

### February Section Meeting: Teaching and Living in the Middle East -- A Professional and Personal Challenge

The Petroleum Institute in Abu Dhabi, United Arab Emirates, was established in 2001 in cooperation with the Colorado School of Mines and with funding from a consortium of oil companies including the Abu Dhabi National Oil Company (ADNOC), British Petroleum, Shell, Exxon-Mobil, JODCO (Japan) and TOTAL (France). This presentation will cover personal and professional aspects of living and teaching engineering in the Middle East and will describe some of the challenges and rewards of living and working in a Muslim Arabic culture.

Dr. Robert (Bob) Baldwin holds the BS and MS degrees from Iowa State University and the PhD from the Colorado School of Mines; all in chemical engineering. Bob is currently Principle Scientist and Group Manager of the Thermochemical Process R&D and Biorefinery Analysis Group at the National Renewable Energy Center (NREL) in Golden. Prior to accepting the position at NREL, Bob spent 30 years at the Colorado School of Mines in the Chemical Engineering Department (including 10 years as chairman) and 5 years at the Petroleum Institute in Abu Dhabi (from 2003 – 2008). Bob is a past Chair of the Rocky Mountain AIChE section, and in 2004 was awarded the title Emeritus Professor of Chemical Engineering by the Colorado School of Mines. Bob is one of the founders of the Petroleum Institute, chaired the chemical and electrical engineering programs, and was primarily responsible for curriculum development, faculty

### February Section Meeting

<b>Topic:</b>	Teaching and Living in the Middle East – A Professional and Personal Challenge
<b>Speaker:</b>	Dr. Robert (Bob) Baldwin Nat'l Renewable Energy Center
<b>Date:</b>	Tuesday, February 17 <sup>th</sup>
<b>Time:</b>	6:00 Social Time 6:45 Dinner 7:45 Presentation
<b>Location:</b>	PPA Event Center 2105 Decatur St., Denver
<b>Cost:</b>	Members: \$20 (w/RSVP)* Non-Members: \$25 Students & Unemployed: \$10

Please RSVP by Friday, February 13<sup>th</sup> (early RSVPs are greatly appreciated!) indicating your name, phone number, and number of attendees. Please RSVP to Martin Vorum by phone at 303-384-7414 or email at [rockyaiche@yahoo.com](mailto:rockyaiche@yahoo.com).

\*Add \$5 for attending meeting without RSVP

hiring and the start-up of all activities during the early stages of operations.

## **Engineering Graduate Student Visit Day at Colorado State University—Ft. Collins**

Colorado State University's College of Engineering will be hosting an Engineering Graduate Student Visit Day on Friday, March 6, 2009. The day will be full of opportunities for prospective students to connect with faculty and learn more about the engineering graduate programs and research opportunities at Colorado State.

The visit day will be hosted by the college and it's departments/programs of biomedical engineering, chemical and biological engineering, civil and environmental engineering, electrical and computer engineering, and mechanical engineering. More information about the visit day and online registration can be found at <http://www.engr.colostate.edu/students/future-students/graduate/grad-visit-day.html>

### **Letter to the Editor: Uranium Anything But Green**

Uranium is anything but green. It may be argued to be a low CO<sub>2</sub> emitter, but to be "green" takes a much more comprehensive examination and analysis of environmental and social costs. I will discuss some of the issues that probably will not be addressed by a "green nuke" presentation.

#### Nuclear Waste Disposal - Mission Unaccomplished

The nuclear waste disposal issues have never been either accomplished successfully or paid for since the nuclear age began....so those enormous costs have never been faced or solved. Yucca Mountain is fraught with major problems and is a very poor site as a geologic depository. Politically and with good reason no one wants nuclear waste in their backyard. If nuclear power is so safe, why does the industry totally rely on being underwritten with a risk free government waiver of liability under the Price Anderson Act. It is because there is no corporation that would build or expose itself to the huge risks if it had to honestly insure itself....and it simply could never get any private insurer to do so. In the 1960s, the heyday of nuclear plant construction, proponents advertised that nuclear power would be too cheap to even meter....but they have never yet paid the true costs of the existing

plants and their full decommissioning and waste disposal problems. Like so many other major social costs, we seem to always be willing to not account for fully embedded cost externalities in our choices.

