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2<sup>nd</sup> Notice

## The *Hottest* Connection

A recent discussion on the Snell Infrared messageboard raised a question often heard when any thermographers get together. "How hot was the hottest electrical connection you've ever found?" was the question posed by Neal Dunn, a thermographer at Hanover Electric Motors in North Carolina.

The "bidding" quickly rose from a starting point of 387° F/197.22° C to Mike Johnsen's (I-R Spectrum Services) 469° F/242.77° C, and went to Brian Yarborough's (HSB Thermography Services) over 1200° F/648.88° C. From faraway Turkey, we heard that Ibrahim Caglayan had found a problem at 268° F/131.11° C, and then Bob Berry (Thermal Vision) checked in with one at 339° F/170.55° C. Jimmy Nelson, also of HSB, chided that his more than 600° F/315.55° C problem made Dunn's look like "syrup on a pancake." Finally, Rich Wurzbach (Maintenance Reliability Group) passed along a find from Mark Lanius (Exelon) of over 842° F/450° C.

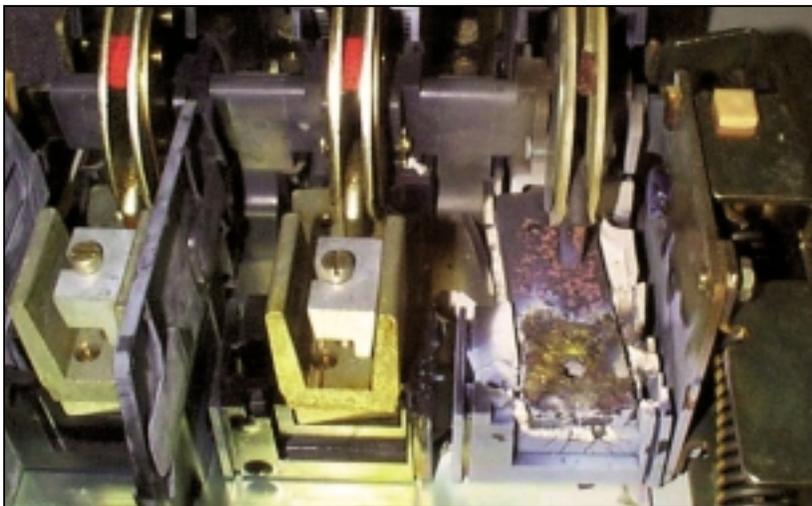
We received the final chapter to this story, however, in a (snail)mail note that really made us sit up and take notice. Mike Peterson (GM) sent an image that he snapped of an Allen-Bradley 400-Amp, 600-volt, flange-mounted disconnect on a main control panel in an air house. When he first found it, the disconnect blade was 1,233° F/667.22° C. He was amazed it was still in operation. After notifying the area operator, they discovered that it would take twenty-four hours to receive the new part. Unfortunately, it was then backordered

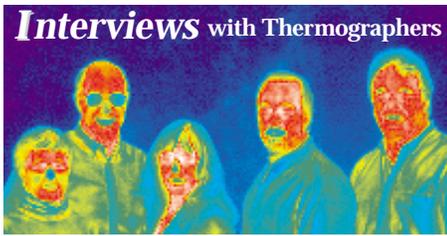
**When he first found it, the disconnect blade was 1,233° F, or 667.22° C. He was amazed it was still in operation.**

and did not show up for nine days. Management then made a decision to wait for the following weekend to shut down.

Fourteen days after finding this problem, Mike inspected it one more time. His image "topped all the competition" by showing a maximum temperature at the blade of 1,604° F/873.33° C. As luck would have it, the device failed the next day! No one was hurt, and the failure—luckily—was not catastrophic. They were back up and running two hours later.

A post-failure investigation showed that electricians had probably tightened the fuse connection but did not remove the fuse to check the fuse-holder mounting screws. A lesson learned for all of us. Thank you, Mike. By the way, if you've found anything hotter than this, we suggest you just keep it to yourself and count yourself lucky that you walked away safely!





Steve Mongeau has served as the Predictive Maintenance Engineer and Infrared Thermography Program Coordinator at Palisades Nuclear Station (Covert, Michigan) for the past eight months. The station is a pressurized water reactor that generates 840 megawatts of power for the Midwest. Although feeling like he has only just gotten

Engineering degree at Michigan State University, he was anxious to expand the use of the technology into non-electrical applications. He has branched out into inspecting emergency diesel generators and station air compressors as well as pumps, motors, and steam traps. He uses ultrasound and reciprocating monitoring to supplement these inspections.

