Insulation Fire Hazards On Farms[1]

Dennis J. Murphy and William C. Arble[2]

Both rigid board foam and sprayed-on cellular plastic foam insulations present serious fire problems when installed as an exposed finish in farm buildings. Insulation foams are most often developed from plastic polystyrenes, polyurethanes, and polyisocyanurates.

The manufacturers of these insulations imply that the materials themselves aren't hazardous, but that improper use or application can create hazards. But many fire experts say that the materials are hazardous because of the typical way that they are applied. The reason for the difference in opinions is the way the insulations have been tested. The manufacturers tested the flammability of the product in the horizontal mode. The flame spread in this position is minimal. However, others have tested the foam insulations in the vertical position. When tested this way, the results are far different.

Just who is technically correct is of little consequence. The fact that foam insulation has been involved in millions of dollars of losses to potato and apple storages, swine houses, poultry plants and other livestock housing is undebated. A common fact is that fires in buildings with foam insulation have spread with alarming speed, resulting in clouds of black dense smoke and devastating loss. It is also a fact that there are many different foam materials with widely different flammability, but under certain conditions all of these materials will burn. Even self-extinguishing foams burn (or else they could not self extinguish under certain situations).

FLAME SPREAD

A yardstick for determining the suitability of certain materials for specific interior finishes in buildings is called flame spread. Examples of Flame spread ratings given to various materials are listed in Table 1.

Table 1. Flame Spread Ratings for Various Materials

Interior Finish Material	Flame Spread Rating
Asbestos-cement board 1/2 in. or 5/8 in. gypsum wall	0
board (dry wall) 1/2 in. treated (fire retardant)	15
exterior plywood	20-25
Red oak lumber	100
Untreated exterior plywood (various thicknesses)	75-200

Flame spread tests of rigid plastic insulation boards show flame spread ratings ranging from 25-2500, depending on the position of the board (horizontal or vertical, surface or corner) and the ignition source. However, in most cases the insulation flashed over (became fully involved by fire) in slightly over one minute. This indicates two things; one, that the insulation does allow rapid flame spread (see Figure 1) and secondly, that exposed foamed insulation can burn at such a rapid rate that evacuation of a building lined

1. This document was published in 1988 as Pennsylvania State University Fact Sheet Safety 20, Pennsylvania Cooperative Extension Service. For more information, contact Pennsylvania State University College of Agricultural Sciences, Agricultural Engineering Department, 246 Agricultural Engineering Building, University Park, PA 16802.

2. Dennis J. Murphy, professor; William C. Arble, PENNTAP Fire Technologist; Agricultural Engineering Department, Cooperative Extension Service, Pennsylvania State University, University Park, PA 16802.

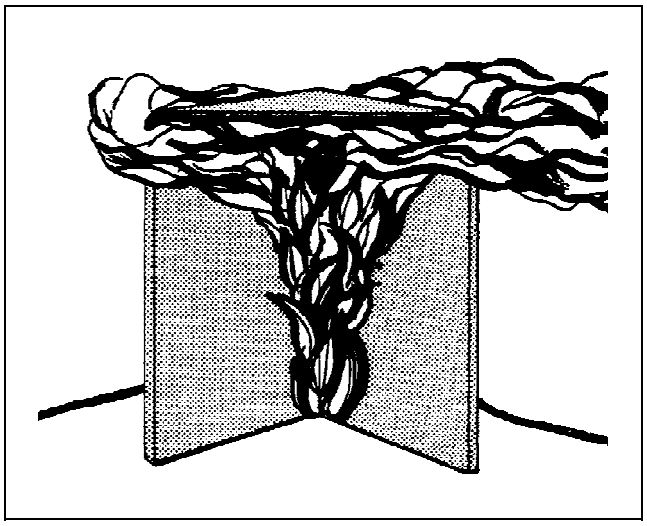

Figure 1. Exposed cellular plastic foam insulations can become burning infernos within seconds

with this type of insulation is nearly impossible.

Building codes typically require that foam insulation be protected with fire resistant barriers because of the foam's relatively low decomposition temperature, questionable flame spread, potential toxic gas generation and high smoke emission. But exposed cellular plastic insulation has been allowed in farm buildings because building codes often are not enforced or are not applicable in rural areas. You should act now to minimize the fire risks to buildings that contain exposed cellular plastic insulation. Many insurance companies that sell farm policies are requiring policy holders to upgrade buildings with exposed foam insulation by either covering the foam insulation or removing it completely.