#### The Ideal Terrorist Targets

Every nuclear power plant and processing facility represents the ideal terrorist target. It is often argued that the power plant containment buildings are built to withstand a huge missile such as an jetliner. That may be true, I can't confirm the claim...but it is really irrelevant. Also at every nuclear power plant there are spent fuel rod storage facilities which are exceedingly poorly protected, not in massive containment structures, and easily penetrable by any terrorist with even minimal assets and the will to bring harm. These wastes are stored because there is no where to put them. And it is only a matter of when such an attack will happen. To build more and more of these targets is simply lunacy. When a strike does happen it would cause radioactive contamination of a huge area, the extent depending on the weather conditions at the time, all resulting from destroying the rod cooling pools and causing a steam cloud dispersed criticality. Keep in mind that all of these plants are located near our heaviest population centers, so the immediate and long term health impacts will be enormous, beyond our ability to contain or remediate. It has often been noted, but systematically ignored by industry and government, that the 9-11-01 attack on the World Trade Center is a minor event compared to an attack that could have flown the same planes into the Indian Points nuclear power plant waste rod storage facilities, just miles away up the Hudson from central Manhattan. The entire NY city, NJ and much of New England would have been contaminated, and deaths would have been massive, both immediate and long term. No real clean up would have been possible, unlike the quick haul off of building wastes from the world trade towers.

#### Nuclear Weapons and Proliferation Probabilities

In addition, the very real and ongoing threat of proliferation of nuclear weapons is still plaguing our world, and is promoted more by the USA than any other nation in its overt failures to honor the nuclear nonproliferation treaty (NPT). Witness the latest USA agreements with India to provide them with nuclear technology and materials, an act which is

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fueling the arms race all over again, this time between India and Pakistan, and destabilizing the entire south and central Asia region. Need I remind all that India is a non-signatory of the NPT? Need I remind all that Pakistan has been the greatest black market purveyor of nuclear weapons technology around the world to North Korea, to Iran and likely to others yet unrevealed. Our recalcitrance in following the mandates of the NPT is unforgivable, mandates which oblige us to eliminate our own arsenal and we ignore continually. Our industry's and nation's failure to take leadership and walk away from nuclear weapons and the false promise of nuclear power is very sad indeed. The reality is that the more uranium and nuclear byproducts that are produced in our world the greater the environmental and social risks to our world. If the world cannot control the black market of opium or cocaine, why does anyone believe that a black market in nuclear materials could be controlled. On probability arguments alone, the more nuclear materials created and circulated in the world inventory, the greater the probability that some will be or already has been diverted to terrorists.

#### Other Energy Choices are Here or Within our Grasp

The AIChE has held numerous presentations from NREL and other leaders in alternative energy non-fossil and non-nuclear options. Great advances have been made in these, and new concepts are arising everyday. There are existing energy alternatives which could in quick order totally obliterate the need for the existing nuclear power plants that are on line, and then go on to negate the need to build any more. It is only inertia of the past, perhaps an old guard that doesn't want to give way to a new future, that prevents us from the implementation and replacement of the nuclear power option. Our task is to take these environmentally safe or at least safer than nuclear options to full power. The real and underlying challenge is to change to more conscious and less consuming lifestyles -- honoring our environment and not destroying it.

#### Closing

There was a time in my Chemical Engineering career that I too fooled myself into believing that if good technology solutions were applied to the uranium fuel cycle and business that the industry of nuclear power was safe and environmentally

acceptable. I worked in environmental engineering and regulatory affairs for a uranium mining and milling company. However, upon more careful assessment I personally determined in the late 1970s that nuclear power was inherently unsafe, and further was inextricably linked with the nuclear weapons threat to our world. I intentionally left that business based on an ethical and moral commitment to myself and my world. I have never regretted that decision, and find that nothing since in the way of changing times or my continued study would cause me to reverse that decision.

I strongly object to the AIChE promoting Uranium and its spin-offs as "Green Energy". We must move forward and lead the way to true green energy sources, sources that are fully renewable, environmentally benign, socially safe, and coupled to a scaled back energy consuming world, specifically including leadership from the chemical industries on those paths. I call upon the members of AIChE to be leaders in bringing us to a safe and prosperous world for all. Do not be blinded by the latest resurgence of what should be declared a failed concept and industry. Do not be blinded by the latest potential for quick profits which ignore the bigger costs. The uranium industry and the uses of uranium it supports are not green in any honest accounting.

Please share this letter with the members and attendees at the meeting and feel free to publish it in your next newsletter.

Richard Andrews, CEO, ZeoponiX, Inc.  
www.zeoponix.com

### **Dennis Gertenbach Responds to Richard Andrew's Letter**

It is too bad that Mr. Andrew was unable to attend the presentation in January. For him and others who missed my talk, I focused on three areas: 1) what has sparked the resurgence in uranium mining and nuclear power plant construction in the world, 2) how uranium is produced from ore, and 3) what are the advantages and disadvantages of nuclear power generation. The goal of my presentation was

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to present factual information and certainly did not promote nuclear power over other energy alternatives. Anyone who would like my PowerPoint presentation can e-mail me at gertenbachd@hazenresearch.com.

As I read Mr. Andrew's message, I was reminded of Benford's Law of Controversy, which states that "Passion in any argument is inversely proportional to the amount of real information advanced." Although this "Law" is mostly tongue-in-cheek, it seems apropos to many of Mr. Andrew's arguments. I would like to address the four arguments from Mr. Andrew's e-mail.

