



Advanced Resources  
International, Inc.

December 2015

# Advanced Resources International QUARTERLY UPDATE

Unconventional Resources • Enhanced Recovery • Carbon Sequestration

Advanced Resources International is a professional services firm that provides geological, reservoir engineering, business and policy analysis and advice on a global basis related to unconventional gas resources, enhanced oil recovery and geologic carbon sequestration. Our quarterly update highlights current industry trends, ongoing and completed projects, recent publications, upcoming workshops and events, and company news. We encourage you to visit our website at [www.adv-res.com](http://www.adv-res.com) to learn more about our company history, research and technology activities, industry news and much more. You may also contact our offices listed at the bottom of this page for additional information.

*Advanced Resources' Senior Staff:*

Steven M. Carpenter

Michael L. Godec

Jason A. Hummel

Jonathan R. Kelafant

George J. Koperna Jr.

Vello A. Kuuskraa

Anne Y. Oudinot

Robin Petrusak

David E. Riestenberg

Scott H. Stevens

Clark Talkington



## LARGE SCALE ENHANCED COALBED METHANE (ECBM) RECOVERY AND CO<sub>2</sub> STORAGE PROJECT IN CHINA

On November 18, 2015, Advanced Resources International signed a contract in Beijing to provide support for a large scale enhanced coalbed methane (ECBM) recovery and CO<sub>2</sub> storage project in China. The other signatories to the contract are the No. 156 Coalfield Geologic Exploration Team Subordinate to Xinjiang, Uygur Autonomous Region Coalfield Geology Bureau (China), and Jupiter Oxygen Corporation (USA). The project plans to demonstrate the commercial viability of carbon capture, utilization and storage (CCUS) via the application of ECBM; as well as the feasibility of commercial scale high flame temperature oxy-combustion with carbon capture for CCUS technology deployment.

For more information:

[http://adv-res.com/pdf/Press Release XINJIANG ECBM TEAM 156 2015 SIGNING.pdf](http://adv-res.com/pdf/Press%20Release%20XINJIANG%20ECBM%20TEAM%20156%202015%20SIGNING.pdf)

<http://jupiteroxygen.com/2015/12/beijing-china-4/>

## 2015 CARBON MANAGEMENT TECHNOLOGY CONFERENCE (CMTC 2015)

Several Advanced Resources International team members delivered presentations at the 2015 Carbon Management Technology Conference (CMTC 2015). The meeting was held November 17 – 19, 2015 at the Sugar Land Marriott Town Square, in Sugar Land, TX and focused on carbon capture, utilization, and storage (CCUS) technologies that provide options for lowering greenhouse gas emissions while maintaining fuel diversity for sustainable growth. Mr. José Figueroa of the U.S. DOE National Energy Technology Laboratory's Carbon Capture Program and George Koperna of Advanced Resources, co-chaired this conference administered by AIChE and supported by the Engineering Founder Societies.



## POTENTIAL ISSUES AND COSTS ASSOCIATED WITH THE CONVERSION FROM UIC CLASS II EOR TO CLASS VI CO<sub>2</sub> STORAGE WELLS

Michael Godec delivered a presentation entitled, "Potential Issues and Costs Associated with the Conversion from UIC Class II EOR to Class VI CO<sub>2</sub> Storage Wells", which reviewed the costs associated with transitioning from carbon dioxide enhanced oil recovery (CO<sub>2</sub>-EOR) to carbon dioxide storage operations. Specifically, the focus was on the potential issues and costs associated with ensuring CO<sub>2</sub>-EOR project gets "credit" for stored CO<sub>2</sub>, along with those associated with converting a CO<sub>2</sub>-EOR project to a CO<sub>2</sub> storage project. Mr. Godec concluded that if important legal and regulatory considerations can be addressed, it is conceivable that costs ensuring CO<sub>2</sub> storage associated with CO<sub>2</sub>-EOR can be relatively modest. He also lent his expertise to the CO<sub>2</sub>-EOR to Storage Panel Session, where he further expounded on the issues related to such transitions.



