WUFI INSTRUCTORS

André Desjarlais is the Group Leader for the Building Envelope and Materials Research Programs at the **Oak Ridge National Laboratory**. He has been involved in building envelope and materials research for over 30 years, first as a consultant and, for the last 16 years, at ORNL. He is active in the building industry, participating in ASHRAE, ASTM, Cool Roof Rating Council, SPRI, Roof Consultants Institute, Roof Industry Committee on Weather Issues, Federal Roofing Committee, Metal Construction Association, Asphalt Roofing Manufacturers Association, and the Building Environment and Thermal Envelope Council. Areas of expertise include building envelope and material energy efficiency, moisture control, and durability.

Andreas Holm, Ph. D., is a research scientist at the **Fraunhofer Institute for Building Physics** in Holzkirchen, Germany, for Indoor Environment, Climatic Impacts. His responsibilities include analyses of room climatic parameters in buildings and means of transportation; physical and psycho-physical measurements with test persons to determine thermal comfort and other comfort criteria; CFD-calculations; calculated analysis of building components and hygrothermal simulation of buildings, microbial growth on surfaces; assessment of mould fungus in interiors; model development for bio-hygrothermics; analysis of constructions, building components and materials as well as building components for heating, ventilation and energy systems on a 1:1 scale under in-situ real conditions of climate and use.

Achilles Karagiozis, Ph.D., is a distinguished research and development engineer at the **Oak Ridge National Laboratory**. He is in charge of research performed at ORNL in heat, air and moisture performance of buildings. Dr. Karagiozis is one of the leading building scientists in North America. He has been performing building science research for the past 16 years, trained more than 600 professionals in moisture design, championed and assisted in the development of innovative material systems and concepts. Research activities have been concentrated in energy efficiency, healthy, durable and sustainable building designs, housing integration issues, wireless route sensing, whole building performance applications, heating, ventilating and air conditioning of buildings and hygrothermal performance of envelopes. He is the US representative for IEA Annex 41 that deals with Moisture in Buildings, and is actively involved in a number of ASTM E06 technical committees and ASHRAE TC 4.4, and SPC 160. Achilles has also developed three or four of the world's most advanced hygrothermal models worldwide (WUFI, MOISTURE-EXPERT, LATENITE and family). As an expert in the area of Moisture Engineering, he has solved many hygrothermal design and retrofit challenges, and has developed multiple design guidelines for various envelope systems. Dr. Karagiozis is the author of more than 120 technical papers and reports related to moisture in buildings.

Hartwig Künzel, Ph.D., Department director of **Fraunhofer-IBP**, the largest research establishment in Germany for building science. Dr. Künzel is responsible for hygrothermal investigations sponsored by industry and government. His duties include scientific research and model development, staff management and financial control. Having acquired specific knowledge in CFD-modeling at Erlangen University, Dr. Künzel concentrated on experimental investigations and computer simulations concerning heat and moisture transfer in building materials and components after joining IBP in 1987. He developed the hygrothermal model WUFI® which has become an internationally recognized and widely applied calculation tool. His research helped to provide a better understanding of the hygrothermal conditions in building envelope systems as well as their consequences on building energy consumption, durability and human comfort. Dr. Künzel has been active in many international projects, technical and standard committees e.g. ASHRAE TC 4.4, TC 1.2 & SPC 160P, CEN TC 89 (chair of work item 29.3 leading to the European Standard on hygrothermal simulations EN 15026) and continuous education seminars. From 1997 until 1999 he lectured to civil engineering students at Stuttgart University. He has been selected as external PhD examiner by the Universities of Denmark, Paris, Lyons and Nice. Dr Künzel has published more than 200 scientific articles in international trade journals, conference proceedings and text books.

SPONSORS

WUFI ® workshops are co-sponsored by

the U.S. Department of Energy (DOE) through

ornl Oak Ridge National Laboratory

Oak Ridge National Laboratory Buildings Technology Center

Oak Ridge National Laboratory (ORNL) in collaboration with

Fraunhofer IBP Institut Bauphysik

the Fraunhofer-Institut für Bauphysik (IBP)

the National Institute of Building Sciences (NIBS)/ Building Enclosure Technology and Environment Council (BETEC)

BEC Building Enclosure Council NATIONAL

NIBS/AIA national organization of the Building Enclosure Councils (BECs)

For details, registration, and updated locations and dates, go to:

http://www.section08.com/wufi.htm

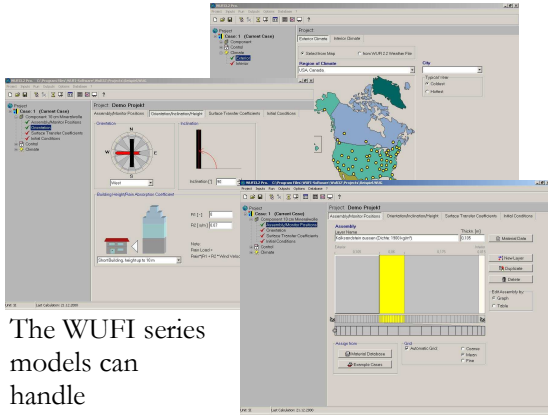
National Building Science Corp.
1220 Rosecrans Street #119
San Diego, CA 92106-2674 · USA

Phone (951) 265-1501
Fax (888) 317-3105
http://www.section08.com

WUFI ® HYGROTHERMAL MODELING WORKSHOPS

Hands-on training in modeling heat and moisture transport in building envelopes

WUFI* series software allows the realistic simulation of the transient hygrothermal behavior of multiple-layer wall and roof systems exposed to natural weather.



