

Annual Report 2018



LSU

Center for
Energy Studies





Contents

2 Center for Energy Studies

- 4** Research Highlights
- 7** Sponsored Research
- 8** Publications 2018
- 10** Speaking Engagements
- 11** Faculty Highlights
- 12** Events & Outreach
- 14** CES in the News
- 14** Personnel

15 Minerals Processing

- 15** Minerals Processing Research Division
- 16** Online Research, Publications and Programs
- 16** Personnel

17 Louisiana Geological Survey

- 17** Mapping & Research
- 22** Geologic Studies
- 22** Energy
- 23** Geophysics
- 24** LGS Publications
- 24** Staff Highlights
- 25** Outreach Activities
- 26** Personnel

27 Radiation Safety Office

- 30** Professional Contributions and Recognitions
- 31** Scholarly Activities
- 32** Personnel

Center for Energy Studies

This past year has been one of continued growth and productivity for the Center, something that could not be sustained without the continued support of the state and our stakeholders. We pride ourselves in being very sensitive and responsive to what we see as the core component of our mission: outreach. The Center's engagement with state policy makers, industry, the media, trade and public interest associations, and even other academics continues to be strong. Attendance at CES events was robust and the number of "hits" we have on our website, seeking information and copies of our various presentations, reports, and other information continues to grow.

We are particularly proud of the increased outreach that has been leveraged through our annual Gulf Coast Energy Outlook (GCEO). This work is more than just a publication and forecast; it serves as an important means of interaction with our community about how energy in Louisiana is changing, and the meaning of those changes for our economy, environment, and citizenry. The GCEO, a joint effort between the Center and our academic colleagues in the E. J. Ourso College of Business, entered its sophomore year with a boon of interest. Sponsorships for the outlook increased and our rollout event on the LSU campus gave us the chance to network with old and new friends alike.

Publication productivity was also up considerably over the past year. Our faculty are not a set of unidimensional researchers publishing in scientific and academic journals alone. Our work includes opinion pieces in regional newspapers and business publications, and, more importantly, several well-recognized trade association publications in electricity and in oil and natural gas production. CES faculty research and opinions were also cited in such publications as the *Wall Street Journal*, the *New York Times*, Bloomberg.com, *The Advocate*, the *Greater Baton Rouge Business Report*, NOLA.com/*The Times-Picayune*, and *New Orleans CityBusiness*.

Lastly, CES contract-sponsored research continues to outperform relative to our current faculty levels. Over the past two years, CES faculty have originated about \$2.5 million in contract research, 70 percent of which was in 2017 and 30 percent of which originated in 2018. Our faculty have over \$2 million per year in proposals under review right now spanning across, on average, a future three-year period.

Our only constraint at this point is people: a deficiency we have worked hard at correcting over the past year. Earlier in 2018, CES undertook an aggressive faculty recruitment process for two open positions. We had around 150 total applications for these two positions, a record level of interest for a CES faculty position over the past two decades. I am happy to report that we have filled both positions with high caliber/high quality emerging scholars that will have both an academic and practical impact on the Center's output. I look forward to discussing all the great contributions these two additions to our faculty, as well as our three "old-timers" have made in our next annual report.

Sincerely,



David E. Dismukes, Ph.D.
Professor & Executive Director



Research Highlights

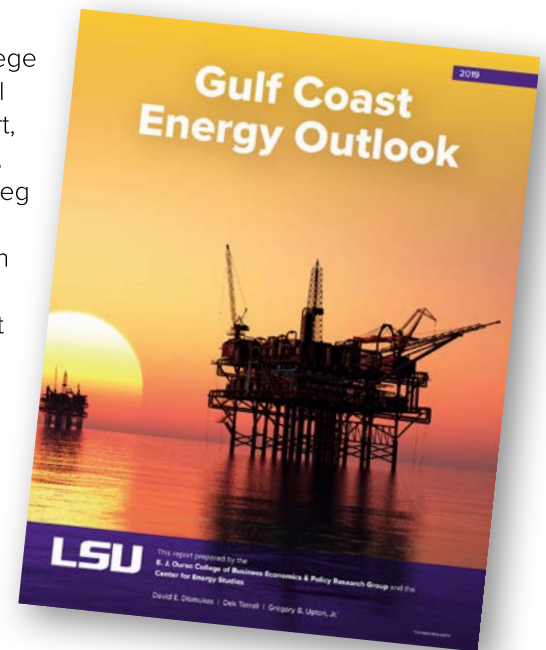
Center Launches 2019 *Gulf Coast Energy Outlook*

On November 16, 2018, the Center for Energy Studies, with the E. J. Ourso College of Business, launched the second annual *Gulf Coast Energy Outlook (GCEO)* report, a collaborative effort by David Dismukes, CES professor and executive director, Greg Upton, CES assistant professor, and Dek Terrell, LSU Economics & Policy Research Group director and professor. The report was introduced at a kickoff event, held at the Center for Energy Studies, at which the researchers presented their findings.

The *GCEO* provides a broad overview of the current status and trends guiding energy markets with an emphasis on the Gulf Coast and reports on upstream oil and gas production, downstream refining and petrochemicals, as well as the contribution of the energy sector to the broader Gulf Coast economy. The report also includes forecasts of future employment in relevant energy sectors.

For 2019, the *GCEO* predicts the overall Gulf Coast energy sector outlook to be a “mixed bag,” as each individual sector is predicted to perform differently:

- ▶ U.S. and Gulf Coast domestic crude oil and natural gas production should remain strong, with drilling activity fueled by higher overall prices. The Gulf Coast region should continue to account for more than half of U.S. crude oil supplies and contribute substantially to overall global energy supplies.
- ▶ Harder to predict are crude oil and natural gas prices, as they are directly impacted by geopolitical uncertainties. Taking several factors into consideration, the *GCEO* anticipates \$60-\$65/Bbl for crude and \$2.50 to \$3/MCF for natural gas.
- ▶ The outlook for the petrochemical sector is flat. While no large chemical or LNG projects are expected to be cancelled completely, there is potential for some rescheduling due to lowered demand from Asia, increased dollar valuations, and trade policy uncertainties.
- ▶ The *GCEO* predicts limited growth for U.S. refining. The growth of U.S. crude oil supplies, the geographic diversity of those supplies, and pipeline infrastructure development will benefit the sector. Export growth of middle distillates, such as jet fuel and diesel, could slow due to an anticipated global economic slow-down and higher dollar valuations.
- ▶ Regional employment is expected to continue to grow during 2019 in both the upstream and downstream sectors for both Louisiana and Texas. Whereas Texas employs approximately two workers in the upstream sector for every downstream employee, Louisiana refining and chemical manufacturing industries currently employ more workers than the upstream sector, and that trend is expected to continue.



The Gulf Coast region will build upon its economic gains from 2018 but those gains will likely be much slower due to concerns about economic growth and geopolitical uncertainties.

Overall, the GCEO anticipates that the Gulf Coast region will build upon its economic gains from 2018 but that those gains will likely be much slower due to concerns about economic growth and geopolitical uncertainties. Ultimately, though, the region will continue to “become a more integrated part of the overall world energy market.”



The 2019 Gulf Coast Energy Outlook was made possible with the support of these sponsors:



Kaiser, Narra Coauthor Recent Publications

CES Professor Mark Kaiser and Research Associate Sid Narra published “U.S. Gulf of Mexico pipeline activity statistics, trends and correlations” in *Ships and Offshore Structures*, 14(1): 1-22. The paper describes pipeline installation and decommissioning activity in the U.S. Gulf of Mexico circa 2016 and discusses active and out-of-service inventory trends.

Kaiser and Narra also published “A hybrid scenario-based decommissioning forecast for the shallow water U.S. Gulf of Mexico, 2018-2038” in *Energy*, 163(November): 1150-1177. The paper presents a model framework to estimate decommissioning activity in the U.S. Gulf of Mexico in water depth of less than 400 feet, a challenging problem due to the sheer number of structures, as well as their diverse types and uses.

In its May 2018 issue, the *Journal of Petroleum Science and Engineering* published an article by Kaiser and Narra titled, “An empirical evaluation of economic limits in the shallow water Gulf of Mexico, 1990-2017.” Updating earlier work, the authors quantify the gross revenue at the end of production of oil and gas structures in water depth less than 400 feet to gain insight into the conditions required for profitable operations.

Operators will continue to operate an offshore structure as long as its net revenue exceeds its direct operating cost, which will vary depending on the type of structure, distance to shore, product type, and other factors. Under certain conditions, operation may continue for strategic reasons when revenues fall below operating cost, and in some cases, the operator will abandon a property before its economic limit is reached, for example, if destroyed by a hurricane. The article quantifies the gross revenue of structures at the end of their life at various levels of categorization to infer economic limits, and then constructs simple regression-models to disentangle the relative importance of primary factors.

“This NSF award represents an excellent opportunity for CES to leverage over a decade’s worth of research on the role of critical energy infrastructure in this manufacturing resiliency process.”

– David Dismukes

CES, Multidisciplinary Team Receive NSF Gulf Coast Manufacturing Resiliency Center Award

In September, the Center for Energy Studies announced that it was part of a team led by Texas A&M University that had been awarded a National Science Foundation planning grant to establish an Engineering Research Center (ERC) for Resiliency Enhancement and Disaster-Impact Interception (READII). The new center will address the critical need for examining the Gulf Coast’s manufacturing sector and its supply chains to become more resilient to natural disasters, specifically hurricanes and floods.

David Dismukes, CES executive director, and a professor in the College of the Coast and Environment, is part of this multidisciplinary team that includes representatives from institutions along the Gulf Coast who will provide expertise in system integration, disaster mitigation, economics, infrastructure, supply chain, system modeling, and optimization. Participants include the TEES Gas and Fuels Research Center at Texas A&M University. In addition to LSU and Texas A&M, participating universities include the University of Texas at Austin, Mississippi State University, Tuskegee University in Alabama, and Florida Atlantic University.

The ERC READII will address a number of key critical topics, including the impact of natural disasters on manufacturing facilities and their respective supply chains, the root causes of manufacturing vulnerabilities, estimating the dynamic relationships between manufacturing industries and their local communities, and identifying novel and proactive strategies and decision tools to facilitate manufacturing resiliency.

“The resiliency of the manufacturing sector along the Gulf Coast is becoming more important as the industry expands with billions in new investments,” said Dismukes. “This NSF award represents an excellent opportunity for CES to leverage over a decade’s worth of research on the role of critical energy infrastructure in this manufacturing resiliency process.”

Dismukes Releases Report on MISO Long-Run Transmission Infrastructure Development

Center for Energy Studies Executive Director and Professor David Dismukes released a report outlining emerging Midcontinent Independent System Operator, Inc. (MISO) transmission planning and infrastructure development issues. “MISO Grid 2033: Preparing for the Transmission Grid of the Future,” released in May 2018, examines the considerable changes that have emerged over the past several years over one of the nation’s largest integrated wholesale power grids.