## PRESSURE TRANSIENT RESPONSE ANALYSIS AT THE SOUTHEAST REGIONAL CARBON SEQUESTRATION (SECARB) ANTHROPOGENIC



**TEST SITE NEAR CITRONELLE, ALABAMA**

JohnRyan MacGregor presented a talk entitled, "Pressure Transient Response Analysis at the Southeast Regional Carbon Sequestration (SECARB) Anthropogenic Test Site near Citronelle, Alabama", which addressed the preliminary findings of research conducted on an experimental monitoring technology. This presentation discussed how pressure pulse data collected from CO<sub>2</sub> monitoring activities associated with the SECARB Anthropogenic Test may be leveraged to constrain the location, and potentially the shape, of the CO<sub>2</sub> plume in the subsurface. His presentation may be found below.

For more information:

[http://adv-res.com/pdf/JR\\_MacGregor\\_CMTC15\[6276331\].pdf](http://adv-res.com/pdf/JR_MacGregor_CMTC15[6276331].pdf)



**DEMONSTRATION OF CO<sub>2</sub> CONTAINMENT AND NON-ENDANGERMENT AT THE SOUTHEAST REGIONAL CARBON SEQUESTRATION (SECARB) ANTHROPOGENIC TEST SITE NEAR CITRONELLE, ALABAMA**

David Riestenberg presented, "Demonstration of CO<sub>2</sub> Containment and Non-Endangerment at the Southeast Regional Carbon Sequestration (SECARB) Anthropogenic Test Site near Citronelle, Alabama", which begins to lay out the framework of multiple lines of evidence to support non-endangerment at the USDOE-NETL's SECARB Citronelle Test Site. His presentation may be found below.

For more information:

[http://adv-res.com/pdf/CMTC\\_2015\\_Riestenberg.pdf](http://adv-res.com/pdf/CMTC_2015_Riestenberg.pdf)



**INTERNATIONAL STANDARDS ORGANIZATION (ISO) TECHNICAL COMMITTEE (TC) 265 PANEL**

George Koperna participated in the International Standards Organization (ISO) Technical Committee (TC) 265 Panel Session. He, along with others on the panel, discussed the basis for generated an international standard for carbon capture, transportation, and storage. While his focus was on CO<sub>2</sub>-EOR, he and others on the panel discussed the trials and tribulations of gaining international consensus and the key issues that each subcommittee is attempting to overcome.

For more information:

<http://fscarbonmanagement.org/cmctc/2015>



**DEVELOPMENT OF THE FIRST INTERNATIONALLY ACCEPTED STANDARD FOR GEOLOGIC STORAGE OF CARBON DIOXIDE UTILIZING ENHANCED OIL RECOVERY (EOR) UNDER THE INTERNATIONAL STANDARDS ORGANIZATION (ISO) TECHNICAL COMMITTEE TC-265, IN ENERGY PROCEDIA**

A recent study by Advanced Resources International for the International Energy Agency Greenhouse Gas Program (IEAGHG) assessed the CO<sub>2</sub>-EOR and CO<sub>2</sub> storage potential of the largest 54 oil basins in the world. The assessment concluded that fifty of these basins have reservoirs amenable to miscible CO<sub>2</sub>-EOR. Assuming "state-of-the-art" technology, oil fields in just the largest discovered fields in these basins (those greater than 50 million barrels of original oil in place) have the potential to produce 470 billion barrels of additional oil, and store 140 billion metric tons of CO<sub>2</sub>.

EOR will continue to lead the way as an early entrant into the CCS project world. CO<sub>2</sub>-EOR provides an opportunity to address both climate and energy security. The role of government in the world-view of CCS is very important. Without the financial incentives provided by the governments around the globe, the rollout of numerous large-scale CCS projects is not likely. Promoting CO<sub>2</sub> storage via CO<sub>2</sub>-EOR can provide new revenues to those participants in the value chain – thereby taking a "second step" toward commercial deployment. With the advancement and success of ISO TC-265, developing economies can more easily enter the CCUS arena by adopting the best practices and standards advanced by TC-265 thereby providing an attractive alternative for GHG mitigation, especially in non-OECD economies.

