



# The Razorback Report

www.arkansasashrae.org

Volume XX, Issue 5, January 2009

Arkansas Chapter Newsletter for the American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc.

## JANUARY MEETINGS

### Northwest Arkansas

Date: Thursday, January 15th

Location: Springdale Country Club

Cost: TBD

Schedule:

4:30 pm Steering Committee Meeting

5:30 pm Social

6:00 pm ASHRAE Business / Dinner

Program—"Survey of Energy and Sustainability Research" - Dr. Darrin Nutter

### Central Arkansas

Date: Tuesday January 13th

Location: Next Level Events

Cost: \$22 / person

Schedule:

10:30 am Board Meeting

11:30 am Tech Session - CSI

11:45 pm Lunch

12:00-1:00 pm Program - "Building Beyond The Code" - Rich Roe

## The President's Message

*By Kim Koch*

*Chapter President*

I have to take this opportunity to thank John Carter, Mike Fullerton and Chris Ahne for pulling together one of our most successful continuing education seminars ever. The geothermal heat pump seminar was well attended and very informative. It takes a lot of people to keep our great chapter running and John, Mike and Chris did a wonderful job with this opportunity for our members.

As I just said, it takes a lot of people to keep our chapter going. With that in mind we are already starting to look for committee chairs, co-chairs and others to help out next year. We need help from everyone to keep us going strong so please consider volunteering time to help us out.

As committee chairs, officers and co-chairs are found for next year, we will start looking towards this year's CRC. The CRC is in Lubbock, TX this year. As many of you know I am an engineer, not a sales representative, so it is a little bit of a stretch for me to convince anyone that Lubbock may be a wonderful place for just a regular vacation. However, I can without a doubt say that an ASHRAE CRC is a fun event no matter where it is held. Some of my favorite CRC memories are from the one I went to in Tyler, TX. It turns out that Region VIII ASHRAE members, and specifically Arkansas ASHRAE members will have fun wherever they get together.

Hope to see you at our January meeting which is our annual joint meeting with CSI. Unlike in the past this will be a noon meeting, located at Next Level Events. The topic will be discussing the ASHRAE 90.1 2007 with a focus on the building envelope.

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## News Flash - Breaking Story

EPA Proposes New Rules For R-22 Phase Out

**DETAILS BEGIN ON PAGE 3**

Month	Tech Session	Speaker	Meeting Topic	Speaker	Section	Date	Location	Meeting Designation	Sponsor
Sept	BIM— Lessons Learned	Mike Fullerton	ASHRAE & BIM	Gordon Holness ASHRAE President Elect	Central	9/4	Next Level Events— Union Station	Membership Promotion	TBA
					NWA	9/4	Golden Corral		
Oct	Eco Friendly Water Treatment	Gary Wirges	Water Conservation In The Sustainable Environment	Dennis Schnell	Central	10/1	Camp Aldersgate	Sustainability	TBA
					NWA	10/2	Whole Hog		
Nov	NA	NA	Presidential Visit— Maintain To Sustain	ASHRAE President Bill Harrison	Central	11/5	Next Level Events	Student Meeting	TBA
					NWA	11/4	AQ Chicken		
Dec	Research Promotion	Steve Titus	Data Center Cooling Requirements	Mike Lawler	Central	12/3	Camp Aldersgate	Research Promotion	TBA
					NWA	12/4	Whole Hog Bentonville		
Jan	TBA – <i>Joint Meeting with CSI</i>	Rich Roe	Building Be- yond The Code	Rich Roe	Central	1/13	Next Level Events	Joint Meeting w/ CSI	TBA
	-				-	Energy & Sustainability	Dr. Darin Nutter		
Feb	TBA	TBA	Modern Refrigerant Piping Practices	Joe Kirby	Central	2/4	Camp Aldersgate	Refrigeration	TBA
					NWA	2/5	TBA		
March	TBA	TBA	ASHRAE 90.1-2007 Update	Mick Schwedler	Central	3/4	Camp Aldersgate	Student Day	TBA
					NWA	3/5	TBA		
April	TBA	TBA	Tour Bethel Elementary	NA	Central	4/1	Bethel Elementary Bryant AR	Sustainability	TBA
	TBA	TBA	Tour Tyson Discovery	NA	NWA	4/2	TBA		
May	Social	NA	Past Presidents Night	NA	Central	TBA	Dickey Stephens Park	TBA	TBA
					NWA	TBA	TBA	TBA	TBA

## Northwest Section Update

Submitted by Landon Lay

Dr. Darin Nutter's presentation this month will be an overview of his ongoing and recent research related to energy and sustainability. The topics will cover both industrial and buildings related projects, including: life cycle assessment (LCA) analysis; GHG inventory at the UA; barriers to implementing industrial energy conservation opportunities (ECOs); night setback/setup simulations for K-12 classrooms buildings; and factors affecting the spread of a bioterrorist agent throughout a building. See you at the meeting!