The report looks at how MISO’s transmission grid has evolved from one primarily focused on regional reliability concerns, to one that has multiple objectives and responsibilities, including assuring open and non-discriminatory access; facilitating electricity commerce across a broad geographic region that spans 15 states and one Canadian province; integrating a wide range of generating resources that include an increasing share of renewables; and incorporating a planning sensitivity for resiliency, cyber security, and economic development concerns of its member states, regulators, and customers.

In the report, Dismukes notes that one of the more considerable challenges for transmission planning is the recognition that, while market value of capacity has diminished over the past several years, the need for new infrastructure investment has not. In fact, if anything, that need has continued to increase.

“MISO Grid 2033” provides background analysis and expands on a wide-ranging discussion held among stakeholders at a November 2017 event titled “MISO Grid 2033: Preparing for the Future.” The event was co-sponsored by the LSU Center for Energy Studies and the Searle Center on Law, Regulation and Economic

Growth at the Northwestern University Pritzker School of Law.

Upton Publishes Paper on Shale Boom Impacts on Residential Mortgages

CES Assistant Professor Greg Upton, with coauthor Meagan McCollum of Baruch College, has published a paper on the impact of the shale oil and gas boom on residential mortgage payments. The study, published in *Resource and Energy Economics*, finds that borrowers with properties located in areas with shale oil and gas booms experienced a six-percent reduction in the probability of missing a mortgage payment over the period 2007-2014.



CES Assistant Professor Gregory Upton authored a chapter on mineral revenues in the book *Exploring Long-Term Solutions for Louisiana’s Tax System*.

CES, LSU Public Administration Institute Analyze Mineral Tax Law

Senate Concurrent Resolution No. 4, passed during the 2018 Second Extraordinary Session of the Louisiana Legislature, calls for the Center for Energy Studies, the LSU Public Administration Institute (LSU PAI), and the La. Tax Institute to analyze the state’s mineral revenues, taxes and exemptions and provide recommendations for improving the tax code. The resolution urges the researchers to consult with stakeholder organizations and relevant legislative committees to formulate specific recommendations.

According to the resolution, the goals of the analysis are

- ▶ improvement of the competitiveness of the state’s oil and gas extraction sector;
- ▶ a decrease or improvement of the difference in tax rates for oil and gas;
- ▶ creation of an equitable system of severance tax exemptions for all wells, not only horizontal wells;
- ▶ improvement and preservation of mineral revenues for the state; and
- ▶ investigation of the reasons behind the fluctuation of La. oil and gas production.

The resolution cites the study led by Professor James Richardson of the LSU PAI, titled *Exploring Long-Term Solutions for Louisiana's Tax System*. CES Assistant Professor Greg Upton authored the chapter on mineral revenues.

After reviewing the current code, running economic analyses, and gathering input from the organizations and legislators, the team plans to make recommendations for improving and simplifying how minerals are taxed. The final report will be due to the Senate Committee on Revenue and Fiscal Affairs and the House Committee on Ways and Means in February 2020.



Sponsored Research

Economic and Policy Analysis of Pipeline Development in Louisiana. David E. Dismukes and Greg B. Upton, Principal Investigators. EnLink Midstream Operating, LP. Project funding: \$30,370.

Economic Impact Analysis for Enable Midstream Partners, L.P. David Dismukes and Greg B. Upton, Principal Investigators. Enable Pipeline. Project funding: \$40,789.

Empirical Analysis of the OCS Pipeline Network in the Gulf of Mexico. Mark Kaiser, Principal Investigator. Bureau of Ocean Energy Management. Project funding: \$219,678.

Estimating the Fiscal Spending Impacts of Offshore Oil and Gas Activity. Greg B. Upton, Subcontractor. Bureau of Ocean Energy Management (BOEM). Project funding: \$9,750.

Integrating Storage into Rooftop Solar: An Economics and Engineering Approach. Greg Upton, Principal Investigator. Louisiana Board of Regents Support Fund: Industrial Ties Research Subprogram. Project funding: \$239,726.

Integrated Carbon Capture and Storage in the Louisiana Chemical Corridor. David Dismukes, Principal Investigator. U.S. Department of Energy's National Energy Technology Laboratory Carbon Storage Assurance Enterprise (CarbonSAFE) program. Project funding: \$1.4 million.

National Science Foundation Planning Grant: Engineering Research Center for Resiliency Enhancement and Disaster-Impact Interception (READII). David Dismukes Co-Principal Investigator. National Science Foundation. Project funding: \$100,000.

Offshore Oil and Gas Activity Impacts on Ecosystem Services in the Gulf of Mexico. David Dismukes, Principal Investigator. Bureau of Ocean Energy Management, Louisiana Coastal Marine Institute. Project funding: \$240,982.

Subsea CO2 Storage. David Dismukes, Co-Principal Investigator. U.S. Department of Energy and Southern States Energy Board.

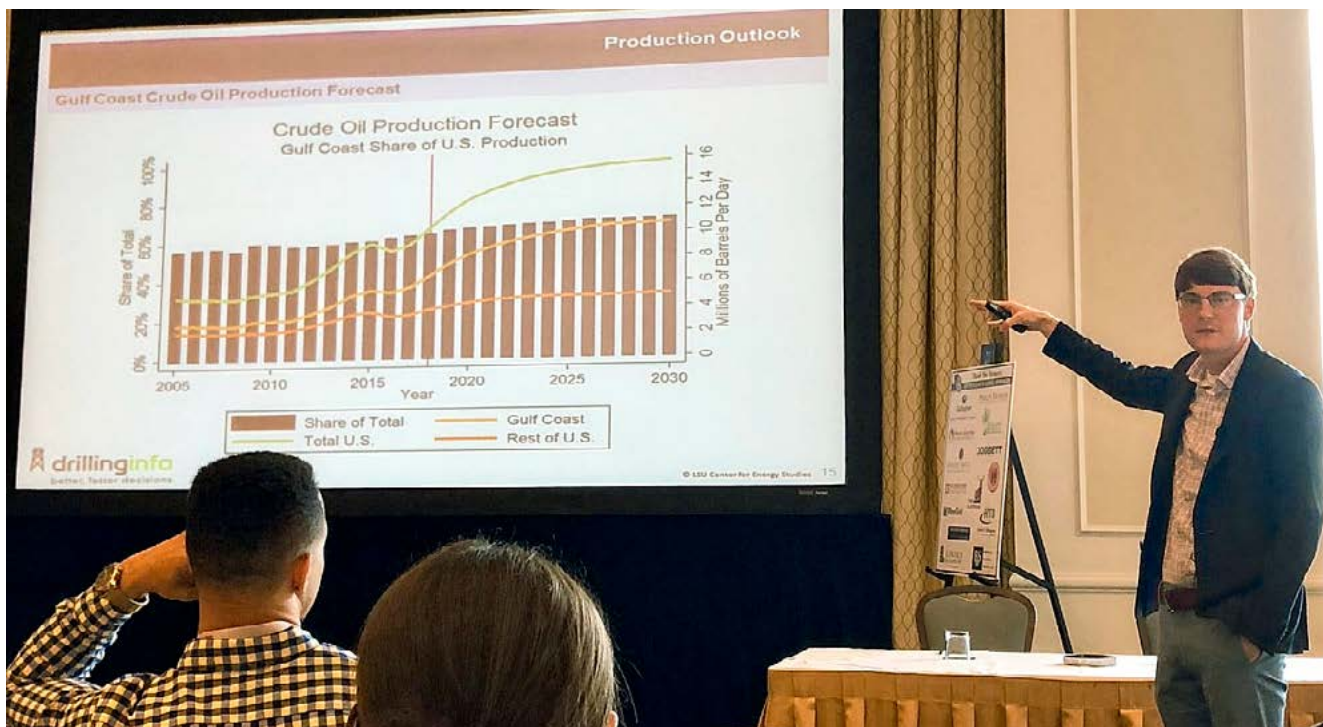
Update to BOEM GOM Factbook. David E. Dismukes, Greg B. Upton, and Mallory Vachon. U.S. Department of the Interior, Bureau of Ocean Energy Management (BOEM). Project funding: \$128,431.



Publications 2018

- Dismukes, David E. "The Dangers of Trade Protectionism for Louisiana Energy Development." *10/12 Industry Report* 3, no. 3 (2018): 51.
- Dismukes, David E. "The Irrelevance of Energy Dominance." *10/12 Industry Report* 3, no. 2 (2018): 55.
- Dismukes, David E. "Why an Offshore Recovery May Never Happen." *10/12 Industry Report* 3, no. 4 (2018): 52-53.
- Dismukes, David E. "The Whys and Hows of Maintaining the Oil Price Rise." *10/12 Industry Report* 3, no. 1 (2018): 60.
- Dismukes, David E. "MISO Grid 2033: Preparing for the Transmission Grid of the Future. Final Report." White paper. LSU Center for Energy Studies.
- Dismukes, David E., and Siddhartha Narra. "Sea-level Rise and Coastal Inundation: A Case Study of the Gulf Coast Energy Infrastructure." *Natural Resources* 9 (2018): 150-74.
- Dismukes, David E., Siddhartha Narra (with Nina Lam, Y. Jun Xu, Kambiu Liu, Margaret Reams, R. Kelley Pace, Yi Qiang, Kenan Li, Thomas A. Bianchette, Heng Cai, Lei Zou, and Volodymyr Mihunov.) "Understanding the Mississippi River Deltas as a Coupled Natural-human System: Research Methods, Challenges, and Prospects." *Water* 10 (8): 1054.
- Dismukes, David E. (with John W. Day, Christopher F. D'Elia, Adrian R.H. Wiegman, Jeffrey S. Rutherford, Charles A.S. Hall, and Robert R. Lane). "The Energy Pillars of Society: Perverse Interactions of Human Resource Use, the Economy, and Environmental Degradation." *BioPhysical Economics and Resource Quality* 3, no. 1 (2018): 1-16.
- Dismukes, David E. (with Adrian R.H. Wiegman, John W. Day, Christopher F. D'Elia, Jeffrey S. Rutherford, J.T. Morris, Eric D. Roy, Robert R. Lane, and Brian F. Snyder). "Modeling Impacts of Sea-level Rise, Oil Price, and Management Strategy on the Costs of Sustaining Mississippi Delta Marshes with Hydraulic Dredging." *Science of the Total Environment* 618 (March 2018): 1547-59.
- Dismukes, David E. (with Brian F. Snyder and Michael Layne). "A cash flow model of an integrated industrial CCS-EOR project in a petrochemical corridor: a case study in Louisiana. With Brian Snyder and Michael Layne. *International Journal of Greenhouse Gas Control*, (July 2018).
- Dismukes, David E. (with Brian F. Snyder and Michael Layne). "Understanding the challenges of industrial carbon capture and storage: an example in a U.S. petrochemical corridor." (2018). With Brian Snyder and Michael Layne. *International Journal of Sustainable Energy*.
- Kaiser, Mark J. "Deepwater Exploration Continues to Attract Attention, Investment." *Offshore* 78, no. 10 (October 2018).
- Kaiser, Mark J. "The Global Offshore Pipeline Construction Service Market 2017 – Part I." *Ships and Offshore Structures* 13, no. 1 (2018): 65-95.
- Kaiser, Mark J. "Producing Wells Declining in Shallow Water Gulf of Mexico." *Offshore* 78, no. 12 (December 2018).
- Kaiser, Mark J. "Review of Gulf of Mexico Well Activity Highlights Decline." *Offshore* 78, no. 9 (September 2018).