This paper was published by Elsevier in the Trends in Ecology & Evolution Issue 30/9, 2015:

[Publication is available through webshop.elsevier.com, CLICK HERE](http://www.elsevier.com/locate/ymb/2015/30/9)



## OPEN PLENARY: THE DYNAMIC ENERGY LANDSCAPE: NATURAL GAS IN THE U.S.

Mr. Vello Kuuskraa, President of Advanced Resources International participated in the 33rd USAEE/IAEE North American Conference held in Pittsburgh, PA, October 25th through 28th, 2015. He was part of the panel for the Opening Plenary: The Dynamic Energy Landscape: Natural Gas in the U.S. This event took place at the Wyndham Grand Hotel.

For more information:

<http://www.usaee.org/usaee2015/>



## EXECUTIVE PLENARY SESSION

George Koperna participated on behalf of Mr. Vello Kuuskraa, President of Advanced Resources International, in the Executive Plenary Session of the SPE Asia Pacific Unconventional Resources Conference and Exhibition. The session discussed the lessons learned and the forward challenges for Australian and North American LNG projects. The presentation drew on how the explosion of shale gas industries in North America has flipped the forward looking LNG supply and demand outlook and how similar burgeoning industries in China, India and South America could impact LNG deployments in Australia. The event took place from November 9th through 11th at the Brisbane Convention & Exhibition Centre, Brisbane, Australia.

For more information on this event, please visit

<http://www.spe.org/events/urce/2015>



## EVALUATION OF MEXICO'S SHALE OIL AND GAS, SPE 177139

Advanced Resources International's Scott Stevens and Keith Moodhe summarized their recent work on shale oil and gas resources in Mexico in SPE 177139, which was presented at SPE LACPEC (Latin America and Caribbean Petroleum Engineering Conference) held in Quito, Ecuador on 18-20 November 2015. For this study, ARI developed a unique geologic and reservoir data base from over 400 Mexican articles and university theses. To date, 10 oil companies have purchased our commercial GIS data base, which is extracted from fully documented publicly released information. Mexico has some of the best shale potential outside the US and Canada, particularly in the Burgos and Tampico-Misantla basins. Shale blocks are expected to be auctioned by the Mexican government during 2016. ARI conducted the first comprehensive public shale evaluation of Mexico for the Energy Information Administration in 2010.

This SPE article will be published in November, 2015:

<http://www.spe.org/publications/techreports/>



## INTERNATIONAL PITTSBURGH COAL CONFERENCE AND THE 2015 U.S. COAL MINE METHANE CONFERENCE COMBINE FORCES IN A SPECIAL COAL MINE METHANE TRACK

The U.S. Environmental Protection Agency's (EPA) Coalbed Methane Outreach Program (CMOP) announced that the 2015 U.S. Coal Mine Methane (CMM) Conference was held in conjunction with the 32nd Annual International Pittsburgh Coal Conference (PCC) in Pittsburgh, Pennsylvania, U.S.A., on 5-8 October 2015.

The U.S. CMM Conference, which has been held annually or biennially since 2007, is the only U.S. conference series dedicated solely to CMM recovery and use. The Conference is dedicated to providing a unique opportunity for in-depth and focused exchange of technical information and policy issues among representatives from industry, government and academia throughout the world. The PCC is an annual event devoted to all aspects of coal, energy, and the environment.

The theme of this year's conference was "Coal - Energy, Environment and Sustainable Development" which covers a wide spectrum of important topics on coal technology, synfuel and environmental issues. The topics cover energy and environmental issues



and technologies related to coal and its byproducts. Over 300 technical papers and posters were presented throughout the conference.

The organizers believed that combining these two important events would provide a single forum for wider participation and deeper discussion of mine methane management and utilization in the United States and around the world.

The U.S. CMM Conference was featured as a stand-alone track within the PCC.

For more information on this conference, please go to <http://www.engineering.pitt.edu/Sub-Sites/Conferences/PCC/Content/Past-2015/>



## **UNDERGROUND STORAGE OF CARBON DIOXIDE: INTRODUCTION AND FIELD DEMONSTRATION EXAMPLES**

David Riestenberg, with Advanced Resources International, Inc gave a presentation on September 14, 2015 at the East Tennessee Geological Society that was being held at the Pellissippi State Technical Community College in Knoxville, TN. The presentation described Carbon Dioxide capture and storage (CCS) technologies have the potential to reduce CO<sub>2</sub> emissions from new and existing coal- and gas-fired power plants and large industrial sources. After separation and compression of CO<sub>2</sub> from the source it is transported to an injection site(s). This presentation will introduce the concept of underground injection and geologic storage of the CO<sub>2</sub> into deep underground rock formations. Experiences with a U.S. Department of Energy-supported demonstration of CO<sub>2</sub> capture, transport and storage, the "Anthropogenic Test", was presented.