## Refrigerant Update

Submitted By: Mark Ring—Newsletter Editor

### Breaking News:

**EPA proposed rules on the adjustments to the allowance system for controlling HCFC production and on the ban of pre-charged appliances with HCFCs – Summary and Comments by Karim Amrane, Vice President of Regulatory & Research for the Air-Conditioning, Heating, and Refrigeration Institute.**

#### Introduction

On December 23, 2008, the Environmental Protection Agency (EPA) published two proposed rules. The first proposed rule would implement the Montreal Protocol caps for production and consumption of HCFCs during the years 2010- 2014. The second rule proposes to ban the sale and distribution of air conditioning and refrigeration equipment pre-charged with HCFC-22. AHRI has requested a public hearing, which based on a recent communication from EPA, has been scheduled on January 7, 2009 (the pre-charged rule will be addressed in the morning and the allocation rule in the afternoon). EPA will accept comments until February 6, 2009 for the pre-charged rule and March 9, 2009 for the allocation rule.

#### Allocation Rule

In the allocation rule, EPA is proposing to adjust existing regulations to address the new cap for production and consumption of HCFCs (i.e., 75% reduction from the aggregate U.S. HCFC baseline for production and consumption effective January 1, 2010). EPA is proposing to continue its past practice of apportioning company-specific production and consumption baseline. For HCFC-22, EPA is proposing to allocate consumption allowances to meet 80% of the servicing need. EPA is assuming that the remaining 20% will be met by recycled and reclaimed HCFC-22. This represents about 50,000 metric tons (2,750 ODP-weighted metric tons) or approximately 72% of the total HCFC consumption cap from the period 2010 to 2014. Of importance to OEMs is the way EPA interprets the term “manufactured”. According to EPA, an appliance is “manufactured” when the “refrigerant loop is completed, the appliance can function, the appliance holds the complete and proper charge, and is ready for use for its intended purposes.” (page 78699) For example, the “manufacture” of a condensing unit “would not be complete until the device is installed in the field, connected with the indoor unit and charged to the proper level.”( page 78700) In other words, for EPA the term “manufacture” means “installation”. This interpretation has severe consequences for OEMs in the pre-charged rule, where EPA is proposing to ban the sale or distribution in interstate commerce of air conditioning and refrigeration equipment manufactured on or after January 1, 2010. In fact, EPA is proposing to effectively ban the installation of condensing units and other air conditioning and refrigeration equipment requiring refrigerant charging (with virgin HCFC-22 or HCFC-142b) in the field at the time of installation even if the product was manufactured (in the real sense of the term) before January 1, 2010. It is interesting to note that the term “manufacture” is discussed in the preamble of the rule but is not defined in the CFR.

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## Membership Report

*Submitted By: Joel Funkhouser – Membership Chair*

I'd like to welcome our newest members: Micah Spahn of Little Rock, Mark Eley of Little Rock, and William Keathley of Little Rock. I applaud you for your interest in the HVAC&R field and look forward to seeing you at our January meeting!

We have a strong chapter, and additional members will help to make us even stronger. Our chapter's membership has increased slightly over the past year, and everyone that attends meetings is encouraged to seek membership to aid in strengthening our chapter. As always, if you have any questions pertaining to membership, please contact me and I'll be happy to assist you.

## Meeting Minutes

*Submitted by Marc White—Secretary*

Board Meeting of December 3, 2008

### Officers and Board Members Present

Kim Koch, President  
Chris Ahne, President-elect/CTTC  
Steve Keen, Treasurer  
Marc White, Secretary

### Committee Chairs Present

Bill Simpson, Student Activities Chair  
Lee Greeson, Reception Chair  
Micah Spahn, Membership Co-Chair  
James Dayer, Chapter Programs Chair  
AD, Webmaster

### Board Meeting Minutes

Kim Koch began the meeting by discussing the status of PAOE points for the region. Currently, Arkansas has points in every PAOE column and has the second most PAOE points in the region, only trailing Monterey by 64 points. She also announced that she and Chris Ahne will be attending the President-elect seminar in January. Kim will be calling past members of the chapter nominating committee to ask if they will consider serving again.