- Kaiser, Mark J. "A Review of Shallow Water Structures in the U.S. Gulf of Mexico circa 2016." *Ships and Offshore Structures* 13, no. 7 (2018): 677-95.
- Kaiser, Mark J. "Well Abandonment Rates in Shallow Water Gulf of Mexico off Historic Highs." *Offshore* 78, no. 11 (November 2018).
- Kaiser, Mark J., and Mingming Liu. "Global Offshore Pipeline Construction Service Market Review 2017 – Part II." *Ships and Offshore Structures* 13, no. 1 (2018): 96-118.
- Kaiser, Mark J., and Mingming Liu. "Modest Increase Projected for Active Deepwater Gulf of Mexico Structures." *Offshore* 78, no. 2 (February 2018): 34-35.
- Kaiser, Mark J., and Mingming Liu. "New Analytical Model Improves Decommissioning Forecasts." *Offshore* 78, no. 1 (January 2018): 37-38.
- Kaiser, Mark J., and Mingming Liu. "A Scenario-Based Deepwater Decommissioning Forecast in the U.S. Gulf of Mexico." *Journal of Petroleum Science and Engineering* 165 (2018): 913-45.
- Kaiser, Mark J., and Siddhartha Narra. "Decommissioning Activity on the Decline in the Gulf of Mexico." *Offshore* 78, no. 8 (August 2018).
- Kaiser, Mark J., and Siddhartha Narra. "An Empirical Evaluation of Economic Limits in the Shallow Water U.S. Gulf of Mexico, 1990-2017." *Journal of Petroleum Science and Engineering* 164 (2018): 230-44.
- Kaiser, Mark J., and Siddhartha Narra. "A Hybrid Scenario-Based Model for Shallow Water Decommissioning in the U.S. Gulf of Mexico." *Energy – The International Journal* 163 (2018): 1150-77.
- Kaiser, Mark J., and Siddhartha Narra. "Idle Structures Represent One Third of U.S. GoM Shallow-Water Inventory." *Offshore* 78, no. 7 (July 2018).
- Kaiser, Mark J., and Siddhartha Narra. "Review of Shallow Water GoM Structure Inventory Offers Preview of Decommissioning Requirements." *Offshore* 78, no. 3 (March 2018): 33-34.
- Kaiser, Mark J., and Siddhartha Narra. "Review of Shallow Water Platform Inventory Offers Preview of Decommissioning Requirements." *Offshore* 78, no. 4 (April 2018): 48-49.
- Kaiser, Mark J., and Siddhartha Narra. "Review of Shallow Water Structures Highlights Classification Challenges." *Offshore* 78, no. 5 (May 2018): 38-39.
- Kaiser, Mark J., and Siddhartha Narra. "Review of Producing Shallow Water Structures Highlights Market Economics." *Offshore* 78, no. 6 (June 2018).
- Upton, Greg B. "Mineral Revenues." Chapter in *Exploring Long-Term Solutions for Louisiana's Tax System*. James A. Richardson, Steven M. Sheffrin, and James Alm. Baton Rouge: LSU Press, 2018.
- Upton, Greg B., and Mark Agerton. "Decomposing Crude Price Differentials: Domestic Shipping Constraint or the Crude Oil Export Ban?" Forthcoming - *The Energy Journal*.
- Upton, Greg B., and Meagan McCollum. "Local Labor Market Shocks and Residential Mortgage Payments: Evidence from Shale Oil and Gas Booms." *Resource and Energy Economics* 53 (2018): 162-97.



Assistant Professor Greg Upton presents on the Gulf Coast Energy Outlook at one of several speaking engagements in 2018.

Speaking Engagements

David Dismukes

“Gulf Coast Industrial Development: Overview of Trends and Issues.” Gulf Coast Power Association Meetings, New Orleans. 8 February 2018.

“Louisiana Industrial Cogeneration Trends.” LWSA Conference, Lafayette, LA. 16 March 2018.

“Infrastructure and Capacity: Challenges for Development.” Society of Utility and Regulatory Financial Analysts (SURFA) Annual Meeting, New Orleans. 20 April 2018.

“2019 Gulf Coast Energy Outlook.” With Gregory B. Upton, Jr., and Dek Terrell. 2019 Gulf Coast Energy Outlook Kickoff Event, Center for Energy Studies, LSU. 16 November 2018.

“Overview of Louisiana LNG issues and trends.” Kean Miller Law Firm: Energy and Environmental Practice Group. Baton Rouge. 28 November 2018.

“How LNG is Transforming Louisiana’s Energy Economy.” Louisiana State Bar Association, Public Utility Section. Baton Rouge. 30 November 2018.

“MISO Grid Vision 2033.” 2018 Winter Regulatory and Policymaker Forum. New Orleans. 11 December 2018.

Gregory B. Upton

“Gulf Coast Energy Outlook.” World Trade Center of New Orleans, Energy Committee Meeting, New Orleans. 15 February 2018.

“LNG Export and American National Gas Markets.” National Association of State Utility Consumer Advocates (NASUCA), Natural Gas Committee, Webinar. 20 February 2018.

“Mid-Stream Investment in the Era of Shale.” Louisiana Pipeliners Association Meeting, Baton Rouge. 26 February 2018.

“Electric Power: Industry Overview, Organization, and Federal/State Distinctions.” EUCI, FERC Electricity 101, Portland, OR. 12 March 2018.

“Gulf Coast Energy Outlook.” American Petroleum Institute (API), Atchafalaya Chapter, Morgan City, LA. 15 March 2018.

“Gulf Coast Energy Outlook.” National Association of Royalty Owners, 2018 Convention, Shreveport, LA. 23 April 2018.

“Energy and Economic Update; LA and Gulf Coast Region.” National Association of Royalty Owners, Shreveport, LA. 23 April 2018.

“Gulf Coast Energy Outlook.” Women’s Energy Network (WEN), South Louisiana Chapter, New Orleans. 26 July 2018.

“Gulf Coast Energy Outlook.” New Orleans Geological Society (NOGS). New Orleans. 10 September 2018.

“Gulf Coast Energy Outlook.” Women’s Energy Network (WEN), South Louisiana Chapter, Lafayette, LA. 13 September 2018.

“The Future of Solar in Louisiana: An Analysis of the Technical and Economic Implications of Solar P.V. Growth on Louisiana’s Economy and Electric Grid.” With Farzad Ferdowsi and Shahab Mehraeen. Southwestern Electric Power Company, Shreveport, LA. 18 September 2018.

“The Future of Solar in Louisiana: An Analysis of the Technical and Economic Implications of Solar P.V. Growth on Louisiana’s Economy and Electric Grid.” With Farzad Ferdowsi and Shahab Mehraeen. Institute of Electrical and Electronics Engineers, Little Rock Arkansas Chapter, Little Rock, AR. 19 September 2018.

“The Future of Solar in Louisiana: An Analysis of the Technical and Economic Implications of Solar P.V. Growth on Louisiana’s Economy and Electric Grid.” With Farzad Ferdowsi and Shahab Mehraeen. Southwest Power Pool (SPP), Little Rock, AR. 19 September 2018.

“Econometric Forecasting and Energy Regulation.”
“Cost Benefit Evaluation for Regulators and Utilities.”
“Economics of Renewable Energy Resources.” Michigan State University Institute of Public Utilities, Advanced Regulatory Studies Program, East Lansing, MI. 1-2 October 2018.

“Electric Power: Industry Overview, Organization, and Federal/State Distinctions.” EUCI, FERC Electricity 101. Newport Beach, CA. 6 November 2018.

“Gulf Coast Energy Outlook.” Society of Louisiana’s CPAs, Oil and Gas Conference, Lafayette, LA. 29 November 2018.

“Mineral Revenues in Louisiana.” Louisiana Tax Institute, Baton Rouge. 3 December 2018.

Faculty Highlights

Dismukes Named to National Petroleum Council Committee on CCUS

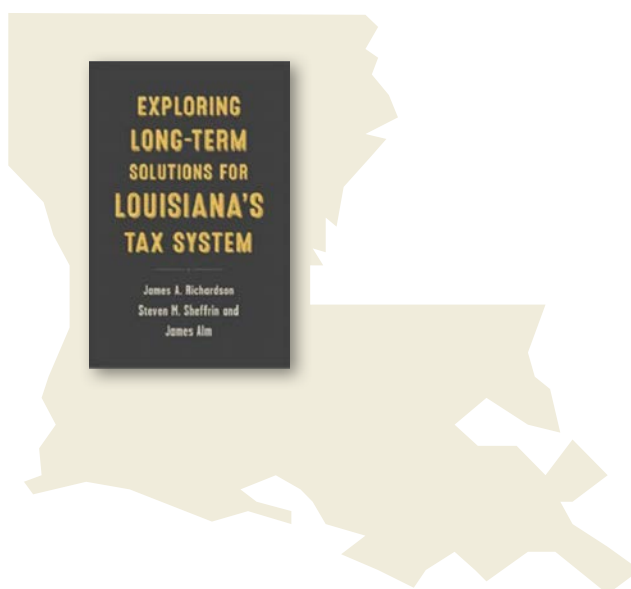
In November, CES Executive Director David Dismukes was named to the National Petroleum Council’s (NPC’s) Committee on Carbon Capture, Use, and Storage (CCUS). CCUS is a process that captures carbon-dioxide emissions from sources such as coal-fired power plants to prevent it from entering Earth’s atmosphere. Former BP America Inc. Chairman and President John C. Mingé chairs the committee, with Deputy Secretary of Energy Dan Brouillette serving as government co-chair.

The committee’s goal is to oversee CCUS’s integration into the energy marketplace, specifically the petroleum industry, in an effort to meet the goal of reducing worldwide carbon emissions. Dismukes attended his first meeting of the CCUS Committee during a meeting of the NPC in Washington in early December.

Upton Contributes Chapter in Louisiana Tax System Text

Assistant Professor Greg Upton contributed the chapter “Mineral Revenues” in the book, *Exploring Long-Term Solutions for Louisiana’s Tax System*, by LSU Professor James Richardson, Tulane Economics Professors Steven M. Sheffrin and James Alm.

The book, published in November 2018, focuses on the economic status of the state, outlines its current tax structure, and provides recommendations for reforming the state’s use of sales tax, how its income tax is applied, and corporate and mineral revenue taxation.



CES faculty presented research at more than two dozen events in 2018.





Events & Outreach

2018 Energy Summit Features FRB of Atlanta Chair Raphael Bostic

The Center hosted its annual Energy Summit on October 24, premiering a new half-day, afternoon format that proved popular with attendees. The program began with a wide-ranging conversation between special guest speaker Federal Reserve Bank of Atlanta President and CEO Dr. Raphael Bostic and CES Executive Director and Professor David Dismukes.