He recently made a unique find in the heat exchanger system. The system cools air in the reactor containment structure, a hundred-foot tall cylinder the walls of which are three-foot thick concrete. Four water to air exchangers, each with four coil units, are cooled with water pumped directly from

The exchanger coil system was designed in such a way that the tubes should never have plugged. However, Steve found several tubes that were, in fact, at a different temperature, suggesting they were partially blocked. Further testing confirmed the fact that biological growth, probably tubercles, had broken free upstream and lodged in the piping. Since Steve's discovery, systems engineers are working to monitor the problem more effectively and flush the piping during outages. This valuable inspection method has not yet been widely used in other water-cooled reactors, a situation Steve hopes will change in the future.

The Palisades program has also paid important indirect returns. Like many nuclear stations, it is eligible for credits from the company that insures it, the Nuclear Service Organization. For a thermography program to receive full credit from NEIL the program must be founded on the solid ground of having a written practice that fully complies with the standards of ASNT. It must also have clear written inspection procedures; Steve is currently undertaking the task of updating and revising existing procedures. Of course, thermographers must also be qualified; Steve received his training from Snell Infrared in a course sponsored by EPRI in May, 2000. Others at the plant who are using the technology will be receiving training at the site later this spring.

With his growing duties, I believe Steve doesn't have a lot of time to spare but when he does he practices both guitar and martial arts. And since he enjoys it so much, he now pretty much looks at infrared as a full-time hobby too. We expect to hear more from him as he continues to practice his newfound "hobby."



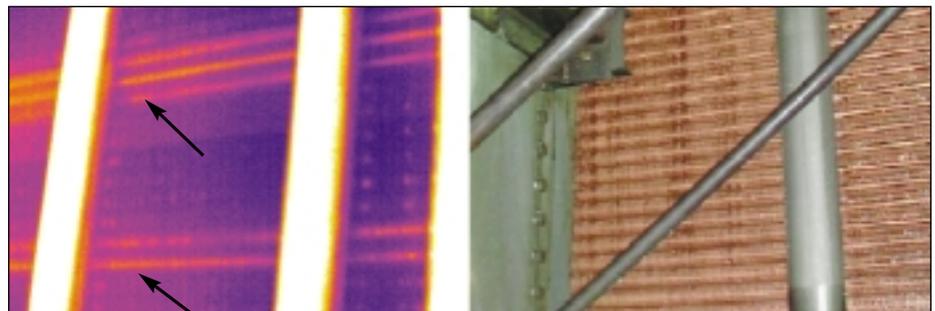
From the air side of the heat exchanger the water tubes can be seen as well as the differences in cooling that are taking place inside the exchanger (cooler area on right side of thermogram).

started, he has no doubts about the value of the technology. It has already proven itself a number of times helping them locate both routine maintenance problems and, in several instances, larger problems that would have taken the station off line.

Originally using a Prism DS, his first big find was a failing transformer. After that he was hooked! He has recently upgraded his equipment to a lighter weight system, a ThermoCAM® 695. Their team of a half-dozen electrical maintenance people began using infrared regularly and have had six major finds in breakers. One, in particular, which fed a load center, had a 60°F phase-to-phase rise when they found it. They are currently monitoring it on a regular basis until the planned spring shutdown for re-fueling.

Steve has had good support from Consumers Energy (Nuclear Management Company), the owner and operator of the station. Having earned his Mechanical

Lake Michigan. In the event the reactor overheated, warm air from the containment would be circulated and cooled to protect the containment structure. A failure of this critical system could also result in increased temperatures inside the reactor dome which would be certain to result in a costly, unscheduled shutdown and probably a lengthy grilling by the NRC. Steve's investigation was, in fact, prompted by an unexplained increase in the dome temperature.



From the water tube side of the exchanger five tubes can be seen that are warmer than the others. These tubes are partially blocked by organic growth from the lake water.

# Thermal Solutions®

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*Mark K. Nichols, Conoco Inc.*

Thank you for putting a conference like this together so ideas can be shared and professional connections can be made.

*Bobby Fogle, Goddard Space Flight Center*

This was a great conference and well organized.

*Larry Burke, Abbott Laboratories*

The location of the conference was great and the hospitality was fantastic.

*John Moreno, General Motors*



Further information about the conference is available on the web at <http://www.thermal-solutions.org>.

Please call 800-636-9820 or e-mail [abstracts@thermal-solutions.org](mailto:abstracts@thermal-solutions.org) if you have any questions.