The WUFI series models can handle contributions from rain, solar radiation, and other crucial weather events on an hourly basis. Both vapor and liquid transport are included, along with the sorptive capacity of building construction materials.

These models are continuously developed by a collaboration between the Fraunhofer-Institut für Bauphysik and Oak Ridge National Laboratory. Your instructors are the program developers.

Certificate of completion issued, eligible for 16 CEU hours.

* **Wärme und Feuchte instationär**

WUFI PRO:

May 4-5, 2009: San Antonio, TX

September 3-4, 2009: Waltham, MA

October 29-30, 2009: San Diego, CA

December 3-4, 2009: Institut für Bauphysik, Holzkirchen, Germany

8:00-8:45 **Welcome, introductions**, load software onto each student's laptop, course overview.

8:45 – 9:15 **Presentation 1: Development of WUFI-ORNL software**, Philosophy of Software, International status of WUFI-ORNL, Structure of Software Collaboration (ORNL-IBP), DOE Future Directive in Moisture Control Research

9:15 - 10:00 **Presentation 2: Hygrothermal Phenomena in Building Practice** –

1. Moisture Effects
2. Examples Cases, Efflorescence, Algae, Mold
3. Assessment Methods

10:00 – 10:10 COFFEE BREAK

10:10 - 12:00 Run WUFI Pro 4.21 – Instructor demonstrates how to run while students follow along on own computers. Set up project, case studies, and parameters. Demonstrate databases of materials and properties. See complete curriculum description o web sire above.

12:00 – 1:00 LUNCH

1:00 - 2:00 Continue simulation outputs and analysis. View and modify graph outputs for output results. Look at mold growth predictions by layers. Export file. Create Movie files. Compare two cases using the movie viewer.

2:00 - 3:00 **Presentation 3: Fundamentals and Prerequisites –** Models; Heat and Storage Transport; Calculation of the coupled Transport:

3:00-315 BREAK

3:15 – 5:30 Class exercise, class forms teams of 4 – 5 persons to solve a real hygrothermal project and make a presentation next day on solutions and conclusions.

DAY 2

8:00 - 8:45 Class presentations (Each group presents their solution). Q & A by other teams and instructors.

8:45 - 9:30 **Presentation 4: Hygrothermal Material Properties**

(1) What Data are Necessary for WUFI?; (2) Basic Properties – Macro- and Micro-structure, density, porosity, vapor diffusion resistance, liquid transport coefficient, (3) Optional Parameters

9:30 - 10:45 Instructor-led WUFI project with class following on own computers – Advanced WUFI features

10:45 – 11:00 BREAK

11:00 – 12:30 Instructor-led new exercise, students following on own laptops - Example of how to enter a new material in WUFI Pro. Q & A 5 minutes. Info on source and sinks in F1 or Help. "Sources and sinks" gives ability to inject water into any layer.

12:30 – 1:30 Lunch

1:30 - 2:00 **Presentation 5**: **ASHRAE Standard 160 Design Criteria for Moisture Control in Buildings** –Purpose is to create a performance-based Design Criteria to calculate whether a component would be susceptible to moisture damage. Provides a link between the design of the envelope and the expected environmental conditions in the building.

2:00 – 2:30 WUFI 4.2-ORNL: Sinks and Sources Option - Hands-on exercise including source and sink button or grid. Heat, moisture, and air change rates input.

2:30 – 3:30 Weather File Analyzer and creating a weather file. Instructor-led hands-on running cases. Additional Tools: Energy, Determine U-value, effect of moisture on heat flows.

3:30 – 3:45 BREAK

3:45 – 4:30 **Presentation 6: Limitations** – What Can WUFI Do? What Can WUFI *Not* Do? WUFI 5 will have durability included (UV, freeze-thaw exposure, temperature).

4:30 – 5:00 Q & A, certificates of completion.

WUFI 2-D/WUFI Plus (2-D & Whole Building simulation, prerequisite is WUFI Pro):

December 9-10, 2009: Institut für Bauphysik, Holzkirchen, Germany

Day 1

9:00 Introduction and General Info
9:15 Installing the Software
9:30 Indoor Conditions and Moisture Buffering (indoor climate survey of residential buildings:
Boundary Conditions in Standards
Moisture Buffering Effects
Conclusions
Outlook: Heritage Buildings
11:00 Break

11:15 The influence of internal boundary conditions on the hygrothermal performance of construction assemblies
12:00 First "no" hands on
12:30 Lunch
13:30 Fundamentals
15:00 Hands on (now the real one)
17:00 Validation of WUFI Plus

Day 2

9:00 Application of WUFI Plus
10:00 Team Work
12:30 Lunch
13:30 Presentation of the results
15:00 Question and Answers

ADVANCED WUFI Workshop (Prerequisite WUFI Pro):

December 7-8, 2009: Institut für Bauphysik, Holzkirchen, Germany

3 September 2009