For more information:  
<http://www.etgs.us/meeting.htm>



## **DEVELOPMENT OF THE FIRST INTERNATIONALLY ACCEPTED STANDARD FOR GEOLOGIC STORAGE OF CARBON DIOXIDE UTILIZING ENHANCED OIL RECOVERY (EOR) UNDER THE INTERNATIONAL STANDARDS ORGANIZATION (ISO) TECHNICAL COMMITTEE TC-265**

Steve M. Carpenter attended the Unconventional Resources Technology Conference (URTEC) which was held in San Antonio, TX at the Henry B. Gonzalez Convention on July 20-22, 2015 and presented, "Development of the First Internationally Accepted Standard for Geologic Storage of Carbon Dioxide Utilizing Enhanced Oil Recovery (EOR) Under the International Standards Organization (ISO) Technical Committee TC-265". International Standards Organization (ISO) has created a technical committee (TC-265) to advance the development of comprehensive standards that address carbon capture, utilization, and storage. A Working Group within TC-265 has been created (WG 6, CO<sub>2</sub>-EOR) focusing on standardization in connection with enhanced oil recovery (EOR) related carbon dioxide storage. The new working group will focus on standardization efforts associated with low-pressure subsurface oil field operating environments and related CO<sub>2</sub> recovery operations, as well as the harmonization of CO<sub>2</sub> supplies with EOR operations both on a daily basis and over multi-year operational horizons, among other topics. Additionally, the working group must address buffer storage and plans to continue the international call for expert participation in its development of standards and other documents related to CO<sub>2</sub>-EOR.



## **AMERICAN NATIONAL STANDARDS INSTITUTE'S (ANSI) CREATION OF THE U.S. TECHNICAL ADVISORY GROUP (TAG) TO ISO TC 82 MINING WITH A FOCUS ON RESERVE ESTIMATION, SAFETY, ENGINEERING, UNDERGROUND COAL GASIFICATION (UGC) AND COAL MINE METHANE (CMM) AND VENTILATION MINE METHANE (VAM)**

Steve M. Carpenter also presented, "American National Standards Institute's (ANSI) Creation of the U.S. Technical Advisory Group (TAG) to ISO TC 82 Mining with a Focus on Reserve Estimation, Safety, Engineering, Underground Coal Gasification (UGC) and Coal Mine Methane (CMM) and Ventilation Mine Methane (VAM)". The International Organization for Standardization (ISO) Technical Committee (TC) 82 – Mining has been in existence since 1955 but little to no standards have resulted from this committee, largely due to the lack of participation of key countries that include the US, UK, and Australia. Now a renewed led by Germany, but also including significant contributions by Russia and China has created renewed interest in developing standards that meet

the specific needs of international mining operations. This includes standardization of specifications relating to machinery and equipment used in opencast and underground mining for the extraction of solid mineral substances, but excluding the preparation and processing of the minerals; recommended practice in the presentation of plans and drawings used in mine surveying; methods of calculation of mineral reserves; and, terminology. This activity is being undertaken because standards are needed to ensure mining operations are done safely and with due regard for protection of the environment.

Supporting this effort will help ensure the United States maintains its rightful place as a global leader in the mining sector and that American norms, best practices, and experiences are recognized and accepted in international standards that can be adopted into the U.S. The specific scope, which included four (4) main topics includes:

1. specifications relating to machinery and equipment used in opencast and underground mining for the extraction of solid mineral substances, but excluding the preparation and processing of the minerals;
2. recommended practice in the presentation of plans and drawings used in mine surveying;
3. methods of calculation of mineral reserves; and
4. terminology.

Most significant is scope of work item number 4, which is designed to integrate the existing US (SEC Guide 7), Canadian (CN 43-101), and Australian (JORC) methods for determining mineral reserves. Future work is expected to include CMM/VAM and UCG. Current participating member nations include Germany, China, Finland, Iran, South Korea, Russian Federation, South Africa, Spain, Sweden, and the United Kingdom. The main focus of the paper will be to inform the UrTEC of the US TAG progress and to solicit expert participation from the UrTEC membership.