Bostic described how his team of regional executives in the Sixth Federal Reserve District communicate with business and industry representatives so that he is equipped with relevant information with which to deliberate policy. In terms of the regional economy, he cited a lack of workers and wage stagnation as areas of concern but said the overall economic outlook was strong.

Later in the day, James Lucier of Capital Alpha Partners provided a Washington, D.C., perspective on energy and federal trade policies. The outlook for offshore oil and gas development, including new discoveries in the Gulf, was given by Steve Conner, operations general manager for the Gulf of Mexico, Chevron North America. University of Tulsa Professor Ron Ripple discussed the role of the U.S. and Louisiana in international liquefied natural gas-based natural gas trade. And Shale Magazine editor David Blackmon gave an overview of U.S. crude oil export trends.

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Chevron Gulf of Mexico General Manager of Operations Steve Conner provided an outlook for oil and gas development in the Gulf at the annual Energy Summit conference held October 24, 2018.

Federal Reserve Bank of Atlanta Chairman and CEO Dr. Raphael Bostic was the featured speaker for Energy Summit 2018.



Dismukes Facilitates MISO Regulators Meeting in NOLA

On December 11, CES Executive Director David Dismukes facilitated a meeting of public service commissioners from several states within the Midcontinent Independent System Operator (MISO) footprint. The senior level, policymaker-only meeting included a robust discussion about the long-term vision for the transmission grid serving the central portion of North America. Some of the detailed topics discussed in the meeting included accommodating future load growth, how to address expansive renewable energy development, and maximizing transmission grid benefits.





CES in the News 2018

Center for Energy Studies' faculty are regularly sought by media to provide expert commentary on current and pressing energy issues. Throughout 2018, faculty responded to more than 20 requests for interviews from local, regional, and national outlets. Faculty also provided professional commentary in the form of op-ed columns.

One prominent energy news topic for 2018 was the potential impacts of the Trump administration's trade initiatives on Gulf Coast economic sectors, including energy and chemical production. Professor David Dismukes provided comments for several *Advocate* articles and wrote op-eds for the *10/12 Industry Report* and *Houmatoday.com* on China's retaliatory tariffs on liquefied natural gas, remarking that LNG facility development would stall as a result of the uncertainties.

Dismukes was also quoted in the *Advocate*, the *Greater Baton Rouge Business Report*, *New Orleans City Business*, the *Houma Daily Courier*, and *Engineering News-Record* on topics ranging from the outlook for industry growth for the year, to the \$9.4 billion investment by Formosa Petrochemical Corp. in St. James Parish, to the withdrawal of NextGEN Utility Systems' controversial proposal to manage Lafayette Utility Systems.

Following the release of the **Gulf Coast Energy Outlook** for 2018, Assistant Professor Greg Upton provided comments to *New Orleans City Business*, *The Advocate*, the *Greater Baton Rouge Business Report*, the *Morgan City Daily Review*, and Fox News15 in Lafayette. He contributed op-eds to the *Morgan City Daily Review* and the *Greater Baton Rouge Business Report*.

In addition, Upton's 2016 white paper, "Oil Prices and the Louisiana Budget Crisis: Culprit or Scapegoat? An Analysis of the Implications of the Oil Price Drop on the Louisiana Budget," was cited in a *Wall Street Journal* article on Gov. John Bel Edwards' efforts to secure funding from the oil and gas industry to restore the state's coast.

Upton was also featured twice in Louisiana Public Broadcasting's weekly news program *Louisiana: The State We're In*, providing commentary on the impact of the price of oil on La. revenues and how, over the past 30 to 40 years, the state's upstream sector has declined while its downstream sector has expanded.

Personnel

Administration

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

Diana Reynolds, assistant to the executive director

Marybeth Pinsonneault, communications manager

Division of Policy Analysis

Gregory B. Upton, Jr., Ph.D., assistant professor

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

Don Goddard, Ph.D., associate professor (retired)

Division of Research & Development

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

Siddhartha Narra, Ph.D., research associate

Division of Energy Information & Data

Omowumi (Wumi) Iledare, Ph.D., (retired) director of the CES 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 director of the Emerald Energy Institute, University of Port Harcourt, Nigeria.

Ric Pincomb, research associate

Stacy Retherford, computer analyst

Mike Surman, computer analyst

Minerals Processing

Photo: Valero



Minerals Processing Research Division

Ralph Pike, Director | F. Carl Knopf, Co-Director | www.mpri.lsu.edu

The mission of the Center's Minerals Processing Research Division (MPRD) includes facilitating research and public service programs in process research and technology transfer, sustainable development, energy management, and inherently safer design, all of which complement, and benefit from, the energy and geological research performed by the Center for Energy Studies and the Louisiana Geological Survey.

In 2018, the Division continued its research data reconciliation and on-line optimization with applications to Gulf Coast chemical plants and refineries. The effort focuses on smaller and mid-size plants whose companies do not have the resources and capabilities of large, international corporations. MPRD also continued with development of web-based energy education and learning modules, which are currently being used to promote key energy technologies to engineering students (sophomore to senior year) at more than 10 universities.

MPRD Begins Research on Data Reconciliation for the Chemical Industry

Recently, the MPRD has begun research on evaluating specific components of process plant performance. This is an expansion of traditional data reconciliation methodology to try and answer "what-if questions" in an actual plant without the traditional chemical engineering modeling approach. In a recent report, Frantisek (Frank)

Madron (ChemPlant Technology) concludes that this is now one of the main areas for data reconciliation and process plant improvement. The MPRD has been collaborating with Madron on various aspects of data reconciliation for several years.

This research seeks to improve the data reconciliation program the MPRD originally developed in 2010, which also included an on-line optimization program and an interactive heat exchanger synthesis program. The programs were made available to all industry in Louisiana and throughout the United States. Industry now wants the data reconciliation analysis to be expanded to help answer "what-if questions." Following data reconciliation, the process can be modeled using key measured variables. It is then possible to answer questions such as, How will a decrease in the feed water temperature to the boiler influence power plant efficiency and possible emissions?

Optimization for Chemical Engineering Systems Text on Kindle Summer 2019

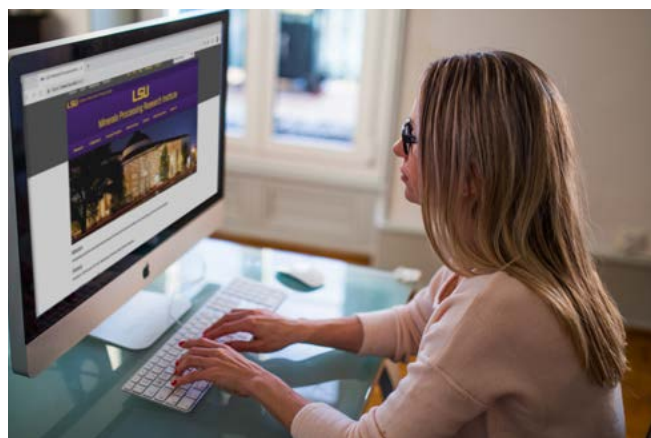
MPRD research results over several years have been incorporated in a book titled *Optimization for Chemical Engineering Systems*, which contains a detailed chapter on on-line optimization. Book publication on Kindle is expected in mid-2019, and copies of chapters from the book can be provided as PDF files by contacting pike@lsu.edu at MPRD.

Interactive On-Line Optimization Program Available

The interactive on-line optimization program is available on the MPRD website mpri.lsu.edu. The program installation files and user's manual can be downloaded. To use the program, the user enters the process model and economic model in a graphics diagram generator that stores the models in the program's database. The measured data from the distributed control system is included as an Excel file that can be extracted from the distributed control system. Then algorithms for data validation and parameter estimation are specified. On execution, the system constructs GAMS source codes for three optimization problems (economic optimization, parameter estimation, and data reconciliation) with the economic and plant models. The system uses GAMS to solve these three optimization problems in sequence. In the solution summary section, the system generates an Excel file of optimum operating conditions for submission to the distributed control system and a final report file that summarizes important results. GAMS also generates and displays three detailed output files corresponding to the three optimization problems. The user must provide the control program that collects steady-state data from the distributed control system as an Excel file and accepts optimal results for the control system as an Excel file. The controller program must include steady-state detection and execution analysis.

Energy Sustainability Remote Laboratory Provides Data, Materials to Engineering Programs

The Center continues to host the Energy Sustainability Remote Laboratory (ESRL), www.esrl.lsu.edu. ESRL allows partner universities to implement authentic experiences by providing data from actual operating energy or energy-intensive manufacturing systems — a natural gas-based cogeneration unit, a nuclear power plant, a coal-fired plant, a photovoltaic solar facility, and bench-scale units for biomass processing to chemicals, and biomass gasification. The ESRL site also provides pre-tested background materials and suggested inquiry-based assignments. Currently, ESRL is used by engineering programs at LSU, Auburn, University of Alabama, University of South Alabama, UNLV, FSU, and several other schools.



Online Research, Publications and Programs

The Division's website www.mpri.lsu.edu was moved to the LSU web server, and it was expanded, revised and extended with new research results including journal articles, conference proceeding, technical reports, theses, dissertations and computer programs. The computer programs have installation files, users' manuals and tutorials. These programs have been developed with industry assistance for Gulf Coast plants and the process models can be applied to comparable plants. The interactive heat exchanger synthesis program THEN has been rewritten and enhanced with an Excel interface and graphical display.

Two programs that can give immediate and substantial energy savings for 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.

The MPRD website also includes professional development, self-study courses for professional engineers' PDH requirements. These courses and computer program are part of the website materials that are continually being revised and extended.

Personnel

Ralph W. Pike, Ph. D., director, Horton Professor of Chemical Engineering

F. Carl Knopf, Ph. D., associate director, Professor Emeritus

Abby Lafleur, student assistant

LSU Cain Department of Chemical Engineering faculty provided research collaboration.

Louisiana Geological Survey



Charles “Chip” Groat, Acting Director | www.lgs.lsu.edu

The Louisiana Geological Survey (LGS) was created by Act 131 of the Louisiana Legislature in 1934 to investigate the geology and resources of the State. LGS is presently a research unit affiliated with the Louisiana State University and reports through the Executive Director of the Center for Energy Studies to the Vice President for Research and Economic Development.

The goals of the Geological Survey are to perform geological investigations that benefit the state of Louisiana by:

1. encouraging the economic development of the natural resources of the state (energy, mineral, water, and environmental);
2. providing unbiased geologic information on natural and environmental hazards; and
3. ensuring the effective transfer of geological information.

Mapping & Research

Surface Mapping: Landforms Map Meets Needs of Coastal Scientists

LGS has published several series of surface geologic maps in various scales over the decades that have been of great use to the geologic community; however, it has been recognized that traditional geologic mapping is not always well understood by non-geologists seeking information relevant to their needs. To fill that need, LGS will soon publish “non-traditional” geologic maps emphasizing landforms rather than age, stratigraphy and lithology. Landforms are described by the appearance of their surfaces, their position in the topography, the processes that created and shaped them, and the ecosystems they support.

