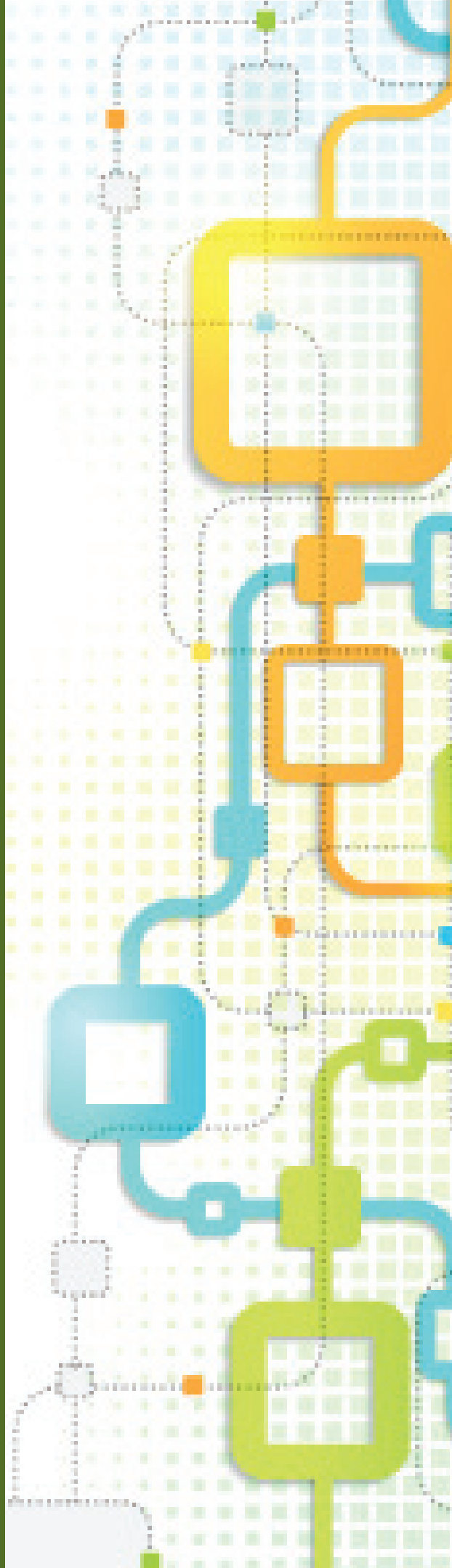




**LSU**

**CENTER FOR ENERGY STUDIES**

# ANNUAL REPORT **2013**





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# 2013: CENTER FOR ENERGY STUDIES

## Natural Gas, Manufacturing Dominate 2013 Research

ALLAN G. PULSIPHER,  
EXECUTIVE DIRECTOR  
[enrg.lsu.edu](http://enrg.lsu.edu)

Throughout 2013, CES's Mark Kaiser, professor and director of the Research & Development Division, and David Dismukes, associate executive director and professor, focused their research on the "revolutionary" development of unconventional natural gas resources. Kaiser provided economic analyses, production forecasts, and profitability assessments of the Haynesville Shale play, while Dismukes examined the potential economic impacts, particularly in Louisiana, of recent capital investments leveraged by the boom.

In his numerous published reports, Kaiser examines the "profit space" of Haynesville wells and demonstrates the conditions under which wells are expected to be economic. He looks at the tradeoff between high initial production, steep decline, and high investment cost that characterize the marginal economics of the shale play. Kaiser shows that better production models and continued technological advances in drilling and completing the complex shale wells will reduce initial outlays and development risk and improve the profitability of the play in the future.

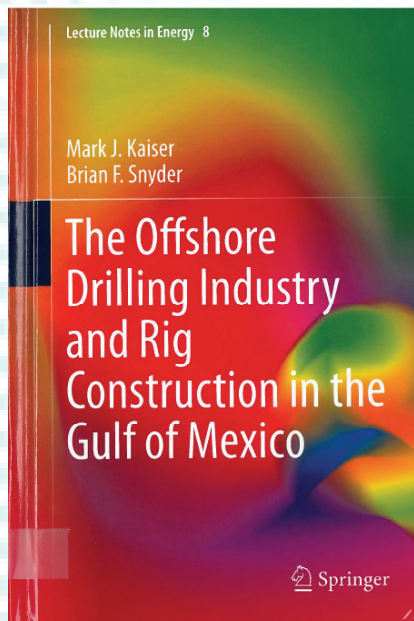
Kaiser and Yunke Yu, research associate, have also provided analyses on the "precipitous" decline in shale drilling in North Louisiana. In a series of articles for the *Oil & Gas Journal*, Kaiser and Yu address the "rapid retrenchment" and the decline in the number of new wells drilled over the past two years in the Haynesville formation. Kaiser and Yu review drilling activity, reserves positions, development cost and profitability in the play, and provide a production forecast for the region.

In January 2013, David Dismukes released "Unconventional Resources and Louisiana's Manufacturing Development Renaissance," which examines the potential economic impacts of recent capital investments leveraged by the boom in unconventional natural gas production in the state. The study was sponsored by America's Natural Gas Alliance and the Louisiana Oil & Gas Association. It provides an economic overview of the Louisiana manufacturing sector, examines the importance of natural gas to this sector, and shows how the emergence of unconventional resources has resulted in a virtual manufacturing investment renaissance in Louisiana.

Dismukes reports that some \$62 billion in new capital investments have been announced in Louisiana and are likely to be developed in the next five to eight years. Statewide impacts include a potential for in-state capital investment in Louisiana to total \$20.2 billion (out of the total of \$62 billion) over the next nine years, with more than \$29.7 billion in economic output over a nine-year period (2011-2019). The investments could result in a cumulative increase of some 214,670 job-years, with a \$9.3 billion increase in wages over a nine-year construction period.

Throughout the year, Dismukes was sought by local, state and national media to comment on the revolutionary natural gas development and its economic impacts. He presented his research to industry groups, including participants at the International Technical Conference in Houston and the Louisiana Chapter of the American Petroleum Institute, as well as members of state and federal agencies, and media, including members of the Baton Rouge Press Club.

For a complete list of 2013  
CES projects, visit  
[enrg.lsu.edu/projects](http://enrg.lsu.edu/projects)



### **Kaiser, Snyder Publish Offshore Drilling Text**

Mark Kaiser and Brian Snyder have co-authored *The Offshore Drilling Industry and Rig Construction Market in the Gulf of Mexico* (London: Springer-Verlag, 2013), a comprehensive text examining the mobile offshore drilling units (MODUs) service and construction industry and the economic impacts of rig construction in the U.S.

MODUs, which include jackups, semisubmersibles and drillships, are supplied through newbuild construction and operate throughout the world in highly competitive regional markets.

