

# INFRA **RED** ANALYZERS INC Certified Thermographers

1

## Java / Video Test



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Founded in 1984, we are an independent consulting firm serving thousands of commercial and institutional clients, including Fortune 500 companies such as GE, IBM, General Dynamics, UPS, International Paper, Wyeth, and Anheuser-Busch, and Lincoln Center, MIT, Brown University, and Dartmouth College.

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The American Society for Nondestructive Testing is the only independent professional organization providing standards for the education and training of infrared thermographers.



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**All of Infra-red Analyzers' Certified Thermographers have completed courses of study and passed examinations as specified by ASNT.**

**In addition, we provide ongoing training and support to our staff in all applications of thermographic testing.**



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## **Committed to Energy Efficiency and Green Building Practice**

**Infra-red Analyzers is proud to be a member of the U.S. Green Building Council, which promotes environmentally responsible buildings and communities that are profitable, healthy places to live and work.**



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# Infrared Thermography

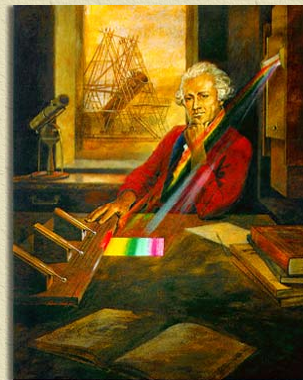
Nondestructive Testing Analyzes  
Building Envelope Performance

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## Sir William Herschel



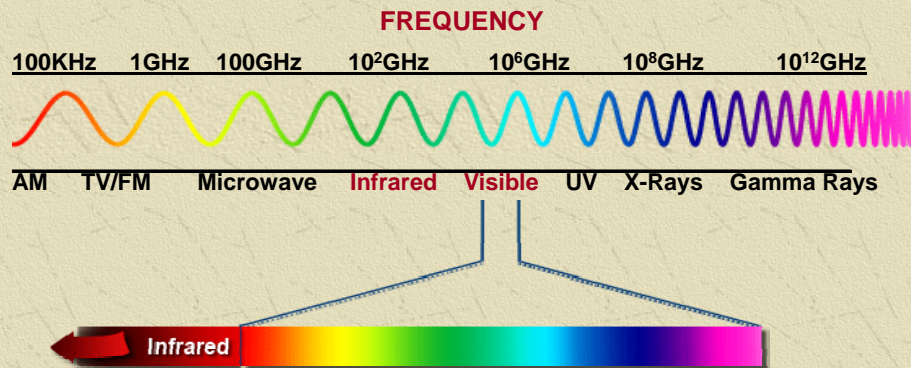
- ✦ Proved existence of infrared radiation, or “calorific rays”
- ✦ Discovered the planet Uranus in 1781
- ✦ His son, John, made the first thermal image in 1830



**Date: 1800**

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# The Electromagnetic Spectrum



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## ThermaCAM™ PM390



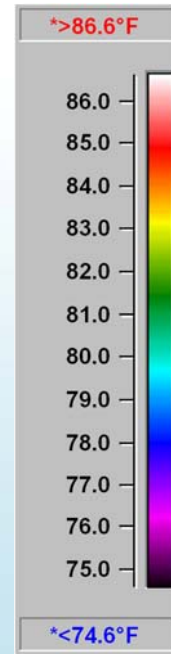
- Digital state-of-the-art focal plane array short wave camera
- Over 65,000 individual detectors
- Sensitive to less than 0.1°C
- Hard copy documentation with videotape, computer disk or photograph (thermogram)

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# Thermogram Interpretation

- Thermograms are digital heat images. The infrared camera is calibrated by the thermographer to represent the desired temperature range in a full spectrum of colors.