For more information:

<http://urtec.org/2015/Technical-Program/Conference-Overview>



George Koperna, chaired a technology-driven panel session, "Operations and Production Challenges – Planning for Long-Term Production" which showed that more than 95 percent of all U.S. oil wells require some form of artificial lift from the start of production. Various pumping methods employed today include beam/sucker rod, gas lift, plunger lift, electric submersible, progressing cavity and subsurface hydraulic pumps. These artificial lift methods coupled with new advances in digital oil field automation allow greater efficiency and less downtime. Yet challenges remain both in equipping extended-reach lateral wells and creating a stable and robust automated monitoring system. The panel will review and assess the current and emerging technologies that are being used to enhance long-term performance for gas and liquids-rich shale wells.

For more information:

<http://urtec.org/2015/Technical-Program/Conference-Overview>



## UPSTREAM CHALLENGES SESSION

Vello Kuuskraa, President of Advanced Resources International, participated in Stanford University's Natural Gas Initiative 2015, "Natural Gas and the Energy Bridge", Symposium held in February 2015 on the Stanford University Campus in Palo Alto, California. He was a panelist on the Upstream Challenges session moderated by Professor Tony Kocscek of Stanford University. Other panelists included representatives from ConocoPhillips and Shell.



For more information:

<https://ngi.stanford.edu/content/natural-gas-and-energy-transition-explored-stanford-natural-gas-initiative%E2%80%99s-inaugural>



## THE FUTURE IS UNCONVENTIONAL

Vello Kuuskraa, President of Advanced Resources International, participated in Rice University's Industry-Rice Earth Science Symposium (IRESS) 2015, "New Geological Targets, Technologies, and Challenges: Our Continuing Dialog with Industry". This 2-day meeting took place on the campus of Rice University in Houston, Texas. Mr. Kuuskraa made the presentation entitled, "The Future is Unconventional", during Session 1: Energy Vision and Industry Perspective on the first day of the conference.

For more information on this meeting please go to:

[http://iress.rice.edu/schedule\\_2015.html](http://iress.rice.edu/schedule_2015.html)



## UPCOMING EVENTS

### 2016 Offshore Technology Conference (OTC2016)

NRG Park  
Houston, Texas  
May 2-5, 2016  
<http://2016.otcnet.org/Content/Join-us-for-OTC-2016/1/>

### AAPG Annual Convention & Exhibition 2016

BMO Centre at Stampede Park  
Calgary, AB  
June 19-22, 2016  
<http://ace.aapg.org/2016>

### Unconventional Resources Conference (2016URC)

San Antonio, TX  
August 1-3, 2016  
<http://urtec.org/2016>

### Thirty Third Annual International Pittsburgh Coal Conference

International convention Centre  
Cape Town, South Africa  
August 8 – 12, 2016  
<http://www.engineering.pitt.edu/pcc/>

### SPE Annual Technical Conference and Exhibition

Dubai World Trade Centre  
Dubai, UAE  
September 26 – 28, 2016  
<http://www.spe.org/atce/2016/>

### GHGT-13

SwissTech Convention Center  
Lausanne, Switzerland  
November 14 – 18, 2016  
<http://www.ghgt.info/>

For a complete list of industry news, recent white papers and case studies please visit our website [www.adv-res.com](http://www.adv-res.com) or contact one of our offices:

<b>Washington, DC</b> 4501 Fairfax Drive, Suite 910 Arlington, VA 22203-1659 Phone: 703.528.8420 Fax: 703.528.0439	<b>Houston, TX</b> 11931 Wickchester Ln, Suite 200 Houston, TX 77043-4547 Phone: 281.558.9200 Fax: 281.558.9202	<b>Knoxville, TN</b> 1210 Kenesaw Ave., Suite 1210A Knoxville, TN 37919-7736 Riestenberg P: 865.240.3944 Cyphers P: 865.240.3957	<b>Cincinnati, OH</b> 1282 Secretariat Court Batavia, OH 45103 Phone: 513.460.0360
--	---	--	---