North American
COALBED METHANE FORUM

Coal Seam Gas
Quarterly
Newsletter

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The *Dog Days of Summer* are officially behind us here in the mid-Atlantic region though the heat and humidity continue well into September. During *Dog Days*, light fare and drink are widely preferred over full course meals. With that in mind, this issue of the newsletter serves up a few articles that the readership will find [hopefully] quite satisfying.

John R. Duda
Managing Editor
John.duda@netl.doe.gov

BOARD MEMBERS TO DELIVER TRAINING COURSE

The North American Coalbed Methane Forum (NACBM) in conjunction with Society of Mining Engineers (SME) and Pittsburgh Coal Mining Institute of America (PCMIA) will present a short course on coalbed methane on Wednesday October 17, 2018 at the Hilton Garden Inn at Southpointe. The following subjects will be covered:

Session 1 - Geology and reservoir properties of CBM.
Session 2 - Horizontal drilling for mine degasification and gas production from deep coal seams.
Session 3 - Vertical well completions for CBM production and hydrofracturing for both vertical and horizontal wells.
Session 4 - Gathering, processing and utilization of coalbed methane.

Dr. Steve Schatzel and Craig Eckhart, Dr. Pramod Thakur, Gary Rodvelt, and Joe D'Amico will deliver the four sessions, respectively. The registration fee is $125.00 for the one-day short course. For additional information and registration, please contact Ms. Beth De Maagd at demaagdconsulting@gmail.com or at 412-389-8467.

FUNDING PROVIDED FOR HEALTH AND SAFETY RESEARCH

Two research teams from West Virginia University have received almost $500,000 in funding from the Alpha Foundation for the improvement of mine safety and health. The first team, led by Derek Johnson, associate professor of mechanical and aerospace engineering, will assess cost effective ways to measure methane in longwall coal mining operations in hopes of preventing methane and dust explosions. Joining Johnson on the team are Nigel Clark, professor of mechanical and aerospace engineering, Yi Luo, associate professor of mining engineering, and Mark Sindelar, research assistant professor of mining engineering. The team's methane watchdog system will deploy a low-cost, multi-nodal methane measurement network that will monitor gas concentrations and velocity continuously along the full length of the longwall face. "The measured methane concentration distribution can be used as an algorithm input to decide whether the shearer should be de-energized before advancing into potentially explosive methane-air pockets," Johnson said. Knowing the methane concentration distribution along the rear end of the shield canopy will enable the development of an improved bleeder ventilation plan. The team plans to combine the methane measurements with shearer location and ventilation flow rates

along the wall face to estimate the methane liberation rates from the coal seam ahead of the shearer and from longwall gob. The ability to accurately collect, record, and analyze methane concentrations at multiple locations will immediately improve mine safety, and will lead to better models and design methods to prevent explosions.

The second team, led by Ihsan Berk Tulu, assistant professor of mining engineering, will evaluate methods to reduce ground control-related injuries and fatalities by developing a practical, mechanics-based approach to pillar design. The research team, which includes Brijes Mishra, associate professor of mining engineering and graduate research assistant Deniz Tuncay, will endeavor to develop a geology-based laminated overburden model. "The recent Analysis of Retreat Mining Pillar Stability LaModel program (ARMPS-LAM) — which was developed at West Virginia University --- was an initial step toward incorporating mechanistic overburden behavior into pillar design," said Tulu. Tulu noted that this new mechanistic mode will aid in reducing the risk factors for the underground mine workers by enhancing our understanding of overburden mechanics in pillar design, thereby improving mine stability. Ground control-related incidents are still one of the leading injury and fatality reason in underground coal mines.

NOTE: The Alpha Foundation for the Improvement of Mine Safety and Health is a private foundation with the mission to improve mine safety and health through funding research and development projects at qualified academic institutions and other not-for-profit organizations. https://www.alpha-foundation.org/

FEDERALLY-SPONSORED VENTILATION R&D

A National Institute for Occupational Safety and Health (NIOSH) mine ventilation study has been investigating the impacts of face length and caving characteristics on airflow pathways and the ability to maintain adequate face airflow levels. Ventilation is the main means of controlling gases and dust in coal mines, with the former being supplemented by methane control techniques in many longwall mines. The U.S. coal mining industry has been undergoing a trend of increasing face lengths on longwall panels. A range of caving conditions have been recognized in U.S. coal mines where rubble may extend up to the longwall shields or, if roof units have very competent mechanical strength, caving may produce void space behind the face shields for several or up to tens of feet. Importantly, face ventilation air must provide a safe, healthy environment for the workers in this area and protect them from hazardous accumulations of methane.

Using three methods of investigation—field studies, numerical modeling and a scaled, physical ventilation model—NIOSH researchers have reached a range of conclusions. In the identification of near-face airflow, researchers determined that more than one path of movement at the front of the longwall face area was present: the main face airflow path and another in the shield leg vicinity and void space, up to the fractured material at the front of the gob or pillared area. Also, within the active panel gob, different flow pathways and rates of movement were present in bleeder (faster) versus bleederless panels. Researchers also noted that from locations up to 2,400 ft by the face on the headgate side of the panel, flow within the gob occurred both towards the back of the panel and towards the active panel face.