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## Building Envelope Analysis

**Infrared Thermography is the only non-destructive and complete system for locating moisture damage, excessive air leakage, and conduction losses in all types of building envelopes.**

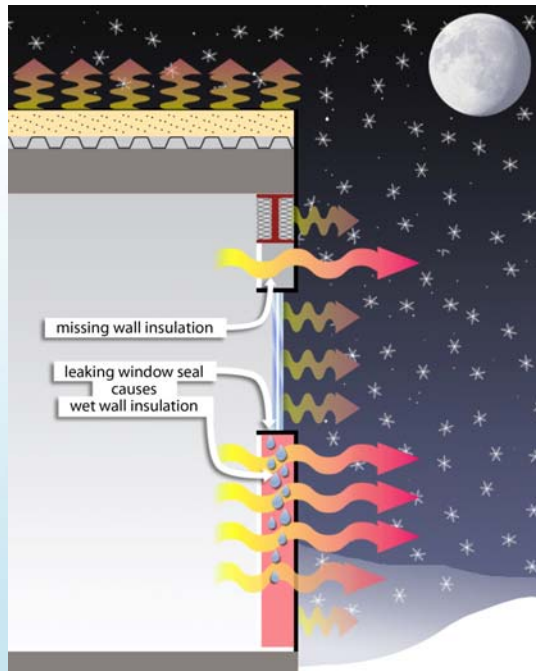
**Many buildings have hidden construction problems that significantly reduce energy efficiency and the integrity and performance of the building envelope.**

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## Impacts of Building Heat Losses

- Drafts, cold and hot spots, occupant discomfort
  - Escalating heating and cooling costs
- Condensation build-up inside walls, roofs, on building surfaces
  - Insulation damage and reduced R-values
- Wood rot, metal corrosion, staining of bricks and concrete
  - Ice dams, frozen pipes
  - Mold growth
- Failure of critical structural components

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## Building Heat Losses

Buildings lose heat two ways:

- 1) **Conduction:** Transfer of heat through solid materials
- **Wet materials** conduct heat much more rapidly than dry materials.
- **Tiny pockets of still air** give insulation its ability to retard heat flow (R-value).
- **R-value is drastically reduced** when air pockets are filled with moisture.

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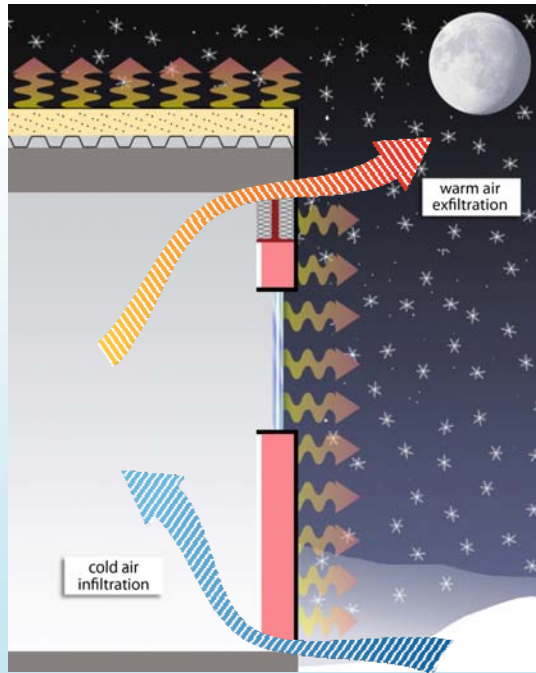


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## Stack Effect

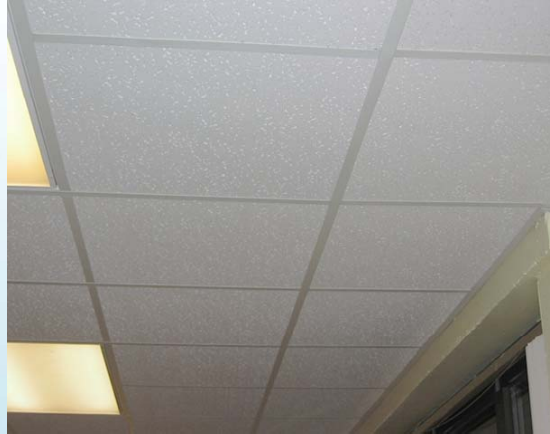
- Cold air infiltration near bottom of building and warm air exfiltration near the top.
- As warm air escapes it must be replaced, so cold outdoor air is pulled into the structure near the bottom.
- Rising warm air creates positive pressure near top of building and negative pressure near the bottom.
- Stack effect substantially reduces occupant comfort and increases heating costs.