Chris Ahne announced that next month's program will be a joint meeting with CSI with the topic being ASHRAE 90.1 building envelope issues; February's meeting will cover refrigerant piping practices and the speaker will be Joe Kirby; March's meeting topic will cover ASHRAE 90.1 updates with the speaker being Mick Schwedler; and the chapter is booked for the May meeting at the Arkansas Traveler's ballgame. There have been 53 RSVP's for the geothermal Continuing Education seminar on Friday. The chapter should clear approximately \$4000 from the seminar. To promote the theme of this year's ASHRAE Society President, "Maintain to Sustain", Chris is looking for leadership contacts for BOMA and other building owner organizations. The chapter will offer to make a presentation to physical plant operators to teach fundamentals of HVAC design and systems. Chris also suggested planning a small informal social event for the chapter in January.

Steve Keen distributed this month's treasurer's report. Steve stated that the chapter's CRC contribution will be made on the December books. Also, the chapter tax forms have been sent and responses received from the state's Attorney General and the IRS. Steve announced that the contributions approved last month by the chapter have been made. The treasurer's report was then approved by acclamation.

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Since this month's newsletter had not gone out at the time of this meeting, approval of the minutes from the November Board meeting was not addressed.

Bill Simpson has received only one scholarship application to date. The deadline for submission has been extended to January 5.

Micah Spahn announced that there will be one new member to introduce in today's meeting.

Lee Greeson stated that meeting reception is going well. However, at the last meeting there were several people who attended without having sent an RSVP. This slows down the check in process. Kim Koch will make an announcement to request that everyone submit an RSVP for the monthly meetings.

Kim Koch adjourned the Board Meeting.

Announcements:

Kim Koch informed everyone that the chapter has \$3000 in scholarship money to award, but that Bill Simpson only has one application to date. Therefore, the deadline has been extended to January 5. Kim announced that next month will be a joint meeting with CSI on Tuesday, January 13 with the topic being ASHRAE 90.1 building envelope issues.

Micah Spahn introduced this month's new member to the chapter.

Kim reminded everyone that Lee Greeson has PDH forms available. She also stated that the chapter is considering having an informal social night in January.

The monthly technical session presented by Mike Lawler of Data Aire was "Energy Efficient Data Centers". Fans in computer room air conditioning (CRAC) units are a great place to look for energy savings. The fans use energy in two ways: 1. the electricity used to run the fan motor, 2. the air conditioning needed to cool the heat produced by the fans. A standard CRAC unit forward curve fan draws 11 amps of electricity while a comparable direct drive plug fan draws only 5 amps. This is a 56% energy savings by simply changing fan types. Direct drive plug fans have other advantages: they eliminate belt dust contamination under raised floors, direct drive fans compared to a belt drive fans are maintenance free, and direct drive plug fans offer better airflow management with raised floor applications. In data rooms, cooling is critical. If the air conditioning system is down, the datacom equipment is down. Therefore, redundant a/c equipment is required. The tiers of data center cooling design are as follows: Tier I - no backup, Tier II - N+1, Tier III - 2(N+1) with inactive redundant path (only one system running at a time), and Tier IV - 2(N+1) with active redundant path (both systems running at same time, but each modulated to 50%). Data Aire recommends a "hot aisle/cold aisle" equipment arrangement for data rooms, with the cold aisle never less than 4 feet (or two full tiles) wide. CRAC units should be placed at the end of hot aisles with airflow parallel to the aisles. This allows better distribution of cold air to the datacom equipment and a direct path for return air back to the units. Orienting CRAC units with airflow perpendicular to aisles does not work well.

Meeting adjourned.



## ASHRAE Geothermal Seminar

We had a very full room for the Arkansas ASHRAE Geothermal Continuing Education Seminar last month. Dr Steve Kavanaugh from the University of Alabama discussed the Design of Ground Source Heat Pumps for Commercial & Institutional Buildings. This was a practical and informative presentation for anyone involved with heat pump systems.