Researchers found differences in caving behavior to be very influential on face air movement. Where no void space was present due to normal caving, rapid air movement was present through the broken material at the front of the gob. Turbulent flow patterns appear to be present at the front of the gob when void space averaged three ft to zero void space. Under normal caving conditions, airflow at the back of the shields moved into the main face stream more than 50% of the way down the face length. A large void space of 22 ft or more allowed air movement to flow freely through this region and produced low rates of air movement at the tailgate corner. These airflow behaviors were noted in all face lengths included in the study, which ranged from 1,000 to 1,250 ft. To reduce exchanges between the longwall face and gob air, researchers are reviewing the aerodynamic environment in these regions using a 1:30th scaled physical model called LIAM (longwall instrumented aerodynamic model). See the link to a 360-degree tour of the LIAM below and to conference and journal papers addressing these subjects. Also, please look for NIOSH's final project recommendations to address these ventilation issues in upcoming publications.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5956541/pdf/nihms949386.pdf

RECENT COAL DATA AND FORECAST

Excerpts from the U.S. Department of Energy/Energy Information Administration Short Term Energy Outlook (September 2018) include:

EIA forecasts U.S. coal production will decline by 1% to 768 million short tons (MMst) in 2018, despite a 10% (10 MMst) increase in coal exports. The production decrease is largely attributable to a forecast decline of 2% (17 MMst) in domestic coal consumption in 2018. EIA expects coal production to decline by 2% (12 MMst) in 2019, because coal exports and coal consumption are both forecast to decrease.

EIA estimates U.S. coal exports through the first half of 2018 were 32% (14 MMst) higher than in the same period of 2017, and June was the second month of this year that exports exceeded 10 MMst. EIA forecasts total coal exports to be 107 MMst in 2018 and 101 MMst in 2019, with U.S. coal exports to Asia expected to remain strong. Three of the top five destinations for U.S. coal exports are in Asia, with India, South Korea, and Japan accounting for more than one-third of U.S. exports through March, the most recent month for which EIA has actual data.

https://www.eia.gov/outlooks/steo/

WV COAL PRODUCTION TO 2040

The Bureau of Business & Economic Research (West Virginia University's College of Business and Economics) recently published **COAL PRODUCTION IN WEST VIRGINIA: 2018 – 2040.** Excerpts from the Executive Summary of that report follow. **Recent Market Trends:** After seeing statewide production fall by nearly in half between 2008 and 2016, West Virginia's coal industry has rebounded over the past several quarters as output increased nearly 27 percent between mid-2016 and mid-2018. Export demand has accounted for nearly all of the improvement in production over the past two years or so due to significant increases in coal shipments to India, Brazil, Ukraine and a few other countries. This has enabled Southern West Virginia to account for a majority of growth in statewide coal output in recent quarters. By contrast, domestic demand has remained negative, but more so for mines in Northern West Virginia, as the US electric power sector transitions away from coal-fired generation over to natural gas.

Short-Term Forecast: The baseline forecast calls for coal production to total approximately 91 million short tons in 2018, which represents a slight drop versus 2017 levels. Overall state output is expected to decline 3 percent annually over the next two years, leaving mined coal tonnage at just over 85 million by the end of the decade. Weakening export activity will likely drive most of the anticipated drop in production through 2020, but the retirement and/or conversion of several gigawatts worth of coal-fired generating capacity that sources coal from West Virginia mines will also account for some of this decline.

Long-Term Forecast: Coal production will continue to decline over the remainder of the outlook period, though most of the declines are expected to end by the early 2030s. Output is expected to fall by more than 12 million short tons between 2020 and 2030, with an additional loss of 7 million tons by 2040. Domestic shipments of thermal coal are expected to wane over the next decade as aging coal-fired generation capacity deals with rising maintenance costs and lack of competitiveness against natural gas, and in some markets, renewables. Both of the state's producing regions will be affected by this trend, but Northern West Virginia will be affected to a greater extent. Southern West Virginia's production should be buoyed by what is expected to be fairly stable levels of export demand, but output is likely to trend lower during the outlook as a growing portion of the region's reserves become unprofitable to recover.

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FORUM'S MISSION STATEMENT

THE NORTH AMERICAN COALBED METHANE FORUM WAS ESTABLISHED IN 1985 TO ADVANCE MINE SAFETY AND TO INCREASE PRODUCTION OF COALBED METHANE AS A WORLD-WIDE ENERGY RESOURCE. THE FORUM PROVIDES AN OPPORTUNITY FOR AN EXCHANGE OF INFORMATION ON COALBED METHANE RESEARCH AND TECHNOLOGY BETWEEN THE PUBLIC AND PRIVATE INDUSTRY SECTORS.