



# Rocky Mountain AICHE News

January 2005

Volume 14 Number 4

## January Section Meeting: Characterization and Simulation of Complex Hydrocarbon Reservoirs

The recent increase in oil price is a clear indication of the industry's difficulty of meeting the world energy demand. New supplies of oil and gas are increasingly difficult to find and this means that the industry must place increased emphasis on improved recovery from existing reservoirs. This talk discusses the important aspect of improved reservoir characterization and simulation to aid in maximizing economic recovery of oil and gas resources.

Advances in computing and its low hardware costs have led to the widespread use of numerical simulation in all fields of engineering. For the past several decades, petroleum engineers have relied heavily on numerical models, because of complex geologic settings and complex recovery processes. Analytical methods, although easy to use, cannot account for the reservoir complexity and time-varying boundary conditions. As a result, numerical methods have become the de facto standard, providing reservoir models for management decision-making. Sensitivity studies, history matching, production forecasting and reservoir development optimization are common applications of reservoir simulations.

A "good" numerical reservoir model begins with a "good" geological model (geomodel). Modern hardware, software and data acquisition techniques have given us the ability to build high-resolution complex 3D stochastic models of the reservoirs. In

### January Section Meeting

- Speaker:** James R. Gilman, Director of Engineering of iReservoir.com
- Topic:** Characterization and Simulation of Complex Hydrocarbon Reservoirs
- Date:** Tuesday, January 18th
- Time:** 6:00 Social Hour/Cash Bar  
6:45 Dinner  
7:30 Presentation
- Location:** Golden Hotel  
800 11<sup>th</sup> Ave, Golden
- Cost:** Members: \$20  
Non-Members: \$25  
Students & Unemployed: \$10

Please RSVP by **Friday, January 14<sup>th</sup>** (early RSVPs are greatly appreciated!). Indicate your name, phone number, and number of attendees by e-mailing Tom Wellborn at [rockyaiche@yahoo.com](mailto:rockyaiche@yahoo.com). Alternatively, you may leave a voice mail for Tom at 303-933-0533.

creating the geomodels, the modeling team focuses on flow-related geologic features of the reservoir, capturing those essential for accurate estimation of flow behavior. Because subsurface data are typically sparse, tools such as geostatistics are often used to create plausible models of geologic property distributions within the geological framework. Improved data gathering tools and data interpretation

(Continued from page 1)

methods such as 3D seismic are also being widely applied to constrain the geomodels. Because numerical simulations are dynamic, they demand much greater computing resources compared with the static geologic models; therefore geomodels can seldom be used directly in numerical simulations. The geomodels must be upscaled to obtain a simulation model. If the geomodel is upscaled correctly, the simulation model is an adequate representation of reservoir geology enabling the modeler to study numerous sensitivities in order to optimize reservoir development.

Jim graduated with an M.S. in Chemical and Petroleum Refining Engineering from the Colorado School of Mines in 1983 and a B.S. in Chemical Engineering from Montana State University in 1978. He has over 25 years experience in the petroleum industry. He is currently Director of Engineering at iReservoir.com where he is involved in providing integrated reservoir characterization and modeling services to the petroleum industry using the state-of-the-art geoscience and engineering technologies.

Jim's expertise includes specialization in the area of application and development of numerical simulators for fluid flow in petroleum reservoirs. He was a co-developer of Marathon Oil Company's 3-D, 3-phase simulator for naturally fractured reservoirs and was instrumental in testing and debugging of the dual-porosity versions of commercial black-oil and compositional simulators for Marathon's applications. In addition to simulation expertise, Jim's work at Marathon Oil Company's Technology Center involved company-wide training, consultation, and project work in the areas of reservoir engineering, reservoir simulation, naturally fractured reservoirs, horizontal wells and production risk/uncertainty analysis. He also was Manager of Reservoir and Well Performance, a multi-disciplinary organization involved in 3-D geologic modeling, laboratory special core analysis, reservoir simulation and general reservoir engineering. Jim has authored or co-authored over a dozen articles dealing primarily with naturally fractured reservoirs or horizontal wells. He was a member of the SPE Editorial Review Committee from 1987-2000 including a term as Executive Editor for SPE Reservoir Evaluation and Engineering. He is

chairman elect of the SPE Monograph Committee and has served on numerous other committees including Chairman of the Twelfth SPE Symposium on Reservoir Simulation (1993). Jim is a registered professional engineer, and a member of the Society of Petroleum Engineers and the American Institute of Chemical Engineers.