Send abstracts to: Thermal Solutions,  
P.O. Box 6, Montpelier, VT 05601-0006  
or e-mail [abstracts@thermal-solutions.org](mailto:abstracts@thermal-solutions.org)

### ***We're looking for papers... Have you considered presenting?***

Share your knowledge and experience with others in the infrared industry! If you're interested in presenting, write a brief abstract (100–200 words) and submit it for review.

**ABSTRACT DUE DATE:** JULY 13, 2001

**NOTIFICATION OF ACCEPTANCE:** AUGUST 17, 2001

**PAPER DUE DATE:** NOVEMBER 1, 2001

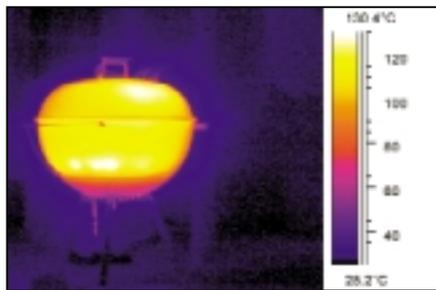
## Calibrated Cooking

There is a growing public awareness regarding the proper way to handle and cook meat to control normal bacterial contamination. Food handling is critical and achieving the correct internal temperature is key to safety. Keep these ideas in mind as we enter prime grilling season!

The USDA recommends the following minimum temperatures are maintained for at least fifteen seconds:

Steak/roast	155°F *
Ground meat	160°F
Ground poultry	165°F
Whole poultry	170°F
Poultry pieces	180°F
Whole fish	145°F

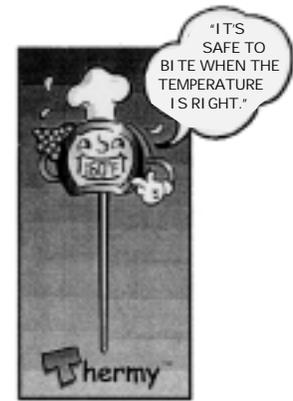
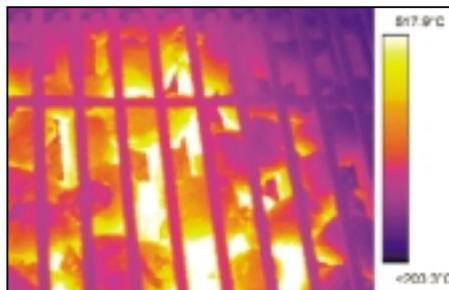
\*All temperatures except steak/roast are measured internally at the thickest part of the cut but not in contact with a bone.



Contrary to widely held belief, it is not possible to tell the temperature of the meat by its color during the cooking process. How do you know you've hit the magic temperature? An appropriate, calibrated temperature-measuring device, of course! A number of products, old and new, are readily available. It is important to understand how they work, how to use them properly, and to make sure they are in calibration.

Most good kitchen stores will have these:

- Thermocouple: these are fast (2–5 sec.) and convenient, having a thin probe attached to the readout by a wire.
- Thermistor: these semi-conductor probes are slower but still useful.
- Fork thermometer: a specialized thermocouple built into the tine of a meat fork;



Food Safety and Inspection Service, USDA

display is built into the handle. Unfortunately these cannot be calibrated.

- Dial thermometer: these devices, which are simply inserted into the meat, are rugged and accurate although slow.

You can check the calibration of any device by immersing it in baths of boiling water and ice water. If it is not reading correctly, you may be able to make an adjustment to bring it back into calibration.

Of course, if your fork thermometer is out of calibration, you can always get out the infrared camera to check on that steak! Simply set the emissivity at .98 and you should get a very accurate surface temperature. Seriously, for more information on safe cooking, visit [www.fsis.usda.gov](http://www.fsis.usda.gov).

Happy (and safe) grilling!

## The Sap is Running

A thermographer is showing his out-of-state friend around his home state of Vermont during late winter and says, "Look, the sap is running." The friend replies "Who is it?" Thus goes one of the oldest (and probably dumbest) jokes repeated every spring at the beginning of "sugaring" season, the time Vermonters gear up to make maple syrup. Nearly everyone who has tasted Vermont's finest knows sap is not a joke. The Agriculture Department ferociously defends the right to use the words "Pure Vermont Maple Syrup" only on a product that meets their high standards.

How does it all happen? The short version of the story is this: Sap is collected from Sugar Maple trees and boiled until it is concentrated into syrup. You can see plumes of steam rising from sugar houses all over the countryside during this time of the year.

Although not everyone develops a taste for it, anyone can tell you it is vastly different than what you buy at the grocery store in a plastic squeeze bottle!