Upgrading the fire resistance of foam insulation is expensive after the building has been in use several years. In these buildings it's too late to consider using alternative insulation systems. Typical 1982 estimates for adding fire barriers to existing buildings range between $.75 to $1.50 per square foot.

FIRE BARRIERS

A fire barrier (see Figure 2) is designed to keep heat away from the insulation so that it doesn't ignite and flashover. The fire barrier might also allow time for extinguishing the fire or to evacuate animals and equipment. Remember, though, that once exposed insulation ignites, accumulations of toxic gases and flashover may occur within seconds. There are two principles to keep in mind when considering covering

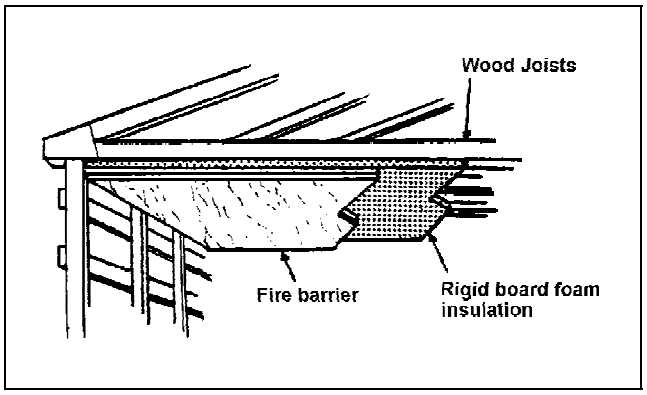

Figure 2. Use fire barriers to prevent flashover of fires involving exposed cellular plastic foam insulation.

exposed foam insulation:

1. The barrier must stay in place during heat buildup. A gypsum board (dry wall, "sheet rock," or equivalent) nailed through foam board into wood framing is probably better than a barrier board fastened by glue.that could crack.

2. The barrier should prevent the insulation from heating to more than 250 degrees F above ambient temperature for 15 minutes after the fire ignites. Gypsum board is more effective than corrugated metal or metal facing, since metal conducts heat of the fire directly to the foam, resulting in melt down.

Following are possible methods of covering exposed insulation in your buildings:

- 1/2 in. gypsum board nailed in place over the insulation.

- 1/2 in. fire retardant plywood. Fire retardant plywood is not usually in stock, but can be ordered from most lumber yards. Make sure the pieces fit tightly and all gaps are sealed. Ordinary exterior plywood will provide some flame spread protection for the foam, however, the plywood itself may burn, thus exposing the insulation.

- 1/2 in. asbestos cement board nailed in place over the insulation.

- 1/2 in. cement based mixture (gypsum-sand or gypsum-vermiculite) applied on the plastic foam insulation. Durability of this treatment depends on the competency of the applicator, so always check on jobs already completed by the applicator.

A few additional points about cellular plastic insulation and fire barriers that all farmers should understand:

1. Some cellular plastic foams melt at temperatures as low as 270 degrees. This may be as little as 180-200 degrees over room temperature.

2. Adding insulation to a building results in holding more heat in the structure during a fire, permitting greater heat buildup on wood or other flammable materials.

3. Most cellular plastic foam insulation boards burn quickly at low temperatures with the same heat release and flame spread as at high temperatures. This is different from most materials that start burning slowly and increase their burning rate as time and temperature increases.

4. Flame retardant additives decrease the possibility of foams catching fire from contact with a small fire source, such as a torch or overheated electrical wire. But a larger source of fire will ignite exposed "flame retardant" foams.

5. A fire test on cellular plastic foams under controlled conditions and blueprint specifications is quite what may occur with foam in place for years, subject to aging, mechanical damage, building modifications, moderate maintenance, and other changes that normally occur during product lifetime.

6. If you are adding a fire barrier to exposed foam insulation, be sure the fire barrier is conducive to the environment it will be exposed to. For example, plywood barriers would be used in swine confinements rather than gypsum board due to moisture problems and possible physical damage.

7. Asbestos is a known carcinogen. If asbestos-cement board is used as a fire barrier and boards must be cut for fitting, wear a respirator approved for asbestos dust. During sawing, fibers are likely to be jarred loose from the bonding substance and become airborne. Currently, there is no known safe level of asbestos dust, so respiratory protection is crucial.