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THE ICYNENE® ADVANTAGE

APPLICATION CASE STUDY:

Insulating a Metal Building for Air Sealing/ Energy Efficiency

Synopsis:

- ✓ Twice as effective at air sealing versus conventional insulation
- ✓ Effective in maintaining lower temperatures in non air conditioned spaces
- ✓ Annual HVAC costs of $1.98 per square foot

The Challenge:

Corrugated steel panel buildings are very popular and are used for everything from laboratories to churches.

> *"However, the panel-style construction technique produces many standing seams in the building envelope. While these are almost always weather tight, they are rarely air tight. This construction method can result in very high infiltration rates. This increases HVAC costs significantly."* [1] *"Random air leakage can account for 30% to 40% of heating/cooling energy costs used within a structure."* [2]

The University of Florida wanted to remodel a corrugated steel building (Building #243) previously used for storage into an Environmental Biotechnology Laboratory. The original structure contained no insulation.

Building Dimensions:	Floor Area	920	sq.ft.
	Avg. Building Height	16.125	ft.

The building envelope for this laboratory was a typical commercial steel panel style construction. Controlling air infiltration in this type of structure is difficult at best.

This project was a collaborative effort between the University of Florida/Energy Extension Service (UF/EES), the Florida Solar Energy Center (FSEC), and the University of Florida/Soil and Water Science Department.

The FSEC was contracted to devise the systems that would seal the building envelope, execute blower door testing, perform detailed building energy simulations for the remodeled structure, size an HVAC system, and check / adjust airflow.

Building 243 at the University of Florida.

The building utilized standard corrugated steel panel construction.

The Solution – Air Sealing with ICYNENE LD-C-50™†:

The original scope of work had FSEC sealing gaps and penetrations in the building envelope (using weather-stripping, caulking, etc.) after renovation to reduce/eliminate uncontrolled flow of hot and humid outdoor air into the lab building. Early in the project, FSEC identified a foam insulation product (Icynene) that could be used within the lab that would insulate and act as an air barrier.

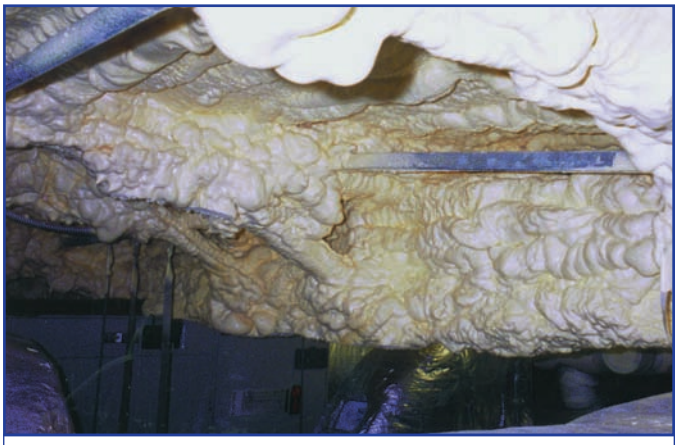
> *"The foam insulation had many desirable features, including the ability to insulate the exterior walls/ roof of the building and significantly air tighten the structure by filling nearly all of the cracks and crevices inherent with steel building construction."* (3.)

> *"UF/EES personnel agreed that this foam insulation product should be used on this lab building. Therefore, FSEC scope of work was reduced since additional air tightening of the building envelope would not be required"* (4.)

Icynene insulation:
- 3.5 inches sprayed on walls
- 5.5 inches sprayed on underside of roof
- metal beams and purlins located in the mezzanine were sprayed to prevent heat exchange

The original renovation plan specified 7 low e double-pane windows. These windows were calculated as not cost effective for this particular project – payback period was 15 years. The building was completed using 7 single pane clear windows with aluminum frames.

The Icynene foam was left exposed in the mechanical room, which is located in the upper area of the building.



Beams and purlins were covered in Icynene to ensure there was no conductive heat transfer from the metal roof.