Physiologically, deciduous trees like Sugar Maples become inactive after they shed their leaves. The sap, which is the active transport system for nutrients, is stored in the roots for the winter. As daytime temperatures begin rising above freezing, this slightly sweet liquid (containing 2–4% sugar) moves up into the branches as the tree gets ready to leaf out. By drilling a small hole through the cambium layer of the tree, sap can be directed through a spout or tube into a bucket.

Trees over 12" in diameter can be "tapped" every year without damage, and bigger trees can have more than one tap in them. On average, a tap produces five to

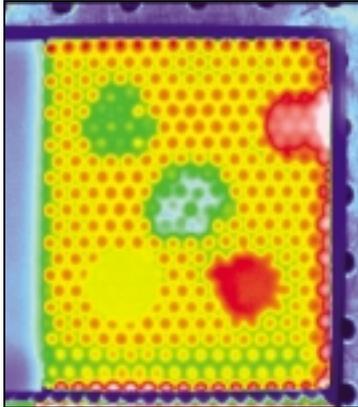


Matt Clark, thermographer from UNICCO Services, with Burr Morse, Vermont sugar maker

thirty gallons of sap in the brief three to six week season. The first sap of the season is usually the lightest color (higher grade) and often the sweetest.

Forty to fifty gallons of sap are boiled down to make a gallon of syrup, which is 67% sugar. The retail cost is \$30–40. When nighttime temperatures no longer fall below freezing, the sap stops flowing and the sugaring equipment is put away for another year. If you can't visit Vermont during sugaring season, at least pick up a pint and give it a try. You might just get hooked on it!

## Thermography Used in Materials Testing: You can learn this application and get certified!



Infrared is a reliable and remarkably fast tool used in the testing of materials. Potential applications include inspecting adhesive bonds, identifying delamination, exploring impact damage and detecting moisture incursion. Snell Infrared has teamed with Thermal Wave Imaging to offer both Level I and Level II training on this subject. The Level II course is coming up: it is available in Detroit July 16–20. One more Level I course will be offered this year: October 15–19.

ASNT guidelines for certification have always been a big factor in the non-destructive testing arena. If your company requires the three-part certification exam it will be available on the last day of the course.

Call Dee today for more information about this course at 800-636-9820.

### **Infrared camera tip of the day:**

If your infrared camera has a viewfinder, make sure you know how to adjust its diopter. It is the small magnifying lens that can be adjusted so the viewfinder screen is in focus. Adjust it until you can clearly see any letters on the screen. Now, when you adjust the camera's lens properly, your thermal images will also be in focus. Expect to adjust the diopter whenever you swap the camera with someone whose eyesight is dramatically different than yours.

### You can reach *Think Thermally*® at:

**Snell Infrared**  
**P.O. Box 6**  
**Montpelier, VT 05601-0006**

**Phone: 800-636-9820**

**Fax: 802-223-0460**

**E-mail:**

**<thinkthermally@snellinfrared.com>**

**Web Site: <http://www.snellinfrared.com>**

## ⚡ Think Electronically! ⚡

**2<sup>nd</sup> Notice**

We are changing the way we distribute *Think Thermally*®. Due to rising postage costs, we will be sending an electronic version of the newsletter by attachment to e-mail. There will be no charge to receive the electronic version, but there will be a subscription price for those who wish to continue to

receive a written copy. Most of our subscribers responded to the notice in our March issue, but we haven't heard from everyone. To guarantee uninterrupted delivery of the highly-acclaimed *Think Thermally*® newsletter, please take a minute to complete the form below and mail or fax it to us today.

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The type of infrared camera(s) I use: \_\_\_\_\_

# Snell Infrared Remaining 2001 Course Schedule

## Level I

June 4–8, Montpelier, VT  
July 23–27, Montpelier, VT  
August 6–10, Seattle, WA  
September 10–14, Kansas City, MO  
September 24–28, Montpelier, VT  
October 15–19, Cincinnati, OH  
October 22–26, Toronto, Canada  
November 5–9, Dallas, TX  
December 3–7, Montpelier, VT

## Level I Review Course with Certification Exam

August 21–23, Montpelier, VT

## Level II

June 4–8, Kansas City, MO  
August 13–17, Montpelier, VT  
September 24–28, Nashville, TN  
November 5–9, Dallas, TX

## Level II Review Course with Certification Exam

August 28–30, Montpelier, VT

## Level III, Best Practices

September 18–20, Montpelier, VT

## Non-destructive Evaluation of Materials

### Level I

October 15–19, Detroit, MI

### Level II

July 16–20, Detroit, MI

## Research, Development & Testing

October 30–November 2, Phoenix, AZ

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