The book describes and categorizes the industrial organization and major players in the contract drilling and construction markets. It features an evaluation of day rates and tests hypotheses regarding day rate factors. Contractor decision-making models are developed, including a net-present value model of newbuilding investment, and market capitalization models are derived. The text also examines jackup construction shipyards and processes, and it provides estimates of labor, equipment, and materials cost in U.S. construction.

## 2013 Publications

Dismukes, D.E. Combined Heat & Power in Louisiana: Status, Potential, and Policies. Phase 1 Report: Resource Characterization & Database. Louisiana Department of Natural Resources. 62 pp.

---. Unconventional resources and Louisiana's manufacturing development renaissance. Washington, D.C.: America's Natural Gas Alliance, and Baton Rouge: Louisiana Oil & Gas Association. 93 pp.

Iledare, O.O. Oil in Latin America (LA-TAM): A statistical review and perspective. Paper presented at the 4th ELAEE Conference, April 8-9, Montevideo, Uruguay.

Iledare, O.O. (ed.) (with A. Adenikinju and A. Iwayemi). *Proceedings of the 2012 NAEE Conference: Energy technology and infrastructure for development*. Ibadan, Nigeria: Atlantis Books. 668 pp.

Iledare, O.O. (with J. Echendu). A comparative analysis of the impact of production sharing contract (PSC) terms and instruments on deepwater E&P in the Atlantic Gulf of Guinea. Paper presented at the 4th ELAEE Conference, April 8-9, Montevideo, Uruguay.

Kaiser, M.J. Coal company valuation, production and reserves. *International Journal of Oil, Gas and Coal Technology* 6(4):367-391.

Kaiser, M.J. and B.F. Snyder. Assessing the offshore drilling market: Fleet values depend upon rig specification, market conditions, and contract backlog. *Offshore* 73(2):44-48.

— . Capital investment and operational decision making in the offshore drilling industry. *Engineering Economist* 58(1):35-58.

— . Economic impacts of the offshore supply vessel shipbuilding market in the Gulf of Mexico. *Maritime Economics & Logistics* 15(2):256-287.

— . Empirical models of jackup rig lightship displacement. *Ships and Offshore Structures* 8(5):468-476.

— . Measuring competition in the offshore drilling market: Analysis finds jackup market unconcentrated; floater market moderately concentrated. *Offshore* 73(4):54-58.

— . Modeling offshore wind installation costs on the U.S. Outer Continental Shelf. *Renewable Energy* 50(February):676-691.

— . Modelling service vessel activity in the Outer Continental Shelf Gulf of Mexico. *International Journal of Logistics - Research and Applications* 16(1):51-85.

— . A primer on the offshore contract drilling industry. *Ocean Development and International Law* 44(3):287-314.

— . Reviewing newbuild drill rig strategies: Data suggests that as contractor size increases, newbuild investment decreases. *Offshore* 73(3):44-47.

— . The five offshore drilling rig markets. *Marine Policy* 39 (May):201-214.

— . The offshore drilling industry and rig construction in the Gulf of Mexico. London: Springer. 312 pp.

Kaiser, M.J., B. Snyder, and A.G. Pul-sipher. Offshore drilling industry and rig construction market in the Gulf of Mexico. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEM 2013-0112. 375 pp.

Kaiser, M.J. and Y. Yu. Haynesville update 1: North Louisiana gas shale's drilling decline precipitous. *Oil & Gas Journal* 111(12):62-67.

Visit [www.enrg.lsu.edu/publications](http://www.enrg.lsu.edu/publications)  
for the Center's bibliography

## Outreach & Education

Center for Energy Studies faculty and staff regularly provide energy information and analysis to the academic community, public agencies, business and civic groups, and the public. David Dismukes is called upon routinely by state agencies to share his expertise. In July, Louisiana Economic Development asked him to provide an analysis of how the president's plan for the nation to convert from coal to natural gas might affect natural gas prices and volatility in both the short run and the long run.

Other regular CES outreach and education includes a legislative update by research associate Elizabeth Dieterich, who provides a twice-weekly e-mail report to subscribers that tracks energy-related bills proceeding through the legislature. And throughout the year, CES librarian Versa Stickle and research associate Ric Pincomb respond to public phone and e-mail inquiries on local, state, and regional energy topics ranging from home energy efficiency information to oil and gas prices.

### 2013 Speaking Engagements

David Dismukes

- "New Industrial Operations Leveraged by Unconventional Natural Gas," American Petroleum Institute Louisiana Chapter Meeting, 14 January.
- "Unconventional Resources and Louisiana's Manufacturing Development Renaissance," Baton Rouge Press Club, 28 January.

- "Louisiana Unconventional Natural Gas and Industrial Redevelopment," Risk Management Association Luncheon, 21 March.
- "Natural Gas & Electric Power Coordination Issues and Challenges," Utilities State Government Organization Conference, Pointe Clear, Alabama, 9 July.
- "Natural Gas Markets: Leveraging the Production Revolution into an Industrial Renaissance," International Technical Conference, Houston, Texas, 11 October.
- "Replacement, Reliability & Resiliency: Infrastructure & Ratemaking Issues in the Power & Natural Gas Distribution Industries," Louisiana State Bar, Public Utility Section Meetings, 15 November.

Allan Pulsipher

- "A Global Energy Overview: Is it a whole new ballgame?" NAP TR-TEC Conference, New Orleans, 29 October.

### CES in the News

Faculty regularly respond to media requests for information on energy issues, including oil and gas exploration and production technology, developments in alternative energy, and environmental and energy policy. In 2013, the Center attracted local, regional, and national media attention for several research endeavors. Media outlets reporting on CES works during the year include

The Advocate

AOL.com

Baton Rouge Area Chamber's  
Catalyst

The Baton Rouge Business  
Report

The Houma Courier

Nola.com



View or download CES presentations at  
[www.enrg.lsu.edu/presentations](http://www.enrg.lsu.edu/presentations)



## Under the Rotunda

The conference area of the Energy, Coast & Environment Building, including the Dalton J. Woods Auditorium, a large conference room, and lobby, provides a venue for commencement exercises, convocations, cultural events, workshops, seminars, and receptions. In 2013, the space served as a venue for 250 events, including 28 public outreach events hosted by the Center for Energy Studies, Louisiana Geological Survey, the School of the Coast and Environment and other units. The conference facilities and calendar are managed by CES librarian Versa Stickle.

### 1960s Arctic Oil Development Topic of August Seminar

In August, the Center hosted a seminar featuring University of Washington Ph. D. candidate Ross Coen, who discussed his book *Breaking Ice for Arctic Oil*. The book examines the political and technological history of the icebreaking tanker SS Manhattan. In 1969, the Manhattan transited the Northwest Passage to test the viability of shipping Alaska North Slope crude oil via circumpolar marine routes. In his presentation, Coen described how, in the late 1960s, upon the discovery of the Prudhoe Bay oil field on Alaska's North Slope, proposed pipelines, drilling pads, offshore terminals, tankers, and other infrastructure might impact the environment of the Canadian Arctic. He also outlined the challenges to Ottawa's claims of sovereignty over the lands and waters of the region and explained how American development proposals would allow for Canada to design its own Arctic resource policies that would protect the environment of the region.