## **January Puzzler: Can you find a solution?**

**Location:** Lyondell-Citgo Refinery in Houston, TX

**Problem:** *The catalyst regenerator of a 100,000 bpd fluid catalytic cracker (FCC) was suddenly derated to 85% of capacity by back-pressure at the large 40' high by 14' diameter refractory-lined knockout drum which served to remove catalyst particles and liquid hydrocarbons from the flue gas. It operated at the regenerator flue gas exit temperature of 1000°F, with the exit gas subsequently being cooled by a waste-heat boiler, than routed into a bag house for fines removal and SOx capture before emission. The back-pressure was not sufficient to shut the unit down, but the air-blower supplying oxygen for the catalyst regeneration was operating at its volumetric limit. A large area on the side of the drum opposite the flue gas inlet which normally measured 250°F now measured 800° F. The same area glowed a dull red at night. Operating margin on the FCC was \$3/bbl of fee, so an opportunity cost of \$45M/day was being incurred.*

**Diagnosis:** *An intact section of refractory had broken off the opposite side of the drum and fell across the inlet without collapsing into pieces.*

**Solution:** *Check the web-site at <http://www.aiche-rm.org> for the solution to this problem. If you don't have access to the web, keep reading, you may find the solution in this issue.*

### **NEW MEXICO CORNER**

Local New Mexico Meeting: January 21, 5:30 p.m.  
Topic: Investigation of the Mechanics of Cereal Flaking  
Speaker: Leon Levine  
Location: To be determined\*\*  
RSVP by Jan. 19 to Kerri Pratt at [PrattKL@cdm.com](mailto:PrattKL@cdm.com)  
\*\*check [www.aiche-rm.org](http://www.aiche-rm.org) for updated information\*\*

## WHAT HAVE I MISSED?

### NOVEMBER-Westminster

Approximately 28 AIChE members heard Dr. Anthony M Dean, William K. Coors Distinguished Professor of Chemical Engineering at Colorado School of Mines, discuss the current state of Solid Oxide Fuel Cell (SOFC) technology. SOFC competes with Proton Exchange Membrane fuel cell technology, but differs in that it operates at much higher (700C) temperatures, uses any type of hydrocarbon (including coal!) as opposed to expensive high purity hydrogen, and employs ceramic in lieu of expensive precious metal membranes. Advantages include higher efficiency, lower weight and widely distributed and typically accessible multiple fuel sources. His presentation focused on three major areas of research for understanding such a complex system: gas phase, electro- and catalytic chemistries. Simultaneous application of "arrogance and naivety" is used to separate the obvious interaction of these interdependent systems. Understanding the pyrolysis reactions and behavior of the oxidized hydrocarbons are key components of both the gas phase and catalytic chemistries. Though transportation applications are restricted by the limited dynamic response and the high efficiency of steady-state operation of such systems, applications for high power generation in remote areas (especially in military environments) will be the most likely path to commercial development. For more information visit the website <http://www.mines.edu/academic/chemeng/faculty/amdean/>

### UPCOMING MEETINGS IN 2005

**February 15:** Nanotechnology by Tapesh Yadav of Nanoproducts Corp

**March 12:** To be determined

**April 19:** Ammonia Plant Tour in Cheyenne, WY

**May 17:** National Oceanographic and Atmospheric Administration in Boulder, CO

*Opening remarks by Tom Wellborn*



*Dr. Anthony Dean presenting to a packed house*



*Tom Wellborn thanking Dr. Anthony Dean*



## AIChE Meetings

### 2005

Apr 10-14	2005 Spring Nat'l Atlanta, GA
Apr 11-13	20 <sup>th</sup> CCPS Int'l Atlanta, GA
May 2-5	Offshore Tech Houston, TX
Sept 26-29	Safety in Ammonia Plants Toronto, Ontario
Oct 30-Nov 4	2005 Annual Mtg. Cincinnati, OH
Nov 2-4	AIChE/ACS Mgmt Cincinnati, OH

### 2006

Apr 23-27	2006 Spring Nat'l Orlando, FL
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The objectives of AIChE are to advance chemical engineering in theory and practice, to maintain a high professional standard among its members, and to serve society, particularly where chemical, engineering can contribute to the public interest.