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## Forensics - Troubleshooting Infrared Testing Pinpoints Causes of:

- Moisture damage
  - Frozen pipes
  - Ice dams and water intrusion
- Missing, wet, or disturbed insulation
  - Cold or drafty living spaces
  - High heating and cooling costs
- Mold infestations (does not actually “see” mold)

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## Energy Efficiency

**Building Owners and Managers are increasingly focused on reducing their heating costs and carbon footprint.**

**LEED certification is rapidly being adopted by many of the players.**

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- **Infrared Testing is the first step in developing a comprehensive and cost-effective plan**
- **Complements but does not replace the need for quantitative calculations**
- **Reveals building performance issues not detectable with traditional techniques**
- **Finds opportunities nobody knew existed**
- **Focuses on actual energy losses and cost-effective solutions**



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## Post-Construction Evaluation

- Acceptance Testing
- Building Commissioning
- LEED Certification



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- **Post-construction verification of materials & workmanship**
- **Evaluates windows, doors, wall systems, roofing and foundation**
- **Verifies and documents actual performance of the building – not the design performance**
- **Makes sure owners get the quality and performance they paid for**

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# Recommendations & Priorities

We track down the sources of problems  
and recommend cost-effective  
strategies to correct them.

Problem areas are prioritized to help  
maximize return on investment.



## Roof Moisture Surveys



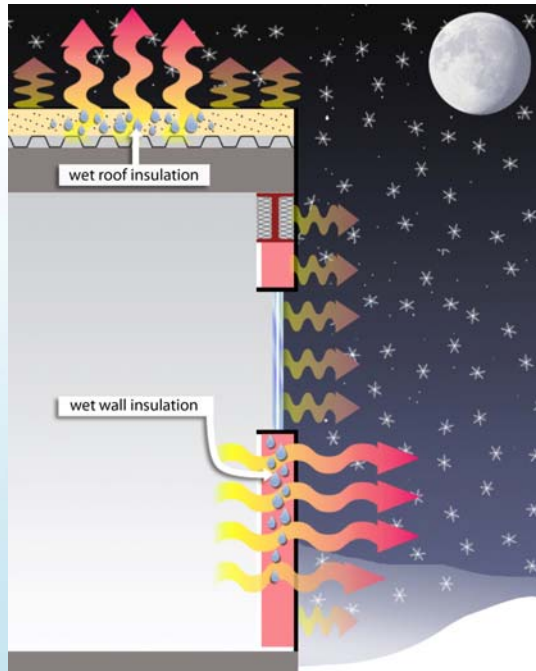
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## Roof Moisture Analysis: Infrared & Nuclear

Nondestructive Testing that locates and documents water-damaged insulation in all types of roofing systems:

- Smooth Surface
- Graveled
- Ballasted

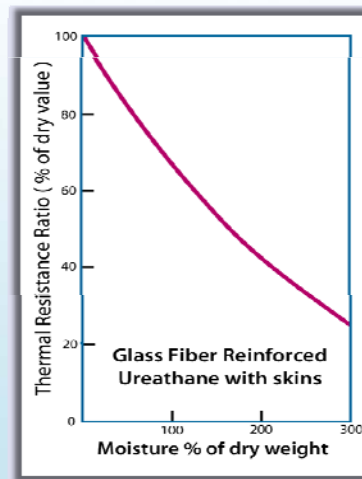
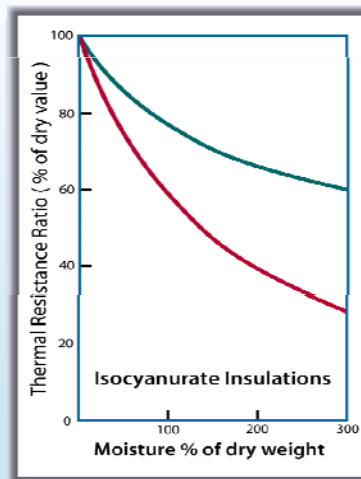
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## Building Heat Losses: Roofs

- Wet roof insulation increases conduction losses.
- Moisture in the insulation substantially reduces its R-value and increases heating and cooling costs.