In August, CES hosted a seminar by Ross Coen, who discussed his book *Breaking Ice for Arctic Oil*, about the SS Manhattan, an icebreaking tanker that transited the Northwest Passage in 1969.

## Energy Initiative Addressed at LSU ORED Retreat

On Friday, October 18, 2013, the LSU Office of Research & Economic Development (ORED) hosted a daylong retreat for more than 70 faculty and administrators with the goal of identifying key objectives for future growth in the priority research areas identified in the ORED strategic plan. Allan Pulsipher, along with James J. Spivey, director of the DOE Energy Frontier Research Center at LSU, and Randy Duran, executive director for the LSU Gordon A. Cain Center for Science, Technological, Engineering, and Mathematical Literacy (STEM), led the discussion on conventional and renewable energy. In their presentation, Pulsipher, Spivey, and Duran identified why energy must be a research priority for LSU: Louisiana and adjacent offshore under federal jurisdiction produce approximately 18% of the oil and 24% of the natural gas that fuels the U.S. economy. Long-term prospects for low-cost natural gas are driving the decisions of major corporations to locate in Louisiana, and the technologies require a trained workforce, both in plant operations and research.

Energy-related topics critical to economic development include the development of conventional energy sources, transport of petrochemical-based energy, nuclear, alternative energy generation (bio-based, solar, etc.), energy storage (load leveling via supercapacitor/hydroelectric/the automotive fleet), Li-ion and fuel cell in the transportation sector, energy conservation in the industrial sector, training and workforce development.

The researchers recommended the use of existing LSU capabilities in geosciences and engineering to focus on oil and gas research and development relevant to Louisiana, with national implications such as shale gas and shale oil. As Penn State uses the traditional strengths and outreach components of a land grant university to address business and environmental challenges created by development of the Marcellus shale oil and gas, LSU is well positioned to take advantage of our proximity to oil and gas resources and the conversion of these resources to higher value products.

According to ORED, the consensus statements generated by each collaborative session of the retreat are to be developed into a set of "actionable items" in support of the goals defined by the Transition Advisory Team and their vision for OneLSU.

# LSU

Office of

## Research & Economic Development



*Wumi Iledare retired January 3 after 21 years of service to the Center for Energy Studies.*

## Iledare Retires from CES

Wumi Iledare, professor and the director of the Energy Information and Data Division, retired January 3, 2014, after 21 years of service to the Center for Energy Studies. He will be director of the Emerald Energy Institute for Petroleum, Energy Economics, Policy and Strategic Studies at the University of Port Harcourt in Rivers State, Nigeria.

Iledare joined CES as an assistant professor in 1992. His many honors include recognition by the Society for Petroleum Engineers in 2008 for his distinguished contribution to the field of petroleum engineering in the area of management and information in Africa. In 2011, he was awarded the Nigerian Association for Energy Economics, or NAEF, Distinguished Fellowship Award in recognition of his “distinguished leadership and contributions to the development of the Energy Sector in Nigeria” and for his support of the NAEF. He was president of the U.S. Association for Energy Economics in 2008 and is the current president of the International Association for Energy Economics.

## Personnel

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### Faculty

**Allan G. Pulsipher, Ph.D.**, executive director and Marathon Oil Company Professor of Energy Policy in the Center for Energy Studies

**David E. Dismukes, Ph.D.**, associate executive director, director of the Policy Analysis Division, and professor

**Omowumi (Wumi) Iledare, Ph.D.**, director of the Energy Information and Data Division, professor of petroleum economics and policy research, adjunct professor of petroleum economics at the Craft & Hawkins Department of Petroleum Engineering at LSU and the University of Ibadan

**Mark J. Kaiser, Ph.D.**, director of the Research & Development Division and professor

**Mike McDaniel, Ph.D.**, professional-in-residence (retired) and an adjunct professor of environmental sciences in the School of the Coast and Environment

**Ralph W. Pike, Ph.D.**, director of the Minerals Processing Research Division and Paul M. Horton Professor of Chemical Engineering

### Research Associates

**Elizabeth Dieterich**

**Siddhartha Narra, Ph.D.**

**Kathryn Perry**

**Ric Pincomb**

**Brian Snyder, Ph.D.**

**Yunke Yu**

### Staff

**Marybeth Pinsonneault**, communications manager

**Stacy Retherford**, computer analyst

**Diana Reynolds**, assistant to the executive director

**Versa Stickle**, librarian

**Michael Surman**, computer analyst

# MINERALS PROCESSING RESEARCH DIVISION

RALPH PIKE, DIRECTOR  
[www.mpri.lsu.edu](http://www.mpri.lsu.edu)

The Minerals Processing Research Division (MPRD) was established in 1979 by federal legislation as one of 31 State Mineral Institutes associated with the U.S. Department of the Interior. The mission includes facilitating research and public service programs in process research and technology transfer, sustainable development, energy management, energy sustainability, and inherently safer design. This minerals processing research and public service complements and benefits from the energy research and geological research performed by other groups in the Center for Energy Studies and the Louisiana Geological Survey.

The current research focus of the MPRD is on energy optimization in the chemical production complex in the lower Mississippi river corridor and on plants that use biomass feedstocks to supply the same products as current plants in this complex. Cooperative research agreements are in place with Monsanto, Motiva Enterprises and Mosaic. This research and technology transfer involves collaboration with process and plant engineers at these and other companies.

## Energy Optimization

To help improve the operability and efficiency of large energy generating systems, Minerals Processing Research Division personnel have instrumented and are collecting data from the 20MW cogeneration system at LSU. Work to date has culminated in a Ph.D. dissertation (May 2013) by Mohammed Shafi Syed titled "A New Diagnostics Tool for Water Injected Gas Turbines – Emissions Monitoring and Modeling." F. Carl Knopf served as dissertation advisor and Ralph W. Pike served as committee member. Articles detailing this work are in review.

## Economic Decision Analysis for Process Engineers

The monograph on Economic Decision Analysis for Process Engineers has been revised extensively and is being prepared for publication. This revision includes an evaluation of the latest process simulation (flowsheeting) programs that interact with elaborate capital cost estimating programs, such as Aspen Plus Process Simulator, Aspen Process Economic Analyzer, Aspen Capital Cost Estimator and Aspen In-Plant Cost Estimator. On-line Chemical Engineering Plant Cost Indices are included along with the best methods for depreciation based on the Corporate Income Tax Rates for 2013 in the U. S. Master Tax Guide, among other additions.

