

Vermin Resistance



Potential damage to insulation by vermin is often given little or no consideration when buildings or industrial facilities are planned, yet it can be a significant oversight. Gnawing, boring, nesting or microbial vermin—including mice, rats, insects and fungi—can cause heavy damage in underground walls and foundations, agricultural and food processing buildings and exterior industrial installations. This can cause loss of thermal performance and mechanical strength, and even complete deterioration of the insulating system itself.

PROBLEMS

- *Multiple Destructive Forces*

According to a U.S. study, after fires and natural weather events, rodents cause the most destruction to buildings. These, along with insects and microorganisms, can insidiously cripple or destroy a system's insulation infrastructure. The results of these attacks are loss of insulation efficiency, bad hygienic conditions and severe economic loss. Destruction can be wrought in a relatively short period of time and is often difficult or impossible to repair.

Nearly all insulations including plastic foams and fibrous materials are subject to easy destruction by vermin. Most insulation manufacturers do not fully confront this problem, explaining only that their materials have no nutritive value. At most, they recommend protective measures be taken against rodents in underground or agricultural applications.

Unfortunately, rats and mice are a basic element of human settlement. Where people live and work, food, waste—and rodents—are sure to be present. This is valid in housing and particularly, in agricultural, food processing and pharmaceutical facilities.

The problem is compounded by the fact that rats and mice are such prodigious breeders. When insulation material is available and appropriate for nesting, the breeding conditions are ideal: the rodent population explodes, meaning the insulation may be destroyed in just a few months. Even where rodent control measures have a high priority, vermin colonies exist because of their innovative and industrious nature. An insulation material useable as food or nesting material can mean the difference between safety and health problems and a sound, rodent-free facility.

- *Rodents*

Most insulations are, to some extent, attacked by rodents. This is the conclusion of a study reported in the February issue of "Landtechnik," a German publication. The findings are confirmed by building owners who complain that, "many animal species find living conditions more pleasant within some insulation materials, even if they have sufficient food and the temperature is normal."

- *The Test Method*

Tests were conducted in a room heated to between 64°F (18°C) and 68°F (20°C). Four adult mice were shut in cages with the sides covered with the thermal insulation to be tested. Each insulation material was tested six times.

Inside the cage, a nest was placed with sufficient food and water. The mice remained in the cage until at least a third of the material tested was destroyed during the maximum period of 20 days.

- *The Results*

Most of the insulating materials were destroyed within a relatively short time. The study clearly shows that the best result was achieved by cellular glass insulation. It was attacked slightly—only twice during the six tests carried out on the material.

DESTRUCTION OF INSULATION MATERIALS BY VERMIN				
Types of Insulation Materials	Materials Destroyed per group per day in ft			Average Test Duration in Days
	AVG.	MIN.	MAX.	
Chipboard panels w/cement bonding	1.81	0.94	3.14	16.0
Expanded polystyrene	27.50	5.31	39.19	2.0
Expanded polystyrene	49.34	30.93	86.77	3.5
Expanded polystyrene w/wood chips	36.48	13.36	64.36	3.0
Extruded polystyrene	13.25	0.12	37.27	9.5
Extruded polystyrene	11.11	0.07	22.62	11.5
Extruded polystyrene	18.61	15.32	18.91	4.9
Polyurethane	16.67	.02	44.59	5.7
Polyurethane coated w/bituminous paper	11.86	.03	24.55	7.7
Fiber Glass	65.53	50.14	78.87	1.0
Cellular glass	0.04	0	0.19	17.0
Perlite-based panel	21.37	14.38	26.32	7.0

- *Insects*

Insulation materials can be destroyed by insects if the materials are not tough enough to resist their gnawing and boring.

Various types of beetles, among other insects, have been found to tunnel through extruded polystyrene, expanded polystyrene, perlite and other insulations on both pipelines and roofs. Eventually, with borings in close proximity, the entire insulation system becomes damaged and ineffective, and subject to collapse. Many insects can undergo their complete metamorphosis within certain insulations.

Termites thrive nearly all over the world. Subterranean termites must have a constant supply of moisture in order to construct mud tubes that connect the main colony in the soil to the food source.