## Future ASHRAE Meetings:

**2009 ASHRAE Winter Meeting**  
**January 24 - 28**  
**Chicago, IL**

**2009 ASHRAE Annual Meeting**  
**June 20 - 24**  
**Chicago, IL**

**2010 ASHRAE Winter Meeting**  
**January 23-27 2010**  
**Orlando, FL**

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## 2007-2008 Chapter Officers

<u>President</u>	Kim Koch	501.666-6776	kkoch@tmecorp.com
<u>Vice-Pres.</u>	Chris Ahne	501.661-0621	cahne@trane.com
<u>Treasurer</u>	Steve Keen	501.374-5420	skeen@powersar.com
<u>Secretary</u>	Marc White	501.664-3311	mwhite@batsonbravo.com

## Board of Governors

Charles Wetzler	501.590-2703	cgwetzler@yahoo.com
Don Huggins	501.374-3731	dhuggins@pettitinc.com
Chris Shaw	501-280-0404	chris@airetechcorp.com
Steve Titus (CRC Alternate)	501-280.0404	chance@airetechcorp.com
John Hodoway (CRC Delegate)	501.372.2900	john.hodoway@mail.ashrae.org

## Committee Chairs

Membership	Joel Funkhouser	jcfunkhouser@garverengineers.com
Student Activities	Bill Simpson	wsimpson@trane.com
Programs	James Dayer	jdayer@fluidsolutionsinc.com
Historian	Steve Titus	sctitus@aristotle.net
Refrigeration	Miguel Purdy	mlpurdy@vcaw.com
Research Promotion	Steve Titus	sctitus@aristotle.net
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## THE RAZORBACK REPORT

ARKANSAS CHAPTER OF ASHRAE  
 P.O. Box 180  
 LITTLE ROCK, AR 72203

LITTLE ROCK CHAPTER  
CONSTRUCTION SPECIFICATIONS INSTITUTE



KNOWLEDGE FOR CREATING  
AND SUSTAINING THE BUILT  
ENVIRONMENT

# LUNCH & SEMINAR

Tuesday, January 13, 2009

11:30 AM - Lunch & Meeting

12:00 PM - Seminar

## JOINT MEETING CSI/ ASHRAE ECONOMIC ADVANTAGES OF BUILDING BEYOND THE CODE

*Presented by Rich Roe, Chairman of PIMA Technical Committee and Atlas Roofing Company*

Rich Roe, Chairman of PIMA Technical Committee and works with Atlas Roofing Company will deliver a presentation that evaluates the economic assumptions about energy and building envelope costs that were used to develop the ASHRAE Standard and compares those assumptions to the energy cost reality of today. Particular focus will be placed on the economic advantages of "Beyond the Code" programs, specifically investigating whether current minimum envelope R-values requirements should be raised even higher. The impacts from this analysis will be extrapolated to evaluate the large-scale impacts of these decisions on existing and new buildings.

**Learning Units: 1 LU/HSW Hour, 1 PDH, 1 CEH, 0.1 CEU**



Knowledge for Creating  
and Sustaining  
the Built Environment

### Next Level Events

Genesis III  
Historic Union Train Station  
Little Rock, Arkansas

Please make reservations by  
phone or email to:

**Lori Hagen, CSI, CDT**  
501-666-6776 Phone

Email:  
lhagen@tmeccorp.com

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**SIGN UP FORM**

**NAME:** \_\_\_\_\_

**Method of Payment:**

- Check
- Bill Me

**Sign up for:**

- Lunch/Seminar
- Seminar Only

**Cost:**

**\$22.00**  
**\$10.00**

*Lunch Reservation  
No-shows will be  
invoiced in full*

**RSVP by NOON on Friday, January 9!**



The poster features a green and orange header with the text "engineering tomorrow... today". Below this, it lists "ASHRAE's 2009 Winter Conference January 24-28" and "AHR Expo Jan. 26-28". The background shows a city skyline with a large American flag. At the top, there is a logo for "SUSTAINABLE Urban Design" with the tagline "Engineering High Performance Buildings" and "2009 AHR Expo Winter Conference". The website "www.ashrae.org/chicago" is at the bottom.

**ASHRAE 2009 Winter Conference  
& AHR Expo**

**McCormic Place  
Chicago, IL**

**You Can  
Register Now at:**

**[www.ashrae.org/chicago](http://www.ashrae.org/chicago)**



*Leave a  
Lasting  
Impression*

Perfect for chapter, individual  
or company recognition.