These landforms are key to understanding natural systems in a state like Louisiana, with generally subtle relief, very similar deposits at the surface, and widely obscured by dense sub-tropical vegetation. Landforms exert tremendous influence and control on soil development, drainage, natural vegetation patterns, wildlife habitats, and the occupation patterns

Environmental scientists, coastal engineers, planners, and decision-makers working in coastal Louisiana may find that landform awareness is highly relevant to the issues that they are examining, such as subsidence, flooding, erosion, habitat change, natural hazards, and land loss.



of indigenous peoples. They affect subsequent human developments such as agriculture, forest management, highway patterns, and the suburban sprawl into wetlands. Landform recognition is essential to the research and engineering efforts that help manage Louisiana's coastline and rivers.

LGS is preparing to publish *Landforms of the Louisiana Coastal Plain* in an effort to meet the requirements of coastal scientists who need to better understand how geology relates to their areas of interest. The mapped landforms help define Louisiana's extensive riverine and coastal floodplains, areas that are subject to episodic stream flooding and hurricane storm surges. They also offer insight into the increased flooding potential of very flat upland regions that retain such low gradients that they can still flood during extreme rain events. The intent is to produce maps that have relevance to a wider target audience, including the general public.

Geologic Mapping: STATEMAP 2017–2018 Deliverables Completed

Since the 1990s, Louisiana Geological Survey research staff have conducted surface-geologic mapping projects, including 1:100,000-scale compilations of 30 × 60 minute geologic quadrangles and 1:24,000-scale fieldmapped 7.5-minute geologic quadrangles. The vast majority of these mapping efforts were funded under the STATEMAP component of the National Cooperative Geologic Mapping Program (NCGMP), begun in 1993 and administered by the U.S. Geological Survey (USGS).

The principal goal of this program was to prepare statewide surface geology coverage at 1:100,000 scale in 30 × 60 minute quadrangle format because it is at the large end of the range of intermediate scales and preserves abundant detail from source mapping done at larger scales, while covering relatively large areas. By the close of FY 2013, LGS had completed 30 × 60 minute geologic quadrangle coverage of the entire state (30 sheets total) with a mix of published lithographs and



Landforms of the Louisiana Coastal Plain will soon be published by LGS.

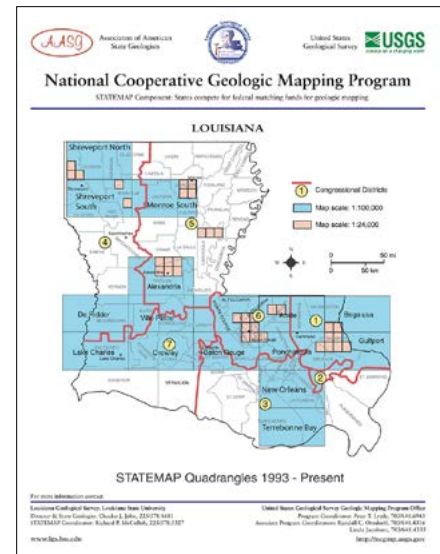
draft open-file compilations. Since the late 1990s LGS also has prepared 7.5-minute geologic quadrangles at 1:24,000 scale totaling 62 sheets. Fifty-two were prepared with STATEMAP support, and the other 10 were prepared for the U.S. Army Corps of Engineers within the Fort Polk region, south central Louisiana.

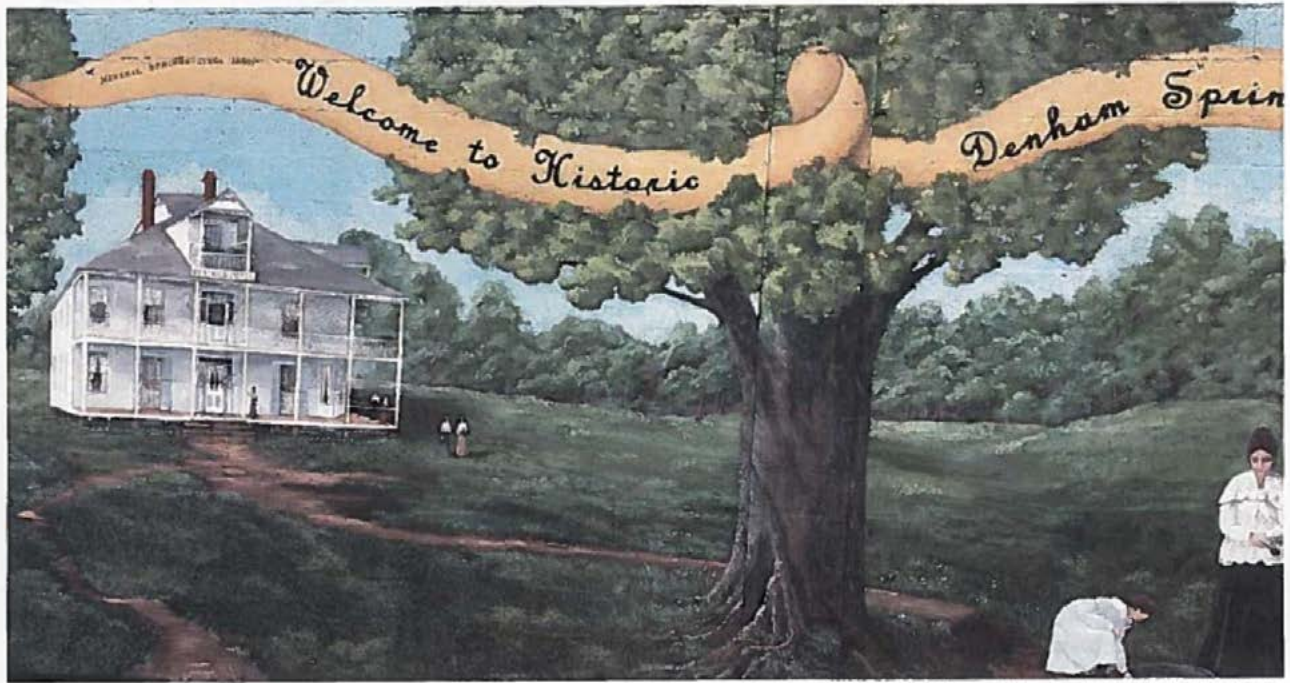
The STATEMAP 2017–2018 deliverables completed and submitted included geological maps and pamphlets covering five 7.5 minute quadrangles in two study areas: the greater Lafayette area in southwestern Louisiana and the southern Baton Rouge area in southeastern Louisiana.

Water Resources: Denham Springs Historical and Spring Study

LGS performed a study near the Amite River, funded by the City of Denham Springs, to determine the location of historical sites and examine spring water chemistry. In 2018, researchers twice sampled five springs within Spring Park and analyzed water for more than 20 different analytes. For comparison, they collected and analyzed water from the city’s six water wells. Spring water is generally far richer in many ions than city water. Average concentrations of magnesium and manganese are more than 50 times larger for spring water than city groundwater. In addition, average concentrations are more than 20 times larger for spring water than city groundwater for barium, chloride, iron and nitrate. Most of the difference of ion concentrations are typical for shallow aquifers except for chloride. This could be a hint that the source of spring water is a combination of the usual groundwater flow from nearby areas, plus storm surge water that comes up the Amite River during some of the extreme flood events.

From December of 2018 to February 2019 a series of magnetic surveys was completed to determine the location of an early water well within Spring





This mural in the Elmontown Antique District was painted in 2013 from an old photograph depicting the hotel and mineral springs.

Drawing of Amite Springs Hotel that was built in 1860s, source drawing on page 6 of City of Denham Springs (2017).



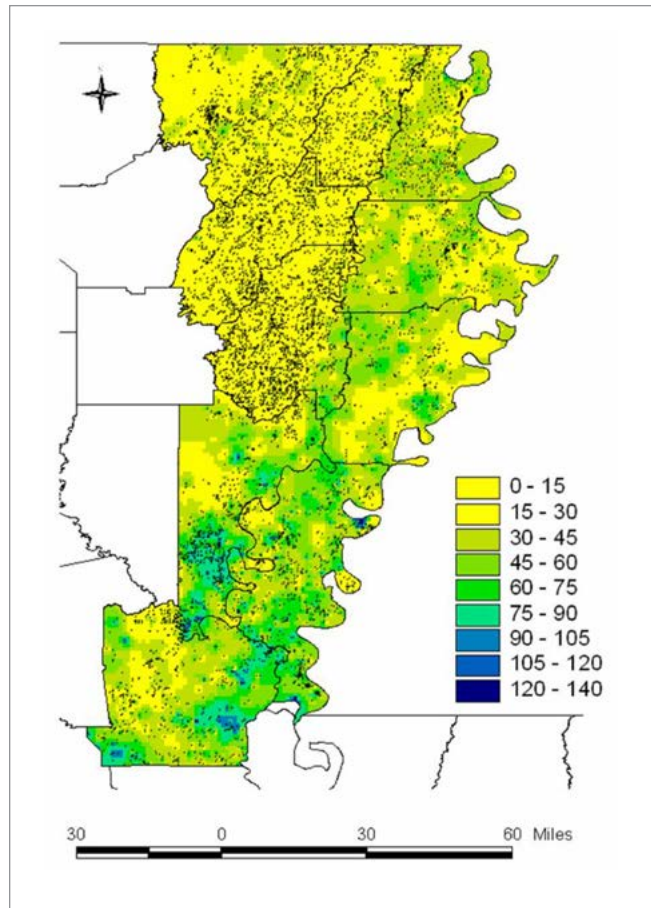
Park and the location of two 19th century hotels that hosted tourists who came to Denham Springs to receive the believed health benefits from bathing in the spring water. It was determined that the possible location for the older of the two hotels could be within a pair of lots the city owns that lie between Magnolia and Tabernacle Streets.