## Thermal Resistance vs Moisture Content



Moisture Gain and its Thermal Consequences for Common Roof Insulations, U.S. Army Corps of Engineers, CRREL

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**Wet insulation absorbs more solar gain during the day...**

The diagram illustrates the process of solar gain during the day. A bright yellow sun is shown in the upper left, with several yellow lines representing solar radiation rays pointing towards a cross-section of a building's exterior wall. The wall consists of a wavy insulation layer at the bottom, a middle layer containing blue water droplets, and a top surface. The solar rays strike the top surface, creating a series of wavy, multi-colored arrows (yellow, orange, red) that point downwards into the insulation and water layer, indicating the absorption of solar energy. The background is a light blue gradient.

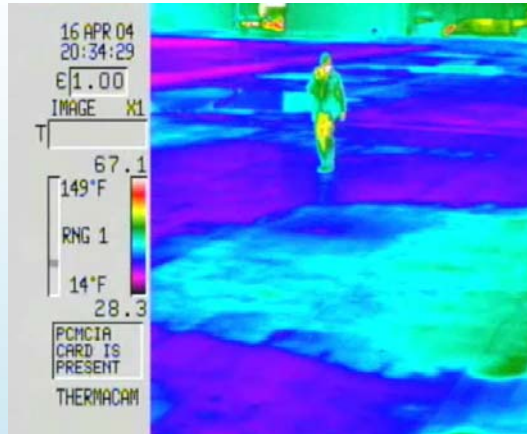
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**..and it releases more stored solar heat during the night.**

The diagram illustrates the release of stored solar heat during the night. The background is dark blue with a full moon in the upper left and small white stars. A handheld infrared thermometer is shown on the right, pointing towards a cross-section of a building's exterior wall. The wall has a wavy insulation layer at the bottom, a middle layer containing blue water droplets, and a top surface. From the top surface, a series of wavy, multi-colored arrows (red, orange, yellow) point upwards, representing the release of stored heat. The background is a dark blue gradient.