## Predictive Models for Barataria Basin

The Louisiana Coastal Protection and Restoration Authority's *2017 Coastal Master Plan: Model Improvement Plan* describes several numerical models to be used for estimating the effect of projects on the ecosystem of the Barataria and Ponchartrain basins. Previous research conducted by the Division on predictive models for the Barataria Bay basin is being evaluated to assist in the numerical modeling of fish and shellfish dynamics for coastal restoration project planning for Barataria Bay and adjacent coastal marsh. Research results are available from solutions of the transport equations that predict velocity profiles, and temperature and salinity profiles along with distributions of different species of nitrogen, detritus, phytoplankton, and other organisms contributing to primary production.

## Technical Sessions at National Meeting

The three following technical sessions were chaired at the American Institute of Chemical Engineers' Annual Meeting in San Francisco, November 3 -8, 2013. Each session had eight presentations from industry engineers and university researchers on numerous aspects of developing innovative processes to produce fuels and chemicals from renewable resources with an average of 50 attendees in the three sessions.

- Sustainable Fuels: Advances in Innovative Processes
- Sustainable Chemicals: Advances in Innovative Processes
- Sustainable Fuels from Renewable Resources

## Collaboration with EPA Sustainable Technology Division

Collaborative research is continuing on new chemical and refinery processes that use renewable resources as feedstocks with Dr. Debalina Sengupta at the EPA Sustainable Technology Research Division at the Environmental Research Center in Cincinnati, Ohio. Dr. Sengupta visited the Division in December for planning the next phase of the research on the potential application of multi-level models for plant level material and energy balances, multi-plant interactions and corporate planning.

## On-Line Research, Publications and Programs

The Division's web site [www.mpri.lsu.edu](http://www.mpri.lsu.edu) has been revised and extended with new research results including journal articles, conference proceedings, technical reports, theses, dissertations and computer programs. It is an extensive web site that has updated professional development self-study courses for professional engineers' PDH requirements. The programs have installation files that can be downloaded and used on an individual's computer. Included with the programs are users' manuals and tutorials. These programs have been developed using actual plants, and the process models can be applied to comparable plants.

Most recently the staff of the Minerals Processing Research Division has been updating available software to ensure compatibility with the new 64 bit version of Excel (Excel 2013).

The revised and expanded book, *Optimization for Engineering Systems* by Ralph W. Pike has been published on Kindle, ASIN: B00BF2TLXO, Amazon Digital Services (2013). It provides current detailed information and programs for process and plant optimization.

Volume II of the book *Modeling Analysis, and Optimization of Process and Energy Systems*, by F. Carl Knopf is in a draft form and includes new topics and extension of topics in Volume I.

To help support plants that use biomass feedstocks to produce chemicals, an open source version of the Peng-Robinson equation of state with special emphasis on water containing systems has been made available. Details of the software can be found in V. K. Kandula, J.C. Telotte, and F.C. Knopf, "It's not as easy as it looks: revisiting the Peng-Robinson equation of state for dew point, bubble point and flash calculations," *IJMEE*, Vol. 41, No. 3, July 2013, pages 188 – 203.

## Technology Transfer

Two technologies that have immediate and substantial energy savings on chemical plants and refineries are "pinch technology" and "on-line optimization." Large companies have corporate level groups that routinely apply pinch technology and on-line optimization. Small to medium sized chemical companies in Louisiana do not have the trained personnel needed to apply this technology. Two short courses on these topics are available on request by contacting the Division at [www.mpri.lsu.edu](http://www.mpri.lsu.edu).

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### MPRD Staff

**Ralph W. Pike**, director, Horton Professor of Chemical Engineering

**F. Carl Knopf**, associate director, Anding Professor of Chemical Engineering

**Mohammed Shafi Syed**, Ph.D. Student

**Abhijith Kondapally**, M.S. Student

**Brianna Robinson**, Environmental Engineering major, Chancellors Student Aid

**William Fernandez**, Biological Engineering major, Chancellors Student Aid

# LOUISIANA GEOLOGICAL SURVEY

CHACKO J. JOHN  
DIRECTOR & STATE GEOLOGIST  
[www.lgs.lsu.edu](http://www.lgs.lsu.edu)

The Louisiana Geological Survey (LGS) was first organized in 1869 and was permanently established by legislation in 1934 by Act 131 of the Louisiana State Legislature and has, since inception, been located on the campus of Louisiana State University (LSU) and was a unit of the Louisiana Department of Natural Resources (LDNR). It was legislatively transferred from DNR to Louisiana State University in 1997 and currently reports to the LSU Vice Chancellor of Research and Economic Development through the Executive Director of the Center for Energy Studies (CES) at LSU, though it functions independently of CES.

The LGS performs geological investigations designed to accomplish its primary mission to promote environmentally sound economic development of the natural resources of the state (energy, mineral, water and environmental). Information is transferred to all stakeholders through publications, conferences, and presentations at professional conferences and other venues as and when needed.

## Personnel & Budget

LGS currently has a total number of full time staff of 14 and two part-time staff including all categories of personnel. The LGS budget continued to decrease every year in the last five years due to budget cuts by LSU and has gone down by approximately 58% with the latest being a 41% cut for fiscal year 2012-2013 and 2013-2014. LGS has been successful in obtaining research grants to offset these budget cuts until now but the continuing economic downturn resulting in fewer opportunities and greater competition for research grants does not bode well for the future. LGS now has a critical number of personnel and cannot

afford to lose any more personnel by layoff or staff leaving for better opportunities as has happened due to the critical budget situation if it is to successfully continue its mission and purpose for which it was legislatively established.

## LGS Contribution to the National Geothermal Data System

The focus of this three year U.S. Department of Energy-funded project with participation from all 50 state surveys represented by the Association of American State Geologists (AASG) and managed by the Arizona State Geological Survey is to identify, catalog, and create geothermal databases and maps for inclusion in the National Geothermal Data System (NGDS). LGS completed all its deliverables for this project in June 2013 which included well temperature data from over 91,000 wells and eight relevant georeferenced geothermal related geologic maps. Final completion of this project by all state surveys will result in the creation of a very large database designed to facilitate the potential development of geothermal and geopressured-geothermal resources in the United States by helping to mitigate much of the upfront risks associated with this resource development.

## Geologic Review

This is a continuing program which began in 1982 to provide regulatory technical assistance to the Coastal Management Division of the Louisiana Department of Natural Resources (LDNR) and to three districts of the U.S. Army Corps of Engineers (USACE) and is renewed every year. Funding for this was provided by USACE (75%) and LDNR (25%). Unfortunately, due



*Marty Horn, assistant professor-research at the Louisiana Geological Survey, performs stream-measurement field work at Beaver Bayou.*

to cutbacks to the USACE, they eliminated their share of the funding which has resulted in not doing any geologic reviews for USACE. The purpose of this program is to review drilling permit applications in Louisiana's coastal zone to avoid and/or minimize environmental damage by proposing alternative concepts like reducing the size of ring levees and slips, reducing lengths of board roads and canals, directional drilling, and use of alternative access routes. This has been a very successful program which has resulted in significant reduction (approx. 75%) in average length of canals and board roads built in the Louisiana coastal zone. It is also, as far as we know, the only program of its kind in the country.