ASHRAE recognizes our members are the foundation of our success. Demonstrate your commitment to our goals, memorialize your support and leave a lasting testament to your membership in ASHRAE through purchase of a paver at our newly renovated ASHRAE Headquarters. Join ASHRAE as we "walk the talk" and celebrate our new sustainability showcase.

**To purchase a paver, visit  
[www.ashrae.org/building](http://www.ashrae.org/building)**





With A Visit Expected From  
Our Society President William  
Harrison and Our First Lady,  
Margaret.

ASHRAE Region VIII  
January 26, 2009  
Monday Night  
6:00 PM to 8:30 PM



Please RSVP to  
John L. Harrod  
Assistant Regional Chair  
[John.Harrod@Benham.Com](mailto:John.Harrod@Benham.Com)  
(405) 607-6110  
Fax (405) 475-5660

Reservations are required

The Kinzie Chophouse  
is a short taxi ride from  
the ASHRAE Headquarters  
Hotel.

Salad Choices:

**Caesar Salad**

Entrée Choice of:

**16 Oz. Kinzie Cut (Bistro Steak) Served  
with Herbed Garlic Butter**

**Herb Crusted Salmon  
Served with a Whole Grain Mustard Sauce**

**Chicken Breast Parmesan  
Served With Spaghetti and Marinara  
Sauce**

Side:

**Grilled Vegetables**

Dessert:

**Crème Brulee**

Beverages:

**Soda, Coffee and Tea**

**Price: \$60.00 per person**

<http://kinziechophouse.com/>

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### Pre-Charged Rule

This rule proposes to ban the sale or distribution or offer for sale or distribution in interstate commerce of all air conditioning and refrigeration equipment containing HCFC-22, HCFC-142b, or blends containing these refrigerants, effective January 1, 2010. The ban covers imported products, products intended for exports, as well as products manufactured in the U.S. for domestic use. EPA is also proposing to extend the ban to products that are suitable only for use with virgin HCFC-22, HCFC-142b, or blends containing these refrigerants. In addition, the proposed rule would ban the sale or distribution in interstate commerce of pre-charged components such as line sets and pre-charged compressor. However, the ban does not apply to newly manufactured equipment charged with recycled or reclaimed refrigerant. According to the definition of "Interstate commerce" found in the allocation rule "The entry points for which a product is introduced into interstate commerce are the release of a product from the facility in which the product was manufactured, the entry into a warehouse from which the domestic manufacturer releases the product for sale or distribution, and at the site of United States customs clearance." (page 78698) EPA is proposing to apply the term "interstate commerce" to "the product's entire distribution chain up to and including the point of sale to the ultimate consumer" (page 78713). However, EPA's interpretation of interstate commerce does not cover the sale or distribution of a product if the product is completely manufactured, distributed, and sold without ever crossing state lines. A product manufactured, distributed and sold exclusively within a particular state is not covered by the rule, if "the raw materials, components, equipment and labor that went into the manufacturing, distributing and selling, or offering for sale or distribution of such a product originated within the state as well." (page 78713)

Based on the meaning of "manufacture" and the definition of "interstate commerce" in the allocation rule, the pre-charged rule will, effective January 1, 2010, do the following:

- Ban the sale or distribution or offer for sale or distribution in interstate commerce of air conditioning equipment charged with virgin HCFC-22, HCFC-142b and their blends.
- Ban the installation of air conditioning and refrigeration equipment charged with virgin HCFC-22, HCFC-142b and their blends, if the installation requires connecting the equipment to a refrigerant loop or adding virgin refrigerant. This ban applies even if the product entered interstate commerce prior to January 1, 2010.
- Ban the import and export of pre-charged air conditioning and refrigerant equipment with virgin HCFC-22, HCFC-142b and their blends.

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- Ban the sale or distribution or offer for sale or distribution in interstate commerce of air conditioning and refrigeration equipment suitable for use with virgin HCFC-22, HCFC-142b and their blends.
- Ban the sale or distribution or offer for sale or distribution in interstate commerce of pre-charged components such as line sets and pre-charged compressors.

