



Regional Challenges

Participants highlighted inconsistencies in inspection and enforcement practices across different jurisdictions.



Training Hurdles

There is a significant need for training in safety protocols, retrofitting techniques, and regulatory compliance.



Safety Concerns

Workforce safety is shaped by jobsite pressures like labor shortages, compressed schedules, and poor coordination.



Energy Efficiency

Mechanical insulation is a cost-effective strategy, saving \$2.5 billion annually in industrial energy costs.



Insulation Strategies

Early involvement of insulation experts in project planning is essential for high-quality, efficient outcomes.

About This Research

This study explores the challenges faced by the heat and frost mechanical insulation workforce in retrofitting aging systems in the US and Canada. As infrastructure ages, insulators must address deteriorated components and hazardous materials, making their work complex and safety-critical. To achieve this, a longitudinal study is conducted, including combining a survey of 369 professional mechanical insulators with three follow-up focus group interviews involving 11 industry representatives, including contractors and facility managers.



This study identifies areas for support, including hazard awareness, technical skills, and standardized practices, to strengthen the mechanical insulation industry.

This longitudinal study was conducted by researchers (Parisa Salehi, Dr. Aslihan Karatas, Dr. Sogand Hasanzadeh, Dr. Behzad Esmaeili)

Contact Information for more details:



akaratas@uic.edu



<https://uicbeilab.github.io/>



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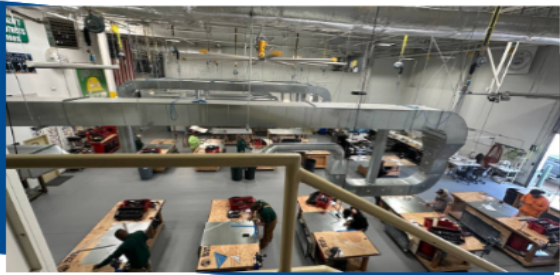
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**HEAT & FROST
INSULATORS**
AND ALLIED WORKERS. EST.1903

Current Challenges in Aging Infrastructure for Mechanical Heat and Frost Insulation Workforce



Supporting the Heat and Frost Mechanical Insulators means more than protecting workers; it strengthens energy efficiency, improves retrofit quality, and helps ensure the long-term performance of aging infrastructure.

Key Survey Findings



The survey highlights several key challenges in retrofitting aging mechanical systems: (1) incomplete or inaccurate documentation, (2) pervasive mold and moisture issues, (3) complex regulatory compliance, (4) hazardous material exposure, and (5) difficult retrofitting conditions. These factors significantly reduce efficiency, increase physical strain, and elevate health and safety risks for the workforce.

Incomplete or inaccurate historical documentation is a common issue, with 70% of insulators encountering it frequently or occasionally. Due to incomplete or inaccurate historical documentation, 46% of participants experienced a moderate to significant impact on work efficiency. They also require additional time for accurate repairs and upgrades of aging mechanical systems. Moreover, 78% of participants, regardless of experience level, consider assistance from experienced insulators to be highly valuable.

Insulators encounter hazardous materials in both aging and newer mechanical systems, though their frequency is 10% higher in aging ones. Among participants working on aging mechanical systems, 90% reported exposure to hazardous materials, and 30% experienced health issues.

Key Survey Findings

The top training needs for working on aging mechanical systems are safety training (38%), retrofitting techniques (32%), and regulatory compliance (28%). Moreover, less experienced insulators emphasize retrofitting skills (38%). Almost 80% of insulators are satisfied with their training. However, 68% of insulators believe additional training is necessary, particularly in handling hazardous materials, improving safety protocols, and understanding aging system designs.

The three most challenging regulations for working on aging mechanical systems are safety regulations (29%), environmental standards (27%), and energy compliance (27%). Environmental compliance is more challenging in the United States, whereas safety regulations are the primary concern in Canada. Experienced insulators found energy compliance more challenging, while less experienced ones reported greater difficulty with safety regulations.



Focus Group Insights

Focus group utilized a framework of Experiences (conditions encountered), Actions (responses in the field), and Needs (required support).

What did participants experience?

- Workforce and scheduling pressures were primary concerns.
- Cost constraints and poor jobsite coordination frequently undermined installation quality.
- Aging infrastructure, climate exposure, and hazardous materials introduced significant risks.
- Participants noted inconsistent inspection practices and a lack of recognition for insulation expertise.

How is the workforce responding?

Industry professionals are prioritizing technical, quality-focused responses, including rigorous retrofit practices and strict standards compliance.

- Mentorship and apprenticeship remain essential for knowledge transfer.
- Routine safety briefings help manage field hazards.
- Ongoing outreach on energy efficiency is critical for educating clients, owners, and policymakers.

What is still needed?

- Enhanced safety and hazard-awareness training.
- More consistent standards across all contractors and jurisdictions.
- Earlier involvement of insulation experts in project planning and design.
- Improved inspection and specification practices.