Texas Railroad Commission
Energy Education & Workforce Development
Curriculum Committee Report
March 5, 2018

Contents

The Curriculum Committee was an outcome of the second meeting of the Texas Railroad Commission – Energy Education & Workforce Development Committee held on December 4, 2017. The purpose of this report is to summarize the work of the Curriculum Committee to date and to make recommendations to the Texas Railroad Commission – Energy Education & Workforce Development Committee.

Committee Roster

Last Name	First Name	Organization	Email
Denkowski	Mark	IADC	Mark.Denkowski@iadc.org
Haut	Rich	HARC	rhaut@harcresearch.org
McAden	Katharine	Parsley Energy	KMcaden@parsleyenergy.com
Taylor	Tyson	Pioneer Natural Resources	Tyson.Taylor@pxd.com
Williams	Julie	Chevron	juliewilliams@chevron.com
Winter	Rhett	IADC	Rhett.Winter@iadc.org

RCC Liaison: Travis McCormick/travis.mccormick@rrc.texas.gov

Charge Given to the Curriculum Committee

The Committee was charged with the development of recommendations concerning the creation of new curriculum that meet the needs of the Texas oil and gas industry that fit in line with existing graduation requirements. In addition, the Committee was requested to look into what current curriculum exists and where gaps may be closed and decrease duplication.

Discussion of Committee Process

The Committee decided that there were two aspects of the charge.

1. Consider the current work force and field operations – what are the core industry learning outcomes that are desired for priority competency areas?
2. In preparation for operating the 'field of the future' – what learning outcomes are needed and how might these be addressed?

The Committee decided to focus on field personnel involved in Production Operations, recognizing that there will be similar core items that are transferable to Drilling Operations, Completion Operations and Well Servicing Operations.

Aspect #1 – Current Work Force Needs

After identifying the core competencies and desired industry learning outcomes, discussions were held with two community colleges (Midland Community College and Lone Star College) to identify current courses and programs that are offered to address these items. In addition, examples of courses and training available throughout the industry were identified and mapped.

Aspect #2 – Needs to Address the 'Field of the Future'

The Committee recognizes that field operations are evolving as new, cost-effective technologies and processes are introduced. The industry workforce working in the 'field of the future' will also evolve with new skills needed. The Committee developed recommendations concerning potential training facilities to address the evolution of field operations and the workforce.

Committee Findings

The Committee believes that Community Colleges and other courses/training available to industry are meeting the needs of the current workforce. As the field operations and the workforce evolves, there are specific requirements that Community Colleges and the training community will need to address.

Aspect #1 – Current Work Force Needs

The Competencies and Learning Outcomes Matrix provides an overview of various industry desired learning outcomes and how community colleges and industry training providers address these for various competency areas. The Committee believes that, overall, current industry desired learning outcomes are being adequately addressed. The relationships between the various community colleges and industry may be strengthened to ensure that workforce training is in sync with industry.

The Committee strongly urges industry to formalize working with community colleges by becoming members of advisory boards. Industry may consider working with community colleges to establish

advisory boards if they do not already exist. A strong need is to have industry provide speakers to special events at Community Colleges to discuss job opportunities.

In 2016 the International Association of Drilling Contractors (IADC) launched the IADC Gateway Program to help fill industry's training needs. Gateway accredits training programs for entry-level positions in the drilling industry, working through community colleges as well as commercial training providers. The program includes classroom and workshop training that provides the entry-level knowledge and skills needed for workers in the drilling and exploration sector of the industry.

The Gateway program goes beyond technical and human factors instruction. It also teaches students what to expect from a career in the industry. Students receive training on intergenerational communication, as their supervisors could be considerably older than they are. The course also makes students aware that they will be away from their families for weeks at a time, live in small quarters and potentially have very limited privacy. They also receive information about career paths, enabling them to begin their job with an idea of how to advance within a company.

Lone Star Community College was the first to receive accreditation to deliver Gateway training. In December 2016, a Gateway summit was held at Lone Star to educate community college administrators across the country on the Gateway program. Representatives from 16 community colleges and education associations, including the American Association of Community Colleges, participated. Gateway accreditation enables community colleges to collaboratively work with industry to rain the workforce.

The Curriculum Committee believes that the Gateway program is a great asset. While focused on entry level jobs related to drilling, it may be leveraged and perhaps expanded to encompass a wider scope that may include entry level positions related to production operations.

Aspect #2 – Needs to Address the 'Field of the Future'

Production costs have been reduced over recent years and safety incident frequency has fallen. Upstream operators will continue to find safe, cost-effective ways to produce more energy. New technologies and processes will continue to improve performance. The next-generation of operations and maintenance will be centered on equipment sensors for performance data, advanced analytics and machine learning to predict and avoid failures with maintenance/replacement on an as-needed basis. This digital-based system will make activity workloads smaller and more predictable, will feed into more efficient and economic management of materials and people and will level the operational risk-return profile towards the steadier profile of a manufacturing based one.

Next-generation operations and maintenance teams will be small and agile, perhaps designed around equipment ownership. For example, an equipment improvement team may be cross-functional with representation from engineering, maintenance and supply chain, have end-to-end accountability for the reliability of the equipment, and be compensated based on results achieved compared to a performance target.

Predictive maintenance will incorporate sensor data and condition monitoring results in a machine-learning algorithm that recognizes patterns associated with failure modes. This will enable maintenance teams to plan better, reduce failure frequency and severity, compress maintenance/replacement downtimes and lower operating costs.

As digital technologies become ubiquitous, unmanned operations become more feasible. Sensors installed on pipelines, wellheads, and other infrastructure equipment will supply massive amounts of data to computers situated at control centers. Information can