### Surface Water Gauging Network Improvements

LGS received a three-year contract (2012-2015) from the Louisiana Department of Natural Resources (LDNR) titled "Surface Water Gauging Network Improvements." The main objective of this project is to provide additional assistance and data to supplement efforts to monitor and manage groundwater and surface water resources being conducted by the U.S. Geological Survey for LDNR. Work involved the selection of approximately 50 gauging stations in collaboration with LDNR for seasonal discharge measurements. This data, combined with data available from other monitoring agencies, is being used to

develop/revise existing rating curves and profiles for the sites. Four new surface gauging sites are being established with approval from LDNR at sites where there are no gauging stations. In addition, LGS will catalog and compile hydrologic and geologic data for publicly owned reservoirs and lakes gathered from existing records and site visits as needed. Project results will be published in annual reports to be provided to LDNR.

### National Coal Resources Data Systems (NCRDS)

The NCRDS project is a co-operative program between USGS and LGS and is currently funded for a five-year period starting July 1, 2010. For the first year of this project, strike-oriented (east-west) cross sections through north Louisiana were prepared to illustrate stratigraphy and the lateral changes and occurrence of Wilcox coal beds in the area. Dip-orientated cross sections in the same area were prepared in the second year of the project. During the third year of the project, structural trend maps of the top of the Wilcox formation and the top of the Midway formation (= base of the Wilcox) were completed along with a data base of two commercial coal bed methane (CBM) sources in Louisiana. This list is comprised of wells drilled for CBM into these seams, subsea tops, and seam thickness in each well. The fourth year project work consists of preparation of the text chapters for the "Coal Bed Atlas of Louisiana" including a description of the geology of north Louisiana and its coal bearing strata.

### LSU Petroleum Engineering Geothermal Project

LGS researchers are continuing to work with faculty from the LSU Petroleum Engineering and other departments on this three-year Department of Energy funded project titled "Zero Mass Withdrawal, Engineered Convection and Well Bore Energy Conver-

sion” which is now in its second year. The project focuses on modeling potential underground technologies and equipment for energy extraction from hot geopressed geothermal brines which are a huge potential energy resource especially in the Gulf of Mexico region. LGS provides information on well temperatures, reservoir geometry, lateral extents, etc. of resource areas best suitable for development for input into the engineering modeling applications.

### Evaluations of Water Permit Requests

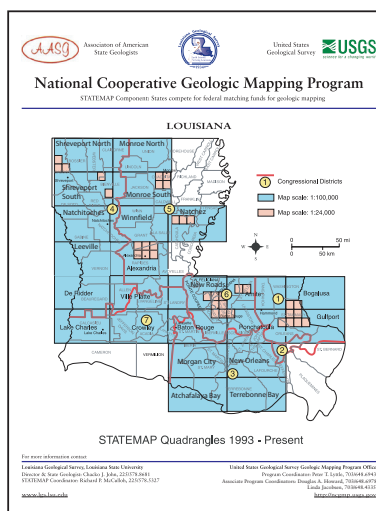
LGS has a contract with the Louisiana Department of Natural Resources (LDNR) to evaluate water use permit requests from various sources for various purposes. Unbiased recommendations are made by LGS on permit requests sent for evaluation from LDNR.

### Inventory and Digital Infrastructure of Historic Louisiana Geological Map Data

LGS has been awarded a new contract from the U.S. Geological Survey’s National Geological and Geophysical Data Preservation Program to fund the proposal *“Inventory and Digital Infrastructure of Historic Louisiana Geological Map Data.”* This is the third year of funding from the USGS program. The task is to inventory the LGS map archives and to index, digitally scan, and catalog the thousands of items into a database with metadata records to help preserve the data and make the collection more accessible. John Snead is the Principal Investigator of the one-year project that also includes Reed Bourgeois, Patrick O’Neill, and Hampton Peele.

### Geologic Mapping

LGS is the only research organization doing geologic mapping in the state of Louisiana. The continuing mapping effort is supported by cooperative agreements with the U.S. Geological Survey under the National Cooperative Geologic Mapping Program approved by the U.S. Congress. The STATEMAP project for fiscal year 2012-2013 involved geologic mapping and compilation of the Natchitoches 30x60 minute quadrangles in the northwestern part of the state. The fiscal year 2013-2014 project will achieve the completion of the 1:100,000 scale coverage of the state with at least draft GIS compilation for all 30x60 minute quadrangles by undertaking the final remaining two, Bastrop and Tallulah, in the northeastern corner of the state. Although LGS has previously mapped some 7.5 minute quadrangles with STATEMAP support in tandem with the geologic compilation of the encompassing 30x60 minute quadrangle, we discontinued this practice in recent years to optimize progress towards the completion of statewide 30x60 minute geologic quadrangle coverage. Beginning in fiscal year 2014-2015 our proposed STATEMAP projects will seek to resume 1:24,000 scale mapping and transition to exclusive focus on field mapping of 7.5 minute quadrangle study areas.



### Allostratigraphic Nomenclature Applied to Geologic Map Units of Quaternary Age

LGS’s Rick McCulloh has reviewed the “Application of Allostratigraphic Nomenclature by the Louisiana Geological Survey to Geologic Map Units of Quaternary Age.” He explains that, in the late 20th century, allostratigraphic nomenclature was formulated specifically for application to terraced depositional sequences and similarly related units. This nomenclature was incorporated into the North American Stratigraphic Code originally published in 1983. Prior to the advent of allostratigraphic nomenclature, efforts at recognition and mapping of surfaces informally dubbed “the terraces” in the Quaternary outcrop belt of the Louisiana coastal plain had spanned most of the 20th century and had become a well-focused and actively debated research topic by midcentury. Once allostratigraphic nomenclature had become available, it appeared to have obvious utility in Louisiana for making better sense of “the terraces,” i.e., for facilitating more systematic classification of the Quaternary units on which they were developed, than previously had been possible. McCulloh notes that LGS first began exploring the application of this nomenclature to the mapping of surface Plio–Pleistocene units in the late 1980s, and since then has found it suited to the mapping of Quaternary units generally in Louisiana. McCulloh predicts that, for the present and foreseeable future, allunit concepts and nomenclature will continue to offer an effective approach to the understanding and classification of mappable onshore Quaternary units of the Louisiana coastal plain.

