resistance – during the monitored exposure period.
- Laboratory test results from samples removed after the exposure confirmed thermal performance and durability – i.e. there was no change in material properties.

A second part of the research project included development of a laboratory durability test protocol that subjected test material to extreme thermal gradient and environmental cycling, including freeze-thaw cycling.² Laboratory testing performed by NRC on samples from the same manufacturing lot of material subjected to the 30-month field exposure confirmed that all types of EPS insulation retained their specified material properties even after being subjected to the laboratory durability test protocol. The test protocol has subsequently been developed into an ASTM standard test method to provide a means of assessing durability performance of all types of insulation.³

¹ Normandin, N., Maref, W., Bomberg, M.T. and Swinton, M.C., In-Situ Performance Evaluation of Exterior Insulation Basement Systems (EIBS) – EPS Specimens, National Research Council of Canada Report No. 3132.1, March 1999.

² Normandin, N., Bomberg, and M. T., Swinton, M.C., Development of a Draft Test Protocol for Evaluating Durability Under Environmental Cycling of Insulation Products for Exterior Basement Applications, NRC Report No. 3132.2, December 1999.

³ ASTM C1512-10, Standard Test Method for Characterizing the Effect of Exposure to Environmental Cycling on Thermal Performance of Insulation Products, published by ASTM International.