Concrete Block Insulating Systems

KORFIL AND ICON EXPANDABLE POLYSTYRENE INSERTS COMPARED TO FOAMED IN PLACE CELLULAR PLASTIC AS A METHOD OF THERMALLY INSULATING CONCRETE MASONRY WALLS

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SECTION I INTRODUCTION

Foamed Cellular Plastics have been commercially available in the United States since the early 50's. Expandable Polystyrene(EPS) Inserts designed for installation in concrete blocks at block manufacturing plants were introduced in the early 70's. On occasion Foamed Cellular Plastics are substituted as an equal to EPS. The intent of this publication is to acquaint the reader with research conducted by the U.S. Department of Commerce, National Bureau of Standards (References No.1, No.2 & No.4). The recommendations concluded by the Bureau of Standards are covered in Section II (Discussion) of this publication and should be considered by the design professional in specifying Foam Cellular Plastics as an alternate to EPS Inserts.

SECTION II DISCUSSION

Four key areas of concern were concluded by the Bureau of Standards in their evaluation of Urea Formaldehyde(UF) Foams.

They are:

A. Toxicity

B. Shrinkage

C. Temperature and Moisture

D. Thermal Efficiency

A. Toxicity

Although UF Foam Insulation has been considered a generic material, there are differences in composition and properties of the various foams which are available due to additives, fillers, extenders and plasticizers added in an attempt to alter certain properties.

Foamed Cellular Plastics are the end result of a chemical reaction. Because this reaction is dependent on several key factors including the age of raw materials, quality, mixing and temperature at which foaming takes place the end result can vary. In the early 70's, guidelines were limited and health hazard problems resulted in the banning of Urea Formaldehyde by certain States. These bans still exist in some states. Exposure to small concentrations of formaldehyde gas can cause allergic reactions. When the concentrations from several sources within a building combine, the end result could become severe.

Toxicity has been the main reason for the decline in the use of UF Foams in the majority of foreign countries. Many reports have been published on foam performance and available information is insufficient to predict the health hazard potential of todays site installed Cellular Foam. It is safe to assume however Urea-Formaldehyde foam insulation releases formaldehyde under normal ambient conditions for many months after application and temperature and humidity can increase the level of release.

B. Shrinkage

When Foamed Cellular Plastic cures, it can undergo linear shrinkage in all three dimensions. As shrinkage occurs within the cores of concrete blocks it may split or crack resulting in lower insulating properties. Ambient temperature conditions can attribute to foam shrinkage with less shrinkage occurring in cold climates. Tests performed by the Bureau of Standards showed under lab conditions shrinkage of upwards to 7% can occur during the first 20 months.

In addition to shrinkage the Bureau of Standards further concluded many of the buildings inspected during the 80's in both the United States and Canada showed the lack of complete filling of cavities due to workmanship or obstructions within walls.

C. Temperature and Moisture

Tests performed by the Bureau of Standards showed certain UF Foam specimens disentegrated after 14 weeks of exposure to temperatures of 104 F degrees and 94% relative humidity. The Bureau also concluded UF Foam is susceptible to hydrolytic degradation which is the chemical reaction between urea-formaldehyde polymer and water.

Data on moisture accumulation within UF Foam indicated that moisture contents of in place foam specimens ranged from 8 to 18 percent depending on exposure conditions.

Rain penetration through insulated masonry cavity walls has been a major concern in European countries. As an example the United Kingdom restricts the use of UF Foam in severe wind driven rain areas unless the outer wythe has adequate rain protection.

D. Thermal Efficency

Both foam shrinkage and moisture content reduce the thermal efficency on UF Foams. The Bureau of Standards concluded for each 1 percent shrinkage there is a reduction in thermal resistance of the insulation by about 5 percent. If moisture is also present in the wall section this will further reduce the thermal resistance.

SECTION III RECOMENDATIONS

Korfil and Icon Insulation Inserts are produced from Expandable Polystyrene, a material whos thermal resistance is not subject to degradation with aging or when exposed to moisture, temperatures below 184 F degrees or shrinkage. In addition, EPS has never been considered a threat from a Toxicity standpoint.

When Urea Formaldehyde Foams are considered as an equal to Inserts for masonry construction the thermal efficency of the foam is subject to possible degradation particularly when used to totally fill the voids of masonry blocks where cores are normally a path for moisture to escape. Toxicity may or may not be an issue but it must be considered since the human element is involved in preparing the foam.

Other UF Foam issues discussed in References No. 1 thru No. 4 which must be addressed are:

1. Possible corrosion of electrical service boxes, ground wires, galvanized ties and steel studs.

2. The possible long term effect on any wood exposed to moist foam.

3. Possible growth of certain types of fungus.

4. Release of Gases other than Formaldehyde as well as Particulates.

5. The effect of Urea Formaldehyde on masonry and mortar.

All products must be able to technically verify statements presented in their literature. The unfortunate situation regarding insulation is it can't be seen and one must assume the material is in place, does not deteriorate and continues to perform its intended use with no adverse effects to anyone or anything.

REFERENCES

No.1- U.S. Department of Commerce- National Bureau of Standards
Report- NBS Technical Note 946
Entitled-"Urea Formaldehyde Based Foam Insulations:
An Assessment of Their Properties and Performance."
Dated July 1977

No.2- U.S. Department of Commerce- National Bureau of Standards
Report- NBS Technical Note 1131
Entitled-"Field Investigation of the Performance of
Residential Retrofit Insulation."
Dated September 1980

No.3- American Society for Testing and Materials Report
Entitled-"Elevated Temperature and Humidity Effects on
Urea-Formaldehyde Foam Insulations Observed by Scanning
Electron Microscopy."
Dated 1983, pages 665-687.

No.4- U.S. Department of Commerce- National Bureau of Standards
Report- NBS Technical Note 1210
Entitled-"Urea Formaldehyde Foam Insulations: A Review of
Their Properties and Performance."
Dated March 1985