#### AHRI Comments to EPA

- Effective 1/1/2010, the proposed rules ban the installation of certain air conditioning and refrigeration equipment such as condensing units, even if the equipment entered interstate commerce prior to 1/1/2010. EPA is apparently not allowing the sale or distribution of certain products that have been placed into initial inventory before January 1, 2010. Not allowing products in inventory to be installed after 1/1/2010 will have a significant impact on the industry (need to quantify in \$) and is contrary to the provisions of the clean air act as it will effectively accelerate the phase-out date of HCFC-22 by 6 months to a year. EPA must use the conventional definition of the term “manufacture” to mean when the product leaves the manufacturer’s plant. Using this new definition will allow for the sale and installation of products which have been placed in inventory prior to 1/1/2010.
- Based on the definition of interstate commerce, EPA is proposing to ban, effective 1/1/2010, the export of air conditioning and refrigeration equipment pre-charged or suitable for use with virgin HCFC-22. This provision will disadvantage U.S. manufacturers who are globally competing against non-U.S manufacturers selling in article 5 countries, as HCFC products are significantly less expensive than products operating with alternative refrigerants. EPA should exempt products intended solely for exports.
- The rule does not apply to air conditioning and refrigeration equipment pre-charged or suitable for use with recycled or reclaimed refrigerant. This provision is unenforceable. The ban should apply to products using virgin as well as recycled and reclaimed HCFC-22, HCFC-142b and their blends. In addition, clarifications from EPA are needed on the following points:
  - The proposed rules will ban the installation of air conditioning and refrigeration equipment after January 1, 2010, if the installation requires connecting the equipment to a refrigerant loop or adding virgin refrigerant to the system. In the case of condensing units or refrigeration display cases, will the ban apply to products manufactured prior to 1/1/2010 and sold after 1/1/2010, if the products are sold for replacement applications where the refrigerant loop is already in place?
  - Are packaged units (such as unitary or packaged terminal equipment) considered “manufactured” (per EPA definition) because the refrigerant loop is complete and sealed at the

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factory, although they require installation in the field (i.e.; mechanical fittings to ductwork or mounting to the wall sleeve)?

- The proposed ban does not apply to air conditioning and refrigeration products intended for use with recycled or reclaimed refrigerant. Does it mean that the regulation will allow the sale or distribution in interstate commerce of any uncharged equipment as long as the equipment is not suitable for use with virgin HCFC-22, HCFC-142b or their blends?

## Chapter Technology Transfer Report

*Submitted By Chris Ahne — CTTC Chair*

We've had a very busy year so far with programs and continuing education opportunities. Tom Hanlon, James Dayer, Lee Greeson, John Carter, and Mike Fullerton are doing a great job and they've got more to offer in '09. We have our joint meeting with CSI in January with the topic of building envelopes to meet or exceed ASHRAE Standard 90.1. Please be sure to RSVP for this meeting and look for the Evite invitation. If you RSVP, we will invoice you for your meal even if you don't show up because the CSI chapter will be billing us for the number of people that we RSVP. In February, we are having our refrigeration night with a well qualified speaker from Refrigeration and Electric Supply. Speaking of ASHRAE Standard 90.1, we will have the chair of the standard committee with us in March to discuss the 2007 standard and maybe we'll get a preview of changes for the upcoming 2010 version. Tom Hanlon is going to put us on a bus to Bryant for the April meeting to tour a LEED school. Finally, set your calendar for May 8<sup>th</sup> and bring your family out to the Traveler's game against the Tulsa Drillers.

To say the Geothermal Design Seminar was a huge success would be an understatement. We had 52 people attend the 8 hour seminar. Our chapter members have spoken that there is a significant interest in the design and application of geothermal HVAC systems. We had owner's representatives, consulting engineers, mechanical contractors, geothermal loop contractors, and equipment suppliers attend. Dr. Steve Kavanaugh presented his favorite subject to us in a very practical sense. His consistent message was to keep geothermal systems simple because the geothermal system design is already challenged with high costs and unfamiliarity. His topics ranged from basics of geothermal applications, advantages and disadvantages of a ground source heat pump system, closed-loop design requirements and control, methods of treating ventilation air, and typical costs associated with these subject systems.

Last, in unison with Bill Harrison's presidential theme of "Maintain to Sustain" we are considering the possibility of presenting a seminar for building operators to help them understand fundamentals of design and maintenance of their HVAC systems. If anyone has any ideas or suggestions for a target audience or coursework to be taught, please let me know. You can contact me at [cttc@arkansasashrae.org](mailto:cttc@arkansasashrae.org).

I hope you all have a Merry Christmas