Trends in Hydraulic Fracturing Investigated

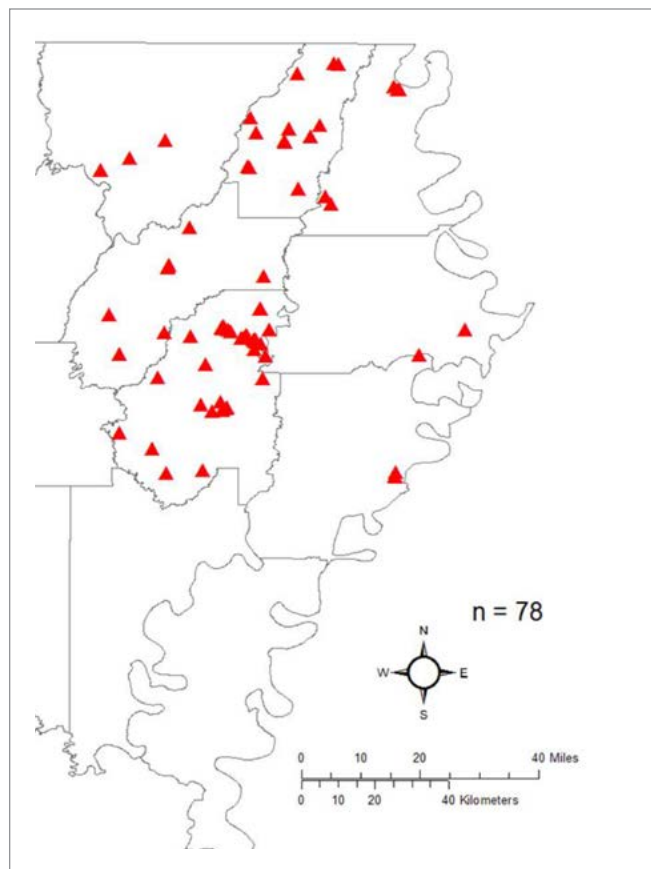
The investigation of trends with hydraulic fracturing in the state of Louisiana is ongoing, with a focus on the eight parishes in which the Haynesville shale gas play lies: Bienville, Bossier, Caddo, DeSoto, Natchitoches, Red River, Sabine, Webster. After approximately 10 years of the Louisiana Department of Natural Resources' collection of sources and volumes of water used for hydraulic fracturing, it is possible to determine trends for Haynesville Formation (shale) as well as other units: Cotton Valley Group (mainly Bossier Formation/shale), Wilcox Groups, and Hesston Formation. There are also nine years of FracFocus data analyzed for trends within the chemistry of reported fracture solutions. FracFocus is a voluntary online data base to which contractors report site location, volumes of water used, depth of fracturing, and water chemistry of solution for fracturing. Results have been presented at the 2018 AAPG annual convention in Salt Lake City, the 2018 GCAGS convention in Shreveport, and the 2012 Louisiana Water Conference in Baton Rouge. Results include major increases in water use for both Haynesville shale and Cotton Valley, mainly Bossier shale. There have been changes in concentrations of chemistry for fracturing solutions used for Haynesville well fracturing during the seven years of FracFocus data, such as increasing concentrations of quartz/sand used for proppant, approximately constant concentrations of petroleum distillants, decreasing concentrations of naphthalene, and decreasing frequency of use of naphthalene and other aromatic compounds.

Mississippi Alluvial Aquifer Study

A regional study of the groundwater within the Mississippi Alluvial Aquifer in a nine-parish region – Catahoula, Concordia, East Carroll, Franklin, Madison, Morehouse, Richland, Tensas, West Carroll in northeastern Louisiana—was funded by the Louisiana Water Institute. This project involved sending letters to owners of private wells and contacting public supply managers requesting permission to sample their wells. The first phase of contacting private well owners has been completed, yielding results for 78 wells. Private well sampling was completed between October 2017 and March 2018. The second phase of contacting public supply managers was to begin in the fall of 2018 and should be completed in the spring of 2019. Each of the samples was analyzed for 25 analytes: aluminum, arsenic, barium, boron, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, phosphorous, potassium, silicon, sodium, strontium, vanadium, and zinc. Highest values of chloride concentration are in Franklin Parish with values over 300 mg/L, which is over the EPA secondary drinking water standard of 250 mg/L. Iron concentration is higher for the eastern portion of the aquifer along the Mississippi River and lower for parishes along western side of the aquifer. Nitrate concentrations are generally highest in Franklin Parish and lower elsewhere, which should not be surprising due to Franklin Parish generally having the thinnest confining clay layer. Results were presented at the annual GCAGS convention in Shreveport. A final report will be submitted to the Louisiana Water Institute and for publication as an LGS report and possibly later in appropriate journal.



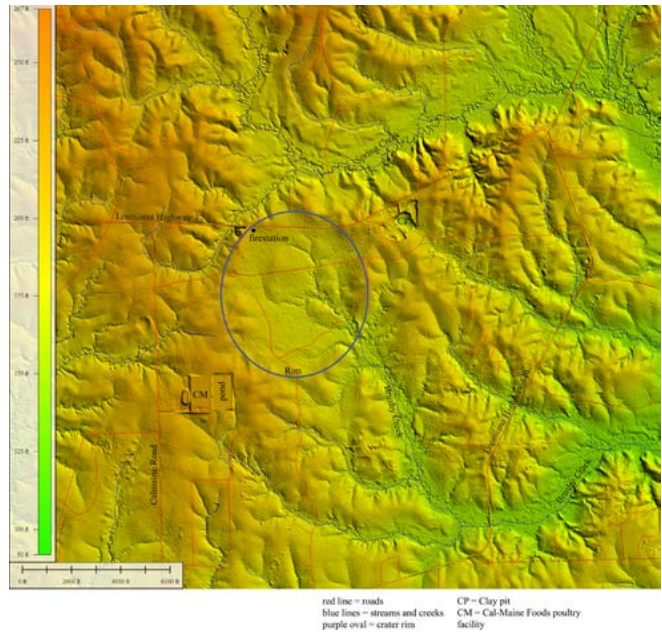
The regional study of the groundwater within the Mississippi Alluvial Aquifer involved the sampling of wells in several parishes in North Louisiana.



Geologic Studies

The LGS has continued to study a diverse range of topics considered important to understanding the geology of Louisiana.

- ▶ Joint research with the LSU Department of Geology and Geophysics and the University of Texas, Austin, Department of Geology concerning the age and origin of the Sabine Plate was published in *Geology*.
- ▶ The results of research conducted with Texas A&M University and Brigham Young University-Hawaii on the age, extent, and stratigraphic significance of the volcanic ash bed, exposed in Rapides Parish and known as the “Chalk Hills Member” of the Catahoula Formation, has been accepted for publication in the *Journal of Geology*.
- ▶ A monograph about the Quaternary stratigraphy and geoarchaeology of the southwest Louisiana continental shelf is currently in preparation for publication by the Bureau of Ocean Energy Management.
- ▶ Research is continuing with the LSU Department of Geology and Geophysics on a suspected extraterrestrial impact crater in St. Helena Parish. The St. Helena crater is the only known meteor crater in Louisiana and one of only 176 on earth. This type of meteor impact occurs once every 2000-6000 years.



Energy

Integrated Carbon Capture and Storage in the Louisiana Chemical Corridor

LGS researchers are participants in the 26-month project “Integrated Carbon Capture and Storage in the Louisiana Chemical Corridor,” funded by the U.S. Department of Energy. The project, which commenced in February 2017, is headed by the Center for Energy Studies, with the collaboration of researchers from the College of Engineering, Department of Geology & Geophysics, Department of Environmental Science, and the Law Institute.

The objectives of this project are (1) to develop a multidisciplinary team of stakeholders with interest in carbon capture and storage in the Louisiana Chemical Corridor along the Mississippi River, (2) to analyze the technical and economic feasibility of an integrated carbon capture and storage project that captures 50 million tons of CO₂ from one or more industrial sources, transport it via pipeline and store it in underground saline reservoirs in existing hydrocarbon fields, and (3) to provide a geologic evaluation using publicly available geologic data for the potential for CO₂ storage in saline reservoirs found in oil and gas fields in South Louisiana.

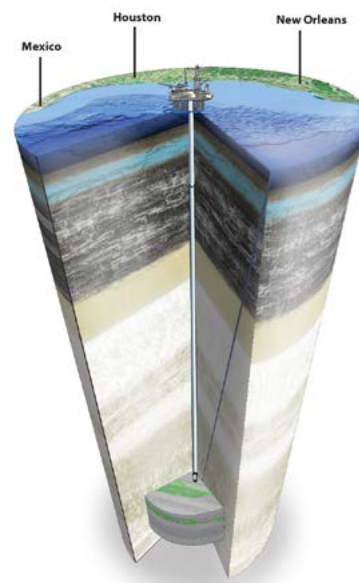
The LGS role in this project is to provide a geological evaluation of selected saline formations with requisite shale seals in Bayou Sorrel (Iberville Parish) and Paradis fields (St. Charles Parish) situated along the Mississippi River industrial corridor. This area has a concentration of petro-chemical industries that generate large volumes of CO₂ emissions which would be the source for CO₂ needed for sequestration.

LGS researchers have completed the geologic evaluation of the selected saline reservoirs in the two fields based on publicly available data and literature. The top of the brine sand reservoir evaluated at Bayou Sorrel lies at a depth of 7300 feet and is approximately 900 feet thick. The prospective saline sand reservoir selected by the project team at the Paradis field is at a depth of 4300 feet and has a thickness of 350 feet. Both Bayou Sorrel and Paradis currently have hydrocarbon production from other mostly deeper zones.

The LGS researchers have pointed out potential geologic issues that need further investigation. These include (1) coring shale reservoirs both above and below the target sections to determine their effectiveness as seals, (2) obtaining seismic data to more accurately determine faulting and lateral extent of both the target and sealing reservoirs, (3) evaluating conditions of casing in the numerous well bores in both fields as they are potential leakage pathways, (4) potential chemical reactions between the injected CO₂ and brine in the target reservoirs, (5) where and how far would the brine displaced by CO₂ injection would travel, and (6) mode of transport of CO₂ from source to sink.

LGS Partners with BEG for Carbon Storage — Resources and Technology Development

LGS has partnered with the Bureau of Economic Geology (BEG), University of Texas, on this project, which is funded by the U.S. Department of Energy under their carbon sequestration program. LGS will provide assistance to BEG for selecting suitable offshore sites for carbon sequestration.



The Gulf of Mexico offshore basin is one of the largest volume regional geologic sinks in the United States for large-scale CCS activities.

Image: beg.utexas.edu

Geophysics

LGS assistant professor Marty Horn continues development of electrical resistivity and magnetometry geophysical techniques for near subsurface features relevant to geology, archaeology, and civil engineering. The techniques have successfully resolved prehistoric and historic human habitations, human graves, modern buried pipelines, and lithostratigraphic relationships in the shallow subsurface. Archaeological field studies have identified locations of potential significance at a dam site (Fannin County, Texas) and floor plan elements of Antelope Creek (1200-1450 AD) dwellings (Potter County, Texas). Field methods have also been applied to the internal structure of five Indian mounds that are widely distributed along the lower Mississippi River fluvial province. Comprehensive geological





and geophysical studies in historic Louisiana and Texas cemeteries have identified unmarked 19th century graves, providing custodians with guidance for renovations and future interments. Investigations of geological and civil engineering problems along the Louisiana Gulf Coast have focused on resolution of regionally and locally important faults as well as undocumented pipelines, both of which impact planning of new construction.

Application of these low-cost, minimal-impact field techniques represents a highly valuable contribution by LGS to the myriad of archaeological, historical, geological, and engineering challenges in the growing Louisiana region.