The Results:

FSEC personnel performed an air-tightness test on the building in August 1995 prior to the start of renovation. Another test was performed in July 1998 after the Icynene foam insulation had been installed but prior to the completion of final building penetrations and proper sealing of these penetrations. Final air-tightness testing was completed on March 5, 1999, and a summary report was provided to UF/ESS on March 8, 1999.

> *"The air-tightness tests indicated that the (Icynene) foam insulation did an excellent job at sealing the steel structure, improving the air-tightness of the building even beyond the target level established during the design phase of the project."* (5.)

Benchmarks	- Average air-tightness for small commercial buildings is 10 ACH_{50} [6] - Project goal for the lab was between 6 and 7 ACH_{50}	
		Air Changes per Hour (ACH) when the building was depressurized 50 pascals with respect to outdoors
August 1995	Prior to the construction renovation	17.8 ACH_{50}
July 1998	After installation of the Icynene foam insulation and interior drywall.	5.4 ACH_{50}
March 1999	Final foaming of all penetrations of building envelope.	4.1 ACH_{50}

This building, after renovation, was operated with an annual HVAC cost of $1.98 per square foot. The HVAC equipment includes:

- 5 ton heat pump (SEER 15)
- 5 ton air conditioning unit (SEER 14)
- Two variable speed drive fans
- Johnson Controls Metasys Panels
- Semco and AirXchange Enthalpy Recovery Wheels

Mechanical room spaces that had Icynene insulation but were not part of the air conditioned space were in the low 90's (F) even during the hottest days.

Icynene air sealed the building envelope tighter than the project requirements and ***twice as tight as the air sealing properties of standard metal buildings with conventional insulation.***

Wendell Porter of the University of Florida demonstrates, on a June day, how Icynene keeps the unconditioned mechanical room at a comfortable temperature.

Wendell Porter demonstrates how the Icynene insulation is cool to the touch and prevents the metal roof deck from heating the interior air. On this June day, the exposed metal roof deck demonstration area was too hot to touch.

Icynene Insulation

Icynene foam insulation products are sprayed into/onto walls, crawlspaces, underside of roofs, attics and ceilings by Icynene Licensed Dealers. They expand in seconds to create superior insulating and air-sealing results. Every crevice, crack, electrical box, duct and exterior penetration is effortlessly sealed to reduce energy-robbing random air leakage. Icynene products adhere to the construction material and remain flexible so that the integrity of the building envelope seal remains intact over time.

Icynene is ideal for residential, commercial, industrial and institutional indoor applications. The products are:

Healthier: Icynene spray foam products are CHPS (Collaborative for High Performance Schools) EQ 2.2 Section 01350 Compliant, meeting nationally recognized requirements as Low-Emitting Materials (LEM) and Environmentally Preferable Products (EPP). Icynene spray foam products are 100% water-blown and contain no HFCs or PBDEs. Icynene seals out dust, pollen and other allergens from entering the structure. As air barriers, Icynene products minimize the potential for airborne moisture build-up and related problems such as mold and mildew.

Quieter: By air-sealing the building envelope, Icynene effectively minimizes airborne sounds. Icynene is perfect for reducing unwanted noises from home theaters, plumbing runs and playrooms.

More Energy Efficient: Icynene delivers up to 50% more energy savings versus traditional insulation.

Information about Icynene insulation can be obtained by calling Icynene Inc. (800-758-7325), visiting the website Icynene.com, or contacting your local Icynene Licensed Dealer.

† The Icynene product installed and addressed in this project example is Icynene's classic formula, ICYNENE LD-C-50™.

Endnotes:

1. Florida Energy Extension Service – University of Florida, Final Report 96-SE-2Y-03-11-05-218 executive summary, page 2
2. Florida Energy Extension Service – University of Florida, Final Report 96-SE-2Y-03-11-05-218 executive summary
3. Florida Solar Energy Center, Final Report FSEC-CR-1153-00, February 2000, page 4
4. Florida Solar Energy Center, Final Report FSEC-CR-1153-00, February 2000, page 4
5. Florida Solar Energy Center, Final Report FSEC-CR-1153-00, February 2000, page 4
6. Florida Solar Energy Center Progress Report for July – September 1998

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