#### Nuclear Waste Disposal

As I stated last month, I see this as the biggest disadvantage of nuclear power generation. While the volume of waste generated from nuclear power plants is quite small compared to other energy sources, it is much more toxic and is a valid concern with using nuclear power. The issues of long-term storage have been bogged down more by politics and fear than by technical concerns. Spent fuel reprocessing, as is done in France and other European countries, would reduce the waste volume in the United States by 75%. However, reprocessing has been halted in the US since 1977 by presidential decree because of concerns with plutonium in the resulting waste. The nuclear power industry is actively investigating other alternatives, for both nuclear power generation and waste fuel reprocessing that would further reduce the quantity and radioactivity of final wastes requiring disposal.

#### Terrorist Attack

Much has been said about terrorists obtaining nuclear material or attacking a nuclear power plant and wiping out tens or hundreds of thousands of people. Unfortunately, much of this rhetoric is based on fear, not on facts. Although I am by no means an expert in this area, I recommend that interested engineers look at the assessments performed by the National Academy of Engineering about radiological attack (dirty bomb) and nuclear attack at <http://www.nae.edu/nae/pubundcom.nsf/weblinks/C-GOZ-642P3W?OpenDocument>, the Congressional Research Service about terrorist attacks on nuclear

power plants at <http://www.globalsecurity.org/military/library/report/crs/rs21131.pdf>, and the United States Nuclear Regulatory Commission about the vulnerability of stored nuclear wastes <http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/reducing-hazards-spent-fuel.html>. These reports point out fallacies of several of the arguments made by Mr. Andrews.

#### Nuclear Weapons

This is another area that the anti-nuclear power crowd always brings up. Blaming the nuclear power industry for nuclear weapons is like blaming the copper companies for the electric chair. Yes, similar to copper being used to make an electric chair, uranium is used to make nuclear weapons. However, the nuclear power industry does not make bombs.

#### Energy Choices

As I mentioned in my presentation, arguing whether nuclear power is green is not the point. The question we really need to ask is "what role should nuclear power play as we integrate all of our energy options to achieve the goals of acceptable cost, reduced CO2 emissions, minimal environmental and social impact, and energy security?" All of our energy choices, including nuclear power, have advantages and disadvantages. As I am fond of saying, there is no such thing as a free lunch.

As engineers, I feel we need to provide society with facts about all of our energy options. Without unbiased information, individuals and society cannot make sound decisions. Engineers must also take the lead in finding solutions to minimize the disadvantages of each of our energy options, including nuclear power, rather than joining those who find a thousand reasons why a problem cannot be solved. Unfortunately, Mr. Andrew's e-mail does not provide unbiased information or any suggestions for overcoming problems.

As I closed my presentation last month, I would like to quote Marie Curie, "Nothing in life is to be feared. It is only to be misunderstood." I would hope that chemical engineers will be in the forefront in overcoming public misunderstanding and fear about chemical technology.

Dennis Gertenbach

## Letter to the Editor: Response to “Uranium Anything But Green”

What Mr. Andrews fails to address is the "energy density" issue that cannot ever be achieved by his "green" alternatives in a cost effective manner - thereby dooming the poor to a life of abject poverty because the alternatives will remain far too expensive on a relative basis. The same approach should be applied to these immediately identifiable social costs as well.

I think debate is good, but I also think decisions must be made about the "here and now" with our best knowledge versus an unrealistic, unpragmatic, and utopian (and "untestable") notion of the future (think AGW).

Fortunately, our economy is now failing due to this philosophy and a forced imminent pragmatism will sweep away the ephemeral, idealistic notions and we will collectively chose to avoid returning to a "stone age" alternative lifestyle.

It has been and always will be a fallacy to judge past actions with the knowledge and social attitudes of today. Similarly, there is great merit to tradition, which is why it is a tradition in the first place!

Tom Wellborn

## Recap of January AIChE Section Meeting

Topic: Uranium, The Other Green Energy  
By: Dennis Gertenbach, Hazen Research, Inc.

Uranium has the advantage in that during the generation of electricity, it produces no greenhouse gases. There are 436 nuclear power plants worldwide with 43 more under construction. About 16% of world electricity generation comes from nuclear power. France leads the world in percent of power from nuclear plants.

The production of uranium for power plants begins with the extraction of the uranium ore. There are many different forms of natural uranium. Uranium ore can be mined, either open-pit or underground and then processed to produce yellow cake. Yellow cake is an intermediate step between ore and fuel rods and is mostly uranium oxide (U<sub>3</sub>O<sub>8</sub>). The uranium can also be extracted in situ, as is proposed for Weld County. The in situ extraction can be done with an acid leach or a carbonate leach. The acid leach tends to remove additional materials that must be removed with additional processing. Carbonate leaching has the advantage of producing mostly pure uranium oxides.