LGS Publications 2018

- ▶ A Study of the Brushy Creek Feature, St. Helena Parish, Louisiana by Andrew Schedl, 2018.
- ▶ Geologic Mapping of Shreveport South and North at 1:100,000 Scale by Paul V. Heinrich and Richard P. McCulloh.
- ▶ Geologic Mapping of Winnfield South and North at 1:100,000 Scale by Paul V. Heinrich and Richard P. McCulloh.
- ▶ Geologic Mapping of Carencro at 1:24,000 Scale (Paul V. Heinrich and Richard P. McCulloh).
- ▶ Geologic Mapping of Duson at 1:24,000 Scale (Paul V. Heinrich and Richard P. McCulloh).
- ▶ Geologic Mapping of Mire at 1:24,000 Scale (Paul V. Heinrich and Richard P. McCulloh).
- ▶ Geologic Mapping of Prairieville at 1:24,000 Scale (Paul V. Heinrich and Richard P. McCulloh).
- ▶ Geologic Mapping of St. Gabriel at 1:24,000 Scale (Paul V. Heinrich and Richard P. McCulloh).

Staff Highlights

Douglas Carlson was appointed Adjunct Associate Professor in the Department of Geology and Geophysics.

LGS mapping scientist R. Hampton Peele became the new editor of the National Hydrographic Dataset (NHD) for Louisiana on October 1, 2017, under contract with Louisiana Department of Environmental Quality. In coordination with the USGS NHD Production Team, Peele is working to get Louisiana's NHD data ready for inclusion in the NHD High Resolution-Plus national dataset.

Outreach Activities

Earth Science Week, sponsored nationwide by the American Geoscience Institute (AGI), was celebrated October 14-20, 2018. Educational Outreach Coordinator Riley Milner, P.G., was invited to present a demonstration of the rocks and minerals in Louisiana and other states and countries as well as the ocean geologic history at The Laboratory Key Academy in Baton Rouge. Milner answered students' questions ranging from a discussion of the rock cycle to how to become a geologist and what one earns.

In March, Milner participated in the BREC Bluebonnet Swamp Nature Center's annual **"Rockin' at the Swamp,"** an all-day event featuring geologic displays from LGS, LSU Geology Club, jewelry vendors, and rock and mineral specimens on display as well as for sale.

For **"Louisiana Tourism Week,"** held May 7-11, 2018, sponsored by the Louisiana Department of Recreation and Tourism, Milner displayed LGS's cartographic materials and provided discussion and information for the local visitors, as well as travelers from across the country. The event took place at the Atchafalaya National Heritage Center at the Butte La Rose tourist center.

In June, Milner took part in the St. James Parish Library in Lusher and Vacherie kick-off of their Summer Program **"Libraries Rock."** He presented displays at both libraries featuring rocks and minerals of Louisiana, specimens from 3.2 billion year old Stromatolite's from South Africa, to fossils from the past and present, mineral specimens representing the full range of mineral types, a microscope display with a Scope-on-a-Rope showing a thin section of the Greenwell Springs Chondrite Meteorite (i.e. stony not Iron-Nickel) and others from many types of rock and minerals, and a display of rocks representing the Rock Cycle (i.e. sedimentary, igneous and metamorphic). Milner was invited to participate in the St. James Parish's "Geology of St. James Parish" dinner and presentation. The activity celebrates the geologic history of St. James Parish and the oil and gas and other economic resources in the parish.

In September, Research Associate Rick McCulloh presented to the **Louisiana Master Naturalists of Greater Baton Rouge workshop** "Introduction to Plants - Identification + Landscaping with Natives," hosted by the LSU Hilltop Arboretum. McCulloh led a workshop with classes and discussion ending in short nature trail to the Waddill Wildlife Refuge Area in East Baton Rouge Parish.

On August 13, the Louisiana Geological Survey, with cosponsor Baton Rouge Geological Society, presented **"Baton Rouge Flood of 2016: What Happened, What We Did, What We Lost, and What We Learned,"** a symposium on the flood that devastated much of the Baton Rouge area in August 2016. The well-attended event featured individual presentations, a panel discussion, and a public Q&A session. John E. Johnston III of the Louisiana Geological Survey served as symposium chair.

In July, the **Louisiana Coastal Geology Symposium 2018**, presented by the Louisiana Geological Survey and the New Orleans Geological Society, brought together scientists, engineers and policy makers from across a range of disciplines to exchange ideas, interpretations and insights on Louisiana coastal geology – both onshore and offshore – and on associated topics. John E. Johnston III of the Louisiana Geological Survey served as symposium chair.





The staff of the Louisiana Geological Survey, along with the LSU Agcenter and the La. Water Institute, hosted the 12th annual **Louisiana Water Conference** in the spring of 2018. Attendance for the conference was approximately 100, many of whom earned continuing education credits as required to maintain their status as registered professional geoscientists.

Personnel

Administrative Personnel

Charles “Chip” Groat, acting director and state geologist, professor

Chacko J. John, Ph.D., associate director, professor

Patrick O’Neill, research associate, LGS Publications Sales and Resource Center

Basin Research Energy Section

John Johnston, research associate (retired-part-time)

Brian Harder, research associate (retired-part-time)

Reed Bourgeois, computer analyst

Geological Mapping & Minerals Mapping Section

Richard McCulloh, research associate

Paul Heinrich, research associate

Water & Environmental Section

Douglas Carlson, assistant professor-research

Riley Milner, research associate

Geophysical Section

Marty Horn, assistant professor-research

Cartographic Section

John Snead, cartographic manager (retired-part-time)

Lisa Pond, research associate

Robert Paulsell, research associate

R. Hampton Peele, research associate

Staff

Melissa Esnault, administrative coordinator

Jeanne Johnson, accounting technician

Radiation Safety



Wei-Hsung Wang, Director | www.lsu.edu/radiation-safety

The LSU Radiation Safety Office (RSO), which reports through the Center for Energy Studies to the Office of Research and Economic Development, is a unique, independent, and critical academic unit. The RSO directly supports and actively engages in research, teaching, and clinical activities involving the use of sources of ionizing and non-ionizing radiation at LSU. Under the direction of the Radiation Safety Committee, the RSO is responsible for developing and implementing radiological control policies and procedures as well as ensuring sound safe practice to not only comply with federal and state regulations and licensing/registration conditions but also assure adequate protection of people, the environment, and the integrity of the University.

The LSU System's broad-scope Radioactive Material License, issued by the Louisiana Department of Environmental Quality (LDEQ), allows the University maximum flexibility to accomplish legitimate and realistic education objectives through the effective and efficient operation of a regulatory-mandated radiation protection program carried out by the RSO. The University's radiation protection program is sanctioned in the LSU System's Permanent Memorandum-30 (PM-30): *Radiation Protection Program* and LSU Policy Statement-99 (PS-99): *Radiation Safety Violations*, while the LSU System's *Safety Procedures for Non-Ionizing Radiation* governs the non-ionizing radiation safety program.

In fiscal year 2017-18, the RSO reviewed and approved 35 grant proposals involving the use of radioactive materials or radiation producing equipment. Funds requested by these proposals were \$46,941,123. Actual funds granted to LSU were \$22,927,322. As of February 2019, eleven out of the

Dr. Orhan Kizilkaya (left), assistant professor at the LSU J. Bennett Johnston Sr. Center for Advanced Microstructures and Devices (CAMD), assists CAMD radiation safety officer Charles A. Wilson IV in conducting an analytical X-ray inspection on a photoelectron spectroscopy system.

Currently, there are...6,048 annual radiation monitoring devices issued under LSU's radiation protection program, which covers the LSU AgCenter and its research stations, the Pennington Biomedical Research Center,...the Center for Advanced Microstructures and Devices (CAMD), the National Center for Biomedical Research and Training, and School of Veterinary Medicine.

35 grant proposals are still under review by the funding agencies. Currently, there are 924 approved radiation workers (including 94 radiation principal investigators) in 191 radiation laboratories with 6,048 annual radiation monitoring devices issued under the LSU's radiation protection program, which covers the LSU AgCenter and its research stations, the Pennington Biomedical Research Center, and associated facilities under LSU such as the Center for Advanced Microstructures and Devices (CAMD), the National Center for Biomedical Research and Training, and School of Veterinary Medicine.



Dr. Masami Yoshimura (left), associate professor of Comparative Biomedical Sciences, explains the quality assurance program of a liquid scintillation counter to Mr. Russell S. Clark, health physicist of the Louisiana Department of Environmental Quality, during a broad scope radioactive material license inspection.

The RSO provides training and monitoring for radiation workers and performs surveys, inspections, survey meter calibrations (63 different types of meters), leak tests, and radioactive waste management to fully meet regulatory requirements and licensing/registration specifications. The RSO also evaluates and inspects inventoried Class 3B and Class 4 laser systems for laser intra beam hazards and provides user training. There are 85 active Class 3B and Class 4 laser systems, 47 approved laser users (including 15 laser principal investigators), and 34 laser laboratories.

LDEQ Conducts Five Inspections in 2018

There were five compliance and enforcement inspections conducted by LDEQ's Emergency and Radiological Services Division/Radiation Section in 2018.

In January, three inspectors visited the RSO and carried out inspections of the broad scope radioactive material license, the physical protection of category 1 and category 2 quantities of radioactive material (PPQRM), and the analytical radiation producing equipment at LSU. The inspectors reviewed the records of individuals granted unescorted access, escorted entry to security zones, routine verification for sources of concern, policy and procedure requirements under PPQRM regulations, the National Source Tracking System, designated Trustworthiness and Reliability Officers, meeting minutes of the Radiation Safety Committee, radioactive waste disposal and

shipment, inventory and leak tests of sealed radioactive sources, personnel and environmental radiation monitoring, ordering, receiving, and delivering of sources of radiation, and semi-annual radiation laboratory audits.

Inspectors also inquired about the point of contact at the local law enforcement agency, the annual ALARA program review, the administrative limits for occupational radiation exposure, the release of liquid radioactive waste, the current status of approved radiation principal investigators, in-laboratory radiation surveys and refresher training, investigation of elevated personal exposure, respiratory protection assessment, quality assurance/quality control and operation of radioanalytical equipment, and the authority of LSU's radiological control program and enforcement. In addition, the inspectors looked over LSU's radioactive material license, the *Radiation Safety Manual*, the radioactive waste management process, and the emergency procedures for radiation spills. The inspectors walked through the radioanalytical laboratories and the radioactive waste storage facilities of the RSO. They also visited 30 radiation laboratories under LSU's radiological control program.

During the laboratory visits, inspectors checked the radiation levels, function and calibration of survey meters, posting and barrier requirements, and the *Radiation Safety Manual*. They also reviewed the inventory and the disbursement logs, the in-laboratory training records, the in-laboratory radiation surveys, and functions of the fume hoods. In addition, the leading inspector questioned the approved radiation workers (e.g., faculty member, clinical specialist, technician, laboratory manager, and graduate assistant) about the research protocols involving uses of radiation sources, designated radiation areas, patient release limits, operation and quality assurance/quality control of radioanalytical equipment, physical parameters and safety features of analytical radiation producing equipment, wearing of personal radiation monitoring devices, procedures of ordering and receiving radioactive materials, and practice for radioactive waste labeling/storage/disposal. After the walk-through, an exit interview was held, and no areas of concern were listed on the LDEQ's Field Interview Form.