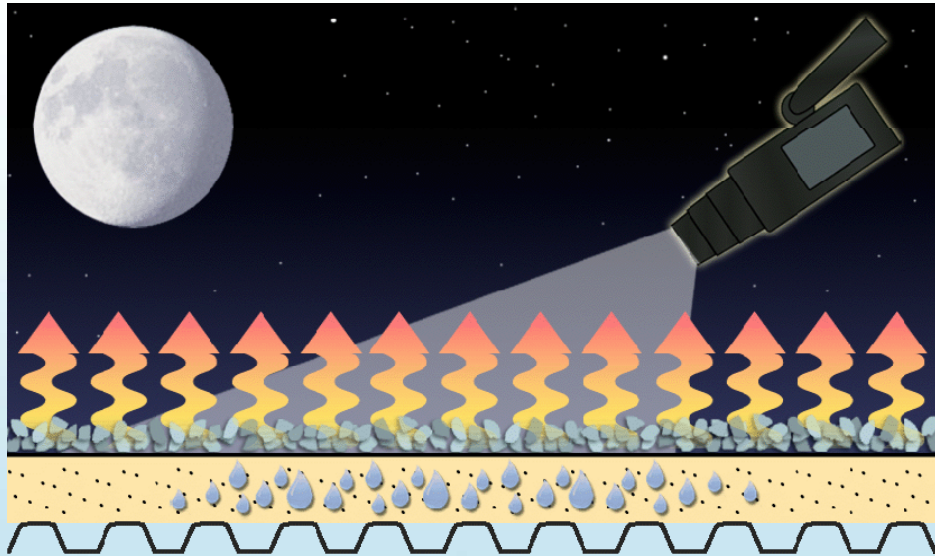
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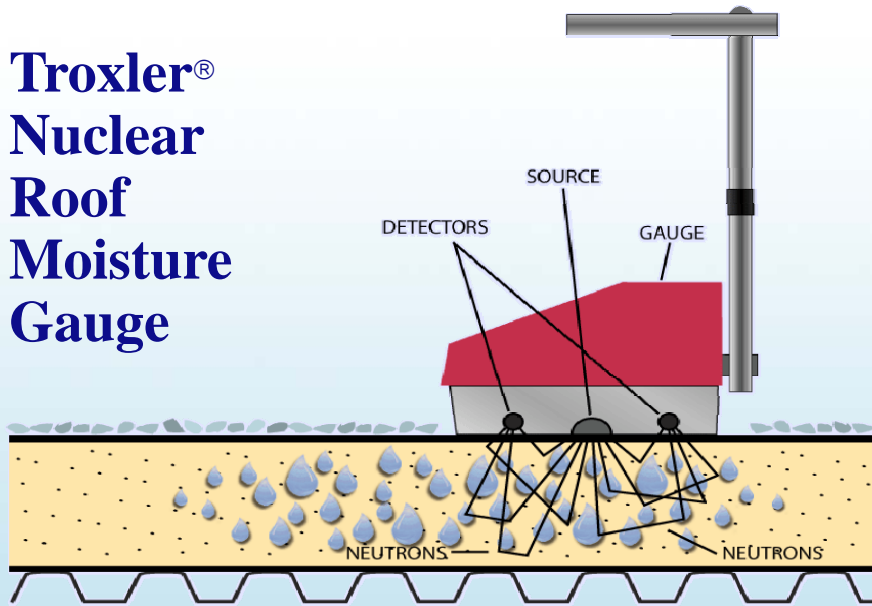
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## Thermal Masking

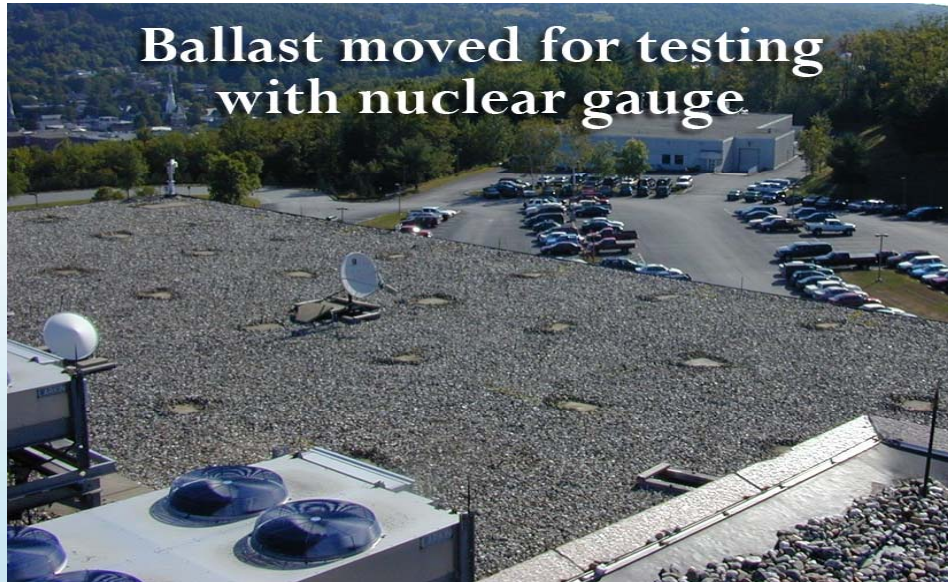


# Troxler® Nuclear Roof Moisture Gauge



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## Ballast moved for testing with nuclear gauge.