## Monroe Natural Gas Field Celebrates Centennial

LGS's Douglas Carlson has written a report on the 100-year history of the Monroe Natural Gas Field (MGF), which lies in northeast Louisiana, with its center approximately 20 miles south of the Arkansas-Louisiana border and 50 miles west of the Mississippi River near Sterlington, La. The MGF is Louisiana's largest natural gas field; more than 10,000 wells have been permitted to draw gas from this field. It is a shallow gas field located 2,000 to 2,300 feet below the ground surface.

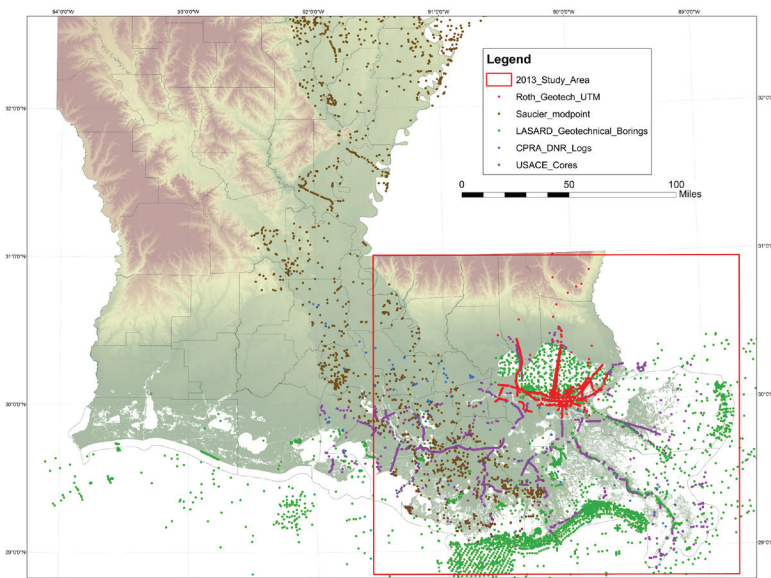
The original gas content of the Monroe Gas Field (MGF) has been determined to be more than 7 trillion cubic feet. Gas was first discovered and extracted in the Monroe area during 1909, before markets were developed to sell and distribute the gas outside of the Monroe area. This first well, drilled in Monroe City Park, yielded a little gas and salt water at a depth of 1300 to 1500 feet. A year later, 1910, a well was drilled in Forsythe Park, which at 2,350 ft. penetrated a layer containing gas and saltwater. This was the first well that was drilled into the current host rock which the MGF lies in. The first commercial production of gas was obtained by Progressive Oil and Gas Company's Spyket no. 1 well in June 28, 1916. It generated enough excitement to draw enough sightseers to cause the need for local railway to add special trains to Monroe to see the well.

For the year 2012, production was 4.69 billion ft<sup>3</sup>/year. Advances in exploration and development technology are probably the main reason for the slower than expected rate of production decline. The introduction of the Haynesville field gas production in 2009, which nearly doubled Louisiana onshore gas production, caused a major change in the MGF's share of Louisiana production. However, the introduction of Haynesville field gas production was less significant for overall U.S. natural gas production. There are three reasons for this relatively smaller impact on fraction of U.S. natural gas production. First, Louisiana's share of U.S. natural gas production has been fairly consistent and at approximately 15%. Second, while the Haynesville production started in 2009, other major gas field production started within a few years of this: Barnett 2001, Fayetteville and Woodford 2007, Bakken, 2009, and Marcellus and Eagle Ford, 2010. Three other U.S. fields have similar if not larger production over the last decade: Barnett January of 2002 to August of 2009 and Marcellus after July of 2012. However, even the interval between September of 2009 and June of 2012, when the Haynesville gas field had the largest natural gas production others--Barnett, Fayetteville and Marcellus--had rates of production similar to the Haynesville. The lead will probably remain for Marcellus for years because its technically recoverable gas resources are approximately 5.5 times that of the second largest field in the U.S., the Haynesville. For the complete report, visit <http://www.lgs.lsu.edu/deploy/uploads/2013%20Newsletter.pdf>



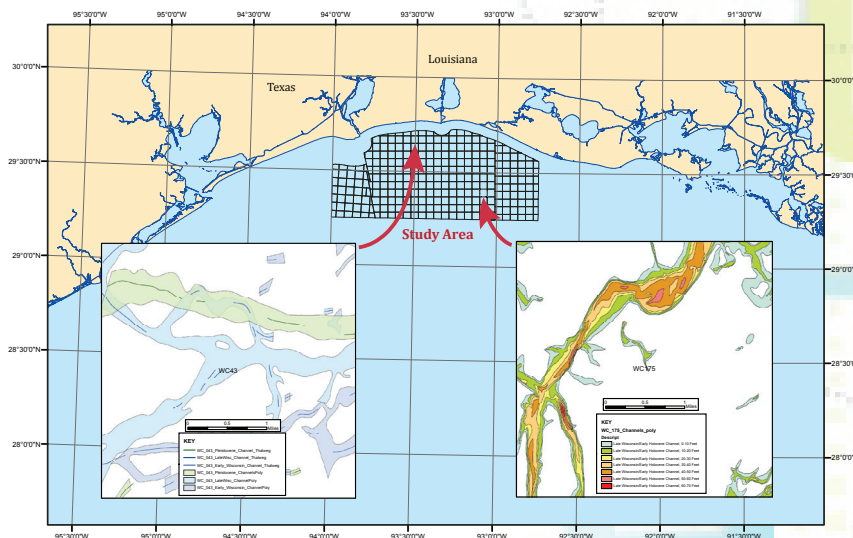
## Late Quaternary Stream and Estuarine Systems to Holocene Sea Level Rise on the OCS Louisiana and Mississippi: Preservation Potential of Prehistoric Cultural Resources and Sand Resources

The Louisiana Geological Survey has entered a cooperative agreement from the Bureau of Ocean Energy Management (BOEM), Bureau of Safety and Environmental Enforcement (BSEE) to investigate possible sand resources and possible archeological sites in the Louisiana state waters in the Outer Continental Shelf. "Late Quaternary Stream and Estuarine Systems to Holocene Sea Level Rise on the OCS Louisiana and Mississippi: Preservation Potential of Prehistoric Cultural Resources and Sand Resources" is a two-year project with Paul Heinrich as Principal Investigator. The project will examine responses of late quaternary stream and estuarine systems to Holocene sea level rise. The objectives of the study are to develop a geophysical and geologic database for the study area, to develop geologic/stratigraphic models, develop a predictive model for paleo-landscape preservation potential, and to evaluate sand resources of paleo-fluvial channel fills within the study area. An understanding of these processes can result in the evaluation and refinement of models used to predict cultural and non fuel mineral resources within deltaic environments. A fully functional Geographic Information System (GIS) will be developed from all collected geospatial data. Robert Paulsell, the project Co-P.I., has coordinated the development of the GIS. Over 118 offshore hazards maps have been digitized, resulting in more than 150 shapefiles. These data are included in the GIS as well as boring data and seismic track line locations. Nomenclature for these data are being developed as most of the hazards maps have different descriptions for similar geophysical features. These data will be archived with the National Oceanographic Data Center (NODC) and the National Environmental Satellite, Data, and Information Service (NESDIS). The project is expected to be completed by September 30, 2014.