In March, an inspector visited the AgCenter's Macon Ridge Research Station in Winnsboro and carried out a routine compliance and enforcement inspection of the radiation-producing equipment safety program. The inspector walked through the facility to check the registration, verify proper postings, and perform a physical inspection of an X-ray unit. The inspector also inquired about copies of the Louisiana Administrative Code Title 33, Part XV. *Radiation Protection*, and training material for operators. In addition, the inspector interviewed the authorized radiation principal investigator of the X-ray unit with questions including



RSO radiation specialist Amin M. Hamideh conducts a survey on the gantry/primary collimator of a decommissioned linear accelerator at the School of Veterinary Medicine.

purpose and typical use of the X-ray unit, use frequency, operating procedures, and operator training. After the walk-through, an exit interview was held and no areas of concern were listed on the LDEQ's Field Interview Form.

In April, an inspector visited the School of Veterinary Medicine and carried out a reciprocity inspection of an out-of-state service provider. This inspection included a field audit of their radiation safety program. Accompanied by the RSO staff, the inspector walked through the facility to verify proper postings, check the radiation levels, examine the function and calibration of a survey meter, and perform a physical inspection of the X-ray unit. The inspector reviewed the radioactive material license, registration certificate for servicing and services, and the reciprocity approval letter of the service provider. The inspector also inquired about copies of the registration certificate of the radiation-producing equipment, the Louisiana Administrative Code Title 33, Part XV. *Radiation Protection*, user manual

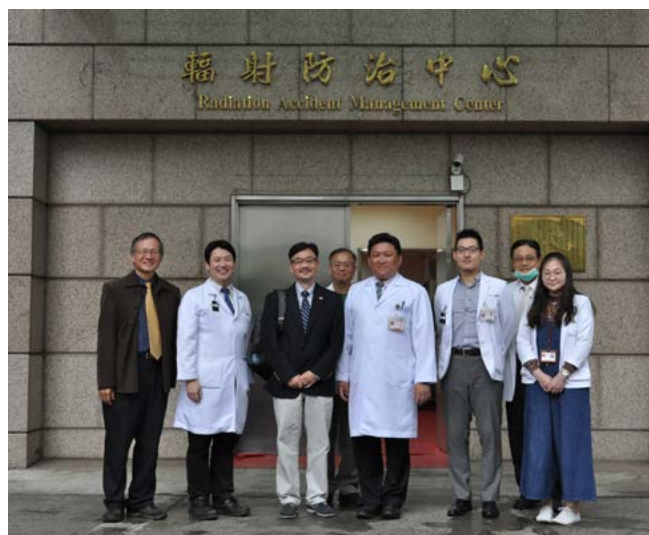
of the single-photon emission computed tomography/computed tomography (SPECT/CT) imaging system, shipment and delivering of sources of radiation, and uses of an electronic personal radiation monitoring device for the field service engineer. The inspector verified that the person conducting the service matched the name on the reciprocity notification. The inspector observed a portion of the service provider's work to determine if regulatory compliance and adequate radiation safety measures were being maintained. In addition, the inspector interviewed the authorized radiation principal investigator with questions including purpose and typical use of the SPECT/CT system, maintenance/service frequency, and operating procedures. After the walk-through, an exit interview was held and no areas of concern were listed on the LDEQ's Field Interview Form.

National Nuclear Security Administration Agreement Includes Personal Radiation Detector Training

LSU and the U.S. National Nuclear Security Administration (NNSA) entered into a contract to implement upgrades of the security control measures to provide reasonable assurance of the security of risk-significant radioactive materials in quantities of concern. This agreement includes not only enhancement of monitoring equipment and physical barriers for nuclear facilities but also training for selected LSU police officers and RSO staff by the NNSA's Office of Radiological Security. Three individuals from the Police Department and the RSO who previously completed the training session on "Radiological Incident Response" participated in "Personal Radiation Detector" training. This two-day training, held at the Y-12 National Security Complex in Oak Ridge, Tenn., provided essential information on the function, operation, and application of personal radiation monitoring devices that have been issued to the incident responding personnel (i.e., LSU police officers and RSO staff) in order to better protect them from significant radiation exposure while engaging in assessing, stabilizing, and neutralizing a threat.

LSU Health Physics Graduate Students Intern at RSO

Anthony Davila, Daniel DiMarco, and Garrett Otis, graduate students in health physics in the LSU's Department of Physics and Astronomy, enrolled in the MEDP 7991 – *Advanced Projects in Medical Physics and Health Physics* course for a summer internship at the RSO in 2018. This internship provided them with opportunities to apply their learned academic knowledge in health physics to practical applications of radiation protection. Upon completion of the mandated



RSO director and professor Wei-Hsung Wang (third from the left) visited the Radiation Accident Management Center of the Tri-Service General Hospital, Taipei, Taiwan.

radiation safety training, they carried out radiation laboratory surveys, receiving and disbursement of radioactive materials, survey meter calibration, radioactive waste management, and leak tests for sealed radioactive sources under the direct supervision of the RSO technical staff.

Professional Contributions and Recognitions

Wilson Invited to Radiation Safety Review of Thailand Synchrotron Light Research Institute

Charles A. Wilson, IV, CAMD radiation safety officer of the RSO, attended the Radiation Safety Review for the Synchrotron Light Research Institute at Nakhon Ratchasima, Thailand. This review comprised four radiological control aspects: interlock system, user and employee's safety, monitoring and shielding of radiation, and rule, regulations, and processes. Wilson and other experts in synchrotron radiation safety from the Shanghai Institute of Applied Physics, Chinese Academy of Sciences (China), Karlsruhe Institute of Technology (Germany), and the National Synchrotron Radiation Research Center (Taiwan) were selected to participate in this review.

Wang Appointed Chair of Health Physics Society's Academic Education Committee

Wei-Hsung Wang, RSO director and Center for Energy Studies professor, was appointed Chair of the Health

Physics Society's Academic Education Committee. Health physics is the application of diverse scientific principles to the protection of people and environment from the hazards of radiation. The committee works to assure that the quality and quantity of individuals entering the health physics profession meet the projected demand and maintains the Health Physics Academic Education Resource Information website, where the education institution listing and other related information are provided. His term ends in July 2022.

Wang Speaks at Our Lady of the Lake Regional Medical Center

Wei-Hsung Wang, RSO director and Center for Energy Studies professor, gave a lecture on "Radiation Awareness for Hospital Clinicians" at Our Lady of the Lake Regional Medical Center for the LSU Health Sciences Center Emergency Medicine Residency Program in Baton Rouge. His presentation covered the topics of radioactivity, radiation exposure and dose, sources of natural and man-made radiation, radiobiological effects, principles, regulations, and practice of radiation protection, and response to nuclear incidents. More than 40 emergency physicians attended this event.

Scholarly Activities

Grant Awarded

- ▶ LSUHSC-NO Radiological Physics for Residents 2018-2019. K.L. Matthews II, J. Dey, W-H Wang, and R.L. Carver, LSU-Health Sciences Center, Contract # 47813-1.

Grant Pending

- ▶ Fate of radioactive particles in aqueous environments. Y-H Kim, Louisiana Board of Regents. (Consultant)
- ▶ LSU expanded nuclear science and engineering graduate fellowship program. F. Lu, Y-H Kim, M.R. Gartia, W. Xie, W-H Wang, U.S. Nuclear Regulatory Commission.
- ▶ LSU nuclear-relevant multidisciplinary scholarship program. Y-H Kim, F. Lu, W. Xie, M.R. Gartia, W-H Wang, U.S. Nuclear Regulatory Commission.

Publication and Presentation

- ▶ A.M. Hamideh, C. A. Wilson IV, and W-H Wang. Using Ba-133 as a calibration surrogate for simulation of gaseous I-131 in a silver zeolite cartridge. *Health Phys* 115:S87, 2018.
- ▶ A.M. Hamideh and W-H Wang. Investigation of counting variations for point and planar radioactive sources inside a silver zeolite cartridge. The 30th Annual Meeting of the Air Monitoring Users Group, October 15-16, Las Vegas, Nev., 2018.
- ▶ C.A. Wilson IV, K.R. Hendrickson, A.M. Hamideh, K.L. Matthews II, W-H Wang. Visualizing high-order decay after disequilibria. *Health Phys* 115:791-796; 2018.



RSO operations manager Jabari Robinson removes an X-ray tube from a Kodak In-vivo Multispectral Imaging System for decommissioning. This system was used for in-vivo imaging of small animals for drug development and life science research.



Journal Manuscript Reviewed (by Wei-Hsung Wang)

- ▶ Paper HPJ-D-18-00134 “Successful migration from radioactive irradiators to x-ray irradiators in one of the largest medical centers in the U.S.” Reviewed for *Health Phys*, 2018 (Kelly Classic, Associate Editor).

Personnel News

- ▶ Dr. Weiwei Xie, Assistant Professor in the Department of Chemistry, was recommended unanimously by the Radiation Safety Committee (RSC) to become a member of the RSC. Dr. Xie is an authorized radiation principal investigator and possesses proficient working knowledge in the areas of radiation producing equipment and radiation safety. Per Permanent Memorandum No. 30, Dr. Xie’s appointment was officially confirmed by LSU President F. King Alexander, with the approval of Dr. Dennis Paul, Chair of the LSU System Radiation Safety Committee.
- ▶ Nicholas T. Desselles, former technical assistant of the RSO, received his Master of Science degree with a concentration in environmental health physics from LSU’s Department of Environmental Sciences in August 2018. Assisted by Charles A. Wilson, IV, CAMD radiation safety officer of the RSO, Desselles’ research project was to investigate the environmental implications of CAMD. Desselles received his bachelor’s degrees in both electrical engineering and physics from LSU. During his undergraduate studies, he was employed by the RSO for six years and became a valuable asset for the RSO. Congratulations, Nick! We wish you the best in your future endeavors.



Nicholas T. Desselles (right), former technical assistant of the RSO, earned his Master of Science degree in environmental sciences from LSU. RSO operations manager Jabari Robinson is on the left.

RSO administrative coordinator Melissa Esnault processes radiation monitoring devices for approved radiation workers.

Personnel

Administration

Wei-Hsung Wang, Ph.D., CHP, CSP, CLSO,
Director & Professor

Jabari Robinson, M.S., CHP, CLSO,
Operations Manager & Laser Safety Officer

Amin M. Hamideh, Radiation Specialist &
Laser Safety Officer

Charles A. Wilson, IV, MS, CLSO, CAMD
Radiation Safety Officer

Melissa H. Esnault, Administrative
Coordinator

Lorrie Gaschen, D.V.M., Ph.D., LSU School
of Veterinary Medicine Liaison

Christy White, D.V.M., Pennington
Biomedical Research Center Liaison

Technical Assistants

Caroline Babin (Lead)

Jasmine Gholston

Kyle Huber

Blaine Irle

Joseph Lahaye

Emaya Moss

Shelby Myers

Raven Stagg

Maia Trailer



The Annual Report is published by the Center for Energy Studies at Louisiana State University.

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Designed by Stephen W. Radcliffe.

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