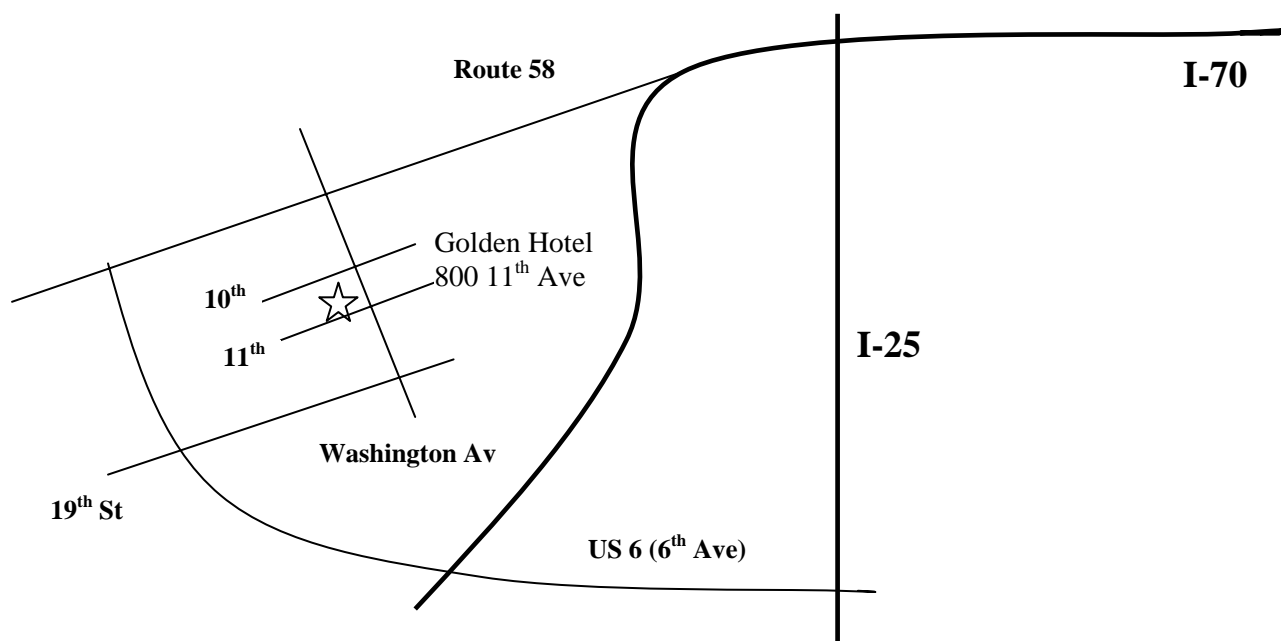
**Solution for January Puzzler (page 2):** *While still in service, the drum was penetrated on the side adjacent to the flue gas inlet with approximately 17 hot taps, into which packing glands were inserted surrounding 3" diameter steel rods. The rods were slowly advanced over three days on a rotating basis in such a way as to push the intact wall of refractory back into place on the opposite side of the knockout drum. Total time involved for diagnosis, solution development and agreement, materials procurement and execution was ten days. Material cost was about \$100M. The unit operated in this fashion for six months until the next scheduled turnaround. The drum looked like it had undergone acupuncture, and was affectionately (albeit briefly) called "the Porcupine".*

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*Send your E-MAIL address to  
[mмоes@ekiconsult.com](mailto:mмоes@ekiconsult.com) to receive  
this newsletter electronically!*



**DIRECTIONS:** From I-70, take Route 58 (exit 265) west towards Golden. Take the Washington St exit and turn left at the stoplight. You will see Golden Hotel on the right side at the corner of 11<sup>th</sup> and Washington Av.

From I-25, take US 6 west towards Golden. Turn right onto 19<sup>th</sup> St. Drive through one stop light, then turn left onto Washington Av. You will see Golden Hotel on the left side at the corner of 11<sup>th</sup> and Washington Av.