Purification of the ore is done using ion exchange resins or solvent (liquid-liquid) extraction. The end result is yellow cake.

One issue that has dogged nuclear power is waste. The waste can be reprocessed and AREVA claims to have a process that can reuse 96% of the used fuel. No other details were available.

Benford's Law:

Passion in any argument is inversely proportional to the amount of real information advanced.

For further information contact:  
Dennis Gertenbach, Senior Vice-President  
Hazen Research, 303-279-4501

## Recap of December AIChE Section Meeting

Topic: Remediation of a 1,4 – Dioxane Plume  
By: Jim Hutton, EarthTech/AECOM

Dioxane is a heterocyclic organic compound that was used as a stabilizer for 1,1,1-Tetrachloroethane. For more information see <http://ntp.niehs.nih.gov/ntp/roc/elevnth/profiles/s080diox.pdf>

An Air Force facility near Tucson used TCE for a number of years and then switched to 1,1,1-TCA as it was considered safer. Dioxane was added to 1,1,1-TCA as a stabilizer. Commercial grade TCA contained about 6-8% Dioxane.

TCE was discovered in water wells in the early 1980's and a remediation program began. A combination of Soil Vapor Extraction and pump-and-treat (air stripping) was used to remediate the TCE plume. The treated water was re-injected into the ground. In 2001, testing was initiated for Dioxane. It was found that the Dioxane plume was more extensive than the TCE plume, probably because the air strippers did not remove Dioxane and thus re-injected Dioxane with the treated water. Levels up to 600 ug/liter of Dioxane were found, it was associated with dichlorethylene (DCE) a breakdown product of TCA.

A number of remedial methods were investigated, including activated carbon, resin adsorption, air stripping, bioremediation and oxidation. Only oxidation was found to be economically effective. UV-peroxide oxidation was rejected as too energy and maintenance intensive. Since the total organic loading was low, ozone-peroxide was economically viable. Ozone-peroxide was selected as the treatment method.

Treatment is expected to last several decades.

For further information contact:  
Jim Hutton, Senior Engineer  
EarthTech, an AECOM Company  
(303) 804-2314

## NEW MEXICO CORNER

*Our next meeting will be a joint meeting with the University of New Mexico AIChE section on February 10, 2009 at 5:30 p.m. We will be touring the new \$43M state-of-the-art Centennial Engineering Center on campus, followed by pizza dinner and a Q&A session with the students. Please RSVP by Friday, February 6th to [GreenfelderKL@cdm.com](mailto:GreenfelderKL@cdm.com) or 505-243-3200. Contact Kerri for room location and parking instructions. Cost is \$15 for AIChE members, free for students (with proper ID).*

*If you'd like to volunteer to speak at a future meeting or if you have any meeting/activity ideas, please let me know! Participation in the Albuquerque area has increased over the last year and I'd like to keep this trend going! Again, a warm "Thank You" to all of the AIChE-NM members for making our little sub-section a great one! See you soon!*

*Kerrie Greenfelder, New Mexico Liaison  
[GreenfelderKL@cdm.com](mailto:GreenfelderKL@cdm.com)*

## Need a little laugh..... SING THIS!

The Atoms Family Song  
(sung to the tune of The Adams Family Theme song)

They're tiny and they're teeny,  
Much smaller than a beany,  
They never can be seeny,  
The Atoms Family.

Together they make gases,  
And liquids like molasses,  
And all the solid masses,  
The Atoms Family.

### Chorus:

They are so small (snap, snap)  
They're round like a ball. (snap, snap)  
They make up the air. They're everywhere.  
Can't see them at all. (snap, snap)

Neutrons can be found,  
Where protons hang around;  
Electrons they surround  
The Atoms Family.

## AIChE Meetings

### 2009

Feb 22-24	Joint AIChE/SPE Workshop Sonoma, CA
Mar 9-12	SBE Accelerating Biopharmaceutical Development Coronado Isl., CA
Apr 26-30	2009 Spring Nat'l Tampa, FL
June 12-14	2009 Leadership Development Conference Augusta, GMA
Sept 13-19	2009 Ammonia Conference Calgary, Alberta
Nov 8-13	Annual Meeting Nashville, TN

For further information, contact National AIChE.

### National AIChE Contact Info

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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.

## Rocky Mountain AIChE News Publication Schedule

### March 2009 issue

Articles due Wednesday, March 4<sup>th</sup>  
Publish on Friday, March 6<sup>th</sup>  
Meeting on Tuesday, March 17<sup>th</sup>

## MEETING SCHEDULE

*The Rocky Mountain District of AIChE generally meets the third Tuesday of every month, September through November and January through May.*

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