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## Technician Using Nuclear Roof Moisture Gauge



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## 1. The only proven scientific method for evaluating the roof's condition

- The survey is independent and unbiased.
- Our only goal is to provide accurate information about the condition of the roof.

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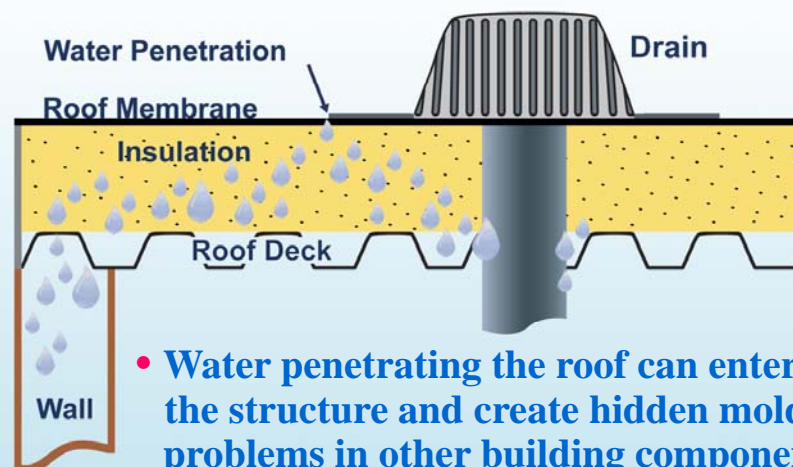


## 2. Pinpoint areas of mold growth

- **Wet roofing provides an excellent environment for mold. Mold requires three things for growth:**
  1. **Nutrient Source: Roof insulations**
  2. **Moisture: Leaky roofs feed the problem**
  3. **Optimum Temperature: Roofs are at excellent temperatures for mold growth during much of the year**

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## 3. Targets Sites of Moisture Infiltration



- **Water penetrating the roof can enter the structure and create hidden mold problems in other building components; floors, ceilings and walls.**

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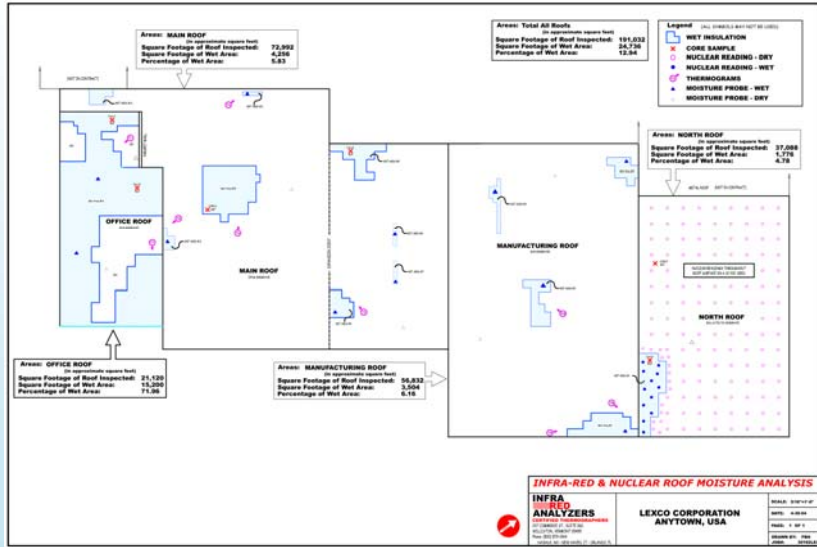
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#### **4. Infrared surveys provide excellent information at low cost**

- **Infrared Surveys typically cost less than 1% of the cost of new roofing; 3-6 cents/sf versus \$5.00–\$8.00/sf for roof replacement.**
- **Roofing decisions involve tens or even hundreds of thousands of dollars. Accurate, scientific information encourages better decisions.**

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# Report Documentation



**Thank you!**