## Research and GIS Development of the Base of the Holocene in the Louisiana Coastal Plain and Adjacent Continental Shelf

This is a two-year (2013-2015), recently funded, project between The Water Institute of the Gulf (TWIG) and LGS with the funds coming from the Louisiana Coastal Protection and Restoration Authority (CPRA) through TWIG. The project involves the preparation of a detailed structural map of the unconformity that forms the base of Holocene sediments within the Louisiana Coastal Zone. During the first year of this project, mapping will cover the Mississippi River Delta region. For the second year, the remainder of the coastal zone and the Louisiana Chenier Plain will be mapped. This unconformity is an important and critical geologic feature because the overlying thickness of typically under-consolidated Holocene sediments is a major factor governing local subsidence rates and depth to solid sediments for the foundation of major structures.



## Outreach

### Rock'n in the Swamp

LGS participated in the event titled "Rock'n in the Swamp" organized by the Baton Rouge Parks and Recreation and is a one day educational outreach for schools. The LGS exhibit booth displayed rocks and minerals found in Louisiana and other places and thin sections. Fossil specimens were also displayed. The LGS booth proved to be one of the star attractions for the hundreds of school students and other adults attending the event.



## Personnel

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**Patrick O'Neill**, LGS Publications Sales and Resource Center

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**Jeanne Johnson**, accounting technician



# RADIATION SAFETY OFFICE

**WEI-HSUNG WANG, DIRECTOR**  
[www.radsafety.lsu.edu](http://www.radsafety.lsu.edu)

The LSU Radiation Safety Office (RSO), which reports through the Center for Energy Studies (CES) to the LSU Office of Research and Economic Development, is an essential, unique, independent, and vital regulatory radiological control unit to support research, teaching, and clinical activities involving the use of sources of ionizing and non-ionizing radiation at LSU. The LSU System's broad-scope Radioactive Material License issued by the Louisiana Department of Environmental Quality (DEQ) allows the University maximum flexibility to accomplish legitimate and realistic research and teaching objectives through the effective and efficient operation of a regulatory mandated radiation protection program carried out by the RSO. Under the direction of the Radiation Safety Committee (RSC), the RSO implements the radiation control policies and procedures such that radiation exposure to faculty, staff, students, the general public, and the environment will be maintained as low as reasonably achievable and that no radiation exposure will be received without societal benefits. Administrative authorization for the radiation protection program from the University is contained in LSU System's Permanent Memorandum-30 (PM-30). Enforcement actions for radiation safety violations are authorized under LSU Policy Statement-99 (PS-99).

Currently, there are 824 approved radiation workers (including 107 radiation principal investigators) and 203 radiation laboratories in the Departments of Agricultural Chemistry, Biological Sciences, Chemical Engineering, Chemistry, Civil & Environmental Engineering, Entomology, Environmental Sciences, Geography & Anthropology, Geology & Geophysics, Mechanical Engineering, Ocean-

ography & Coastal Sciences, Physics & Astronomy, and Plant Pathology & Crop Physiology; in the Schools of Animal Sciences, Electrical Engineering & Computer Science, Nutrition & Food Sciences, Kinesiology, Plant, Environmental & Soil Sciences, Renewable Natural Resources, and Veterinary Medicine; and for the Athletic Department, the Center for Advanced Microstructures and Devices (CAMD), the Louisiana Emerging Technology Center (LETC), National Center for Biomedical Research and Training (NCBRT), the Pennington Biomedical Research Center (PBRC), and the Student Health Center. The RSO provides training and personnel monitoring for radiation workers as well as performs routine site surveys and audits, radiation survey meter calibrations, x-ray equipment inspections, radioactive waste management, and leak tests of sealed radioactive sources for approved radiation laboratories to fully comply with regulatory requirements and licensing conditions. Information about ionizing radiation safety and training is located on the RSO website.

In fiscal year 2012-2103, the RSO reviewed and approved 53 grant proposals involving the use of ionizing radiation sources. Funds requested by these proposals were \$39,830,167. Actual funds granted to LSU were \$26,366,881.

The RSO is also responsible for the non-ionizing radiation safety within the purview of the *LSU System's Safety Procedures for Non-Ionizing Radiation*. There are 91 active Class 3B and Class 4 laser systems, 104 approved laser users (including 16 laser principal investigators), and 37 laser laboratories in the Departments of Biological & Agricultural Engineering, Biologi-

cal Sciences, Chemistry, Geology & Geophysics, Mechanical Engineering, Oceanography & Coastal Sciences, and Physics & Astronomy, as well as CAMD, NCBRT, and the School of Veterinary Medicine (SVM). The RSO evaluates and inspects the inventoried Class 3B and Class 4 laser systems for laser intra beam hazards as well as provides online training. Information on ultra-violet radiation safety in the workplace is also available on the RSO website.

Due to limited manpower and resources, the Center for Energy Studies provides administrative support for accounting and purchasing activities, computer and network maintenance, and personnel management for the RSO.

### Inspection by DEQ

Two inspectors from DEQ's Radiation Surveillance Section Radioactive conducted material license and Increased Controls inspections of LSU's radiation protection. They examined

the approval categories for radiation principal investigators and the policies and procedures for Increased Controls. They reviewed the records of individual, area, and declared pregnant woman radiation exposure monitoring and investigation for elevated personnel exposure. They also reviewed records of Radiation Safety Committee meetings and members, the annual review of the radiation protection program, inventory and leak tests of sealed radioactive sources, radiation laboratory contamination surveys, escorted access to Increased Controls areas, and radioactive waste disposal. The inspectors also inquired about the functions and applications of the Health Physics Assistant software and the procedures for receiving, monitoring, documentation, and disbursement of radioactive material packages. They visited the Increased Controls areas, tested the alarm monitoring system, and verified the list for individuals with unescorted access. In addition, they walked through 35 randomly selected radiation laboratories

to check the radiation levels, calibration of survey meters, posting requirements, and security in these. After the walk-through, an exit interview was held, and no areas of concern were listed on the DEQ's Field Interview Form.

### Professional Contribution and Recognition

Wei-Hsung Wang, associate professor of CES and director of RSO, spoke at the 2013 American Industrial Hygiene Conference and Exhibition in Montreal in May. As the invited Dr. Herman Cember Memorial Lecturer, Wang gave a presentation on naturally occurring radioactive materials (NORM) for industrial hygienists. NORM is a significant concern for workers in the oil and gas industry, requiring monitoring and control measures to reduce unnecessary radiation exposure to the workers.