A relationship between the use of some insulation materials and the expansion of termite populations has been proven.

Current construction practices include the use of expanded or extruded polystyrene panels to insulate foundation walls. This creates two major problems: extreme difficulty in detecting the mud tubes in these materials, and lack of suitable insecticides for treating infestations.

Although termites cannot obtain nutrients from these insulation materials, the panels provide a protective environment for tunneling from the ground to wooden structures, even when these structures are protected by concrete block or poured cement. And when the termites are detected, treatment is difficult because carriers and solvents of the insecticides registered for use against subterranean termites dissolve the polystyrene.

- *Microorganisms*

Fungi and bacteria are ubiquitous in air and on natural substrates, so they are always available to attack any suitable insulation material when moisture and temperature conditions are appropriate. Even the use of filtration in ventilating systems may not prevent intrusion of spores or bacterial cells into a facility because other pathways of entry exist.

Food materials for these microorganisms are readily available in the organic materials used in the structure and decoration of homes, buildings and plants. Limiting the use of organic-based materials to prevent microbial growth is impractical except where moisture is present or condensation is likely, and the removal of contaminated material would be difficult. For example, organic insulation materials should not be used in ventilation systems where relative humidity will routinely exceed 75%, or where removal would be costly.

If moisture does not have access to organic materials, fungal and bacterial growth can be curtailed. In commercial and industrial facilities where chillers, chilled water and steam systems are common, the selection of an inorganic, impermeable insulation material becomes critical for reducing growth of these microorganisms.

Insulation materials themselves are generally not a culture medium for these organisms. However, the airborne spores of fungi and other microorganisms are often attracted to the "soils" that are formed in many open-structured insulations where moisture, dust and greasy substances collect.

For example, in Baltimore, a cellulose-based, fire protection insulation was used throughout a hospital's ventilating system. It subsequently became damp because of condensation. Fungal spores, which can cause human infections, increased rapidly and were transmitted via the system. Eventually, this caused an epidemic followed by lawsuits. The material had to be removed from the entire building.

Other serious problems may occur where commercial and industrial buildings are constructed without basements—particularly when they are near areas used for food production or storage.

THE COMPONENT, PRINCIPLE SOURCES AND HEALTH HAZARDS CAUSED BY MICROORGANISMS			
Bioaerosol	Component	Principle Sources	Primary Health Effects
Fungi	Organisms	Damp surfaces	Hypersensitivity Pneumonitis (HP)
	Spores	Outdoor air, damp surfaces	Asthma, Rhinitis
	Antigens	Outdoor air	Systemic Infection
	Toxins	Damp surfaces	Cancer
	Volatile	Damp surfaces	Stachybotryotoxicosis Headaches, Mucous Membrane Irritants
Bacteria	Organisms	Cooling towers	Pneumonia
	Spores	Hot water sources, hot damp surfaces	Hypersensitivity Pneumonitis (HP)
	Product	Stagnant water reservoirs, industrial processes	Humidifier Fever, chills Asthma

THE PROBLEMS CAUSED BY VERMIN ARE THREE-FOLD

- There is the loss of thermal efficiency that results from partial or total destruction of the insulation.
- Second, there is the potential for transmission of infectious diseases to humans and domestic animals through contamination of food, transmission of airborne microorganisms, etc.
- Finally, there are the enormous economic losses, including increased energy consumption, corrosion and repair costs of installations exposed by gnawing, short-circuited electrical installations, costs to repair roof and pipe insulation and waterproofing layers—even structural loss and the deterioration of products produced or stored at the facility.

The FOAMGLAS® Cellular Glass Insulation Solution

Virtually all of the vermin problems encountered with other insulation materials are eliminated with cellular glass. In addition, when properly installed, this material can even serve as a barrier to vermin damage.

The resistance of cellular glass insulation to rats, mice, insects and microorganisms has been proven in both carefully executed tests and in decades of field service. There are no known reports of attack or destruction of cellular glass insulation by these life forms.

In testing going back as far as the 1940s, the insulation was declared "ratproof" and free of evidence of attack by gnawing or boring insects. In fact, the rodent-resisting ability of cellular glass is so great that it can be categorized along with concrete, sheet metal and glass as a building material that discourages gnawing.