Wang explained that, when natural gas is brought to the surface, radioactive radon is often mixed in with



*RSO operations manager Jabari Robinson checks the function of a pancake Geiger-Mueller probe radiation survey meter.*

it. After radioactive radon decays, a series of radioactive “daughters” are produced, and some of the decayed progenies are of particular concern with natural gas production and refining. These radioactive daughters tend to adhere to and accumulate on the inside surfaces of the flow lines, filters, and production equipment. In oil exploration and production, radioactive radium is brought out of the ground with oil. Radioactive radium is chemically bound with the scale found on the inside of a pipe or in surface equipment, e.g., separators, heater treaters, and tanks. These radioactive materials are of primary concern for internal exposure through inhalation and ingestion.

The Dr. Herman Cember Memorial Lecture was initiated by the American Industrial Hygiene Association (AIHA) Ionizing Radiation Committee in 2011. Cember’s distinguished scientific contributions to the field of radiological health and his renowned technical capabilities were highly recognized and sought out by national and international organizations such as the Health Physics Society, the American Academy of Health Physics, and the International Labour Organization, as well as the U.S. Environmental Protection Agency and the U.S. Nuclear Regulatory Commission.

Founded in 1939, the AIHA, with more than 10,000 members, is one of the largest international associations serving the needs of occupational and environmental health and safety professionals. Industrial hygienists are the guardians of workplace safety, applying science to identify, solve, and prevent health and safety concerns.

Wang also completed all requirements for certification as a Certified Safety Professional (CSP). Administered by the Board of Certified Safety Professionals (BCSP), this highly respected certification is awarded to individuals who meet academic standards, satisfy professional safety experience re-

quirements, and have passed two rigorous examinations. The examinations cover engineering and management aspects of safety, applied sciences, legal and regulatory matters, professional affairs, and other safety-related topics.

CSPs specialize in protecting workers, the public, property, and the environment by identifying, evaluating, and controlling hazards. The CSP typically directs safety programs at a corporate level to reduce risk and loss.

BCSP establishes standards for verified competency in professional safety practice. BCSP is a nationally accredited, non-profit corporation chartered in Illinois, with headquarters in Champaign.

### Staff News

Amin M. Hamideh has assumed the position of Radiation Specialist in the RSO since January 2013. Hamideh received bachelor’s degrees in both biochemistry and physics from LSU and is equipped with a desirable academic background in health physics. He is also familiar with the experimental methodology in protein X-ray crystallography.

After completing his bachelor’s degree in biochemistry, Hamideh conducted research in the Department of Biological Sciences at LSU. His project focused on the protein crystallization of phosphorylated PFKFB1, 6-phosphofructo-2-kinase:fructose-2,6-biphosphatase enzyme, in rat liver. This enzyme, also contained in humans, initiates the synthesis and degradation of fructose-2,6-bisphosphate, a metabolite found in glycolysis during cellular metabolism. Fructose-2,6-bisphosphate activates the glycolysis pathway and inhibits the gluconeogenesis pathway in metabolism. PFKFB1 has been a target in pharmaceuticals involved with type-2 diabetes as well as cancer research. While phosphorylated, PFKFB1 favors the gluconeogenesis pathway; thus an increase in blood sugar. By blocking the phosphorylation site in the enzyme, glycolysis can be favored and result in a decrease in blood sugar. To further understand the effects of phosphorylated PFKFB1, X-ray diffraction studies were done on the enzyme. With this information, chemical compounds can be identified to



RSO Radiation Specialist Amin Hamideh examines the results from leak tests of sealed radioactive sources using a proportional counting system.



RSO technical assistant Jamie Dismukes inspects dry solid radioactive waste for proper disposal.

block the phosphorylation site in the enzyme using computational molecular dynamics.

While engaging in his research activities, Hamideh became intrigued by the world of radiological health and decided to return to LSU to obtain another bachelor's degree in medical and health physics. Upon completion of his degree, he was hired as radiation specialist for the Radiation Safety Office. Hamideh is currently pursuing his master's degree in medical and health physics at LSU and board certification in health physics.

Jabari Robinson has assumed the position of operations manager in the RSO since July 2013. Robinson received his master's degree in medical & health physics from LSU, and his bachelor's degree in physics from Southern University. The topic of his master's thesis was "Verification of Direct Brachytherapy Dosimetry for a Single Seed Implant." His most recent employment was with DEQ as a radioactive material license reviewer, and subsequently a radioactive material inspector.

During his six-year tenure with DEQ, Robinson wrote and amended radioactive material licenses, responded to radioactive material licensees and x-ray registrants' inquiries, reviewed initial submissions and licensee revisions to radioactive material licenses, and evaluated shielding plans for radiographic, fluoroscopic, CT, PET-CT, clinical LINAC, and HDR installations.

He approved work plans for cleanup of Naturally Occurring Radioactive Material (NORM), assessed release request of NORM impacted sites, reviewed NORM waste manifest, and ensured that the sites of origin were registered and the sites for disposal were approved. He also audited radiation safety training courses, radiation awareness courses, and radiological survey courses, reviewed quarterly reports from suppliers of generally licensed radioactive material, and ensured that the recipients were licensed. He was a resource for the CRCPD whitepaper that dealt with electronic brachytherapy. In addition, Robinson conducted routine inspections on various types of facilities. This included nuclear medicine facilities, nuclear pharmacies, fixed gauge sites (chemical plants), portable gauge sites (construction), industrial radiography offices and job sites, analytical x-ray sites, NORM impacted sites, and broad-scope sites (educational institutions). He responded to citizen complaints, carried out incident investigations, and reviewed responses to licensee deficiencies uncovered in his investigations and inspections to ensure that they were resolved. Furthermore, Robinson contributed to emergency response for both radiological and non-radiological emergency events. He played important roles in nuclear power accident drills for radiological emergency preparedness. These roles included accident assessment, dose assessment, and field team member.

His responses to major events include Hurricane Gustav, Hurricane Isaac, and BP Deepwater Horizon.

He possesses an excellent working knowledge of radiation protection, radiological emergency response, and radiation regulations. The broad range of professional activities that he has conducted has given him an extensive experience and flexibility that is beneficial to the implementation of LSU System's broad-scope Radioactive Material License.

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#### **Radiation Safety Office Personnel**

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**Jabari Robinson, M.S.**, operations manager & laser safety officer

**Amin M. Hamideh**, radiation specialist & laser safety officer

**Richard E. Teague**, RRPT, senior technologist

**Lorraine Day, Ph.D.**, CAMD liaison

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**Christy White, D.V.M.**, PBRC Liaison

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To donate to either or both of the Center for Energy Studies' scholarship funds, in support of LSU students majoring in energy-related fields, please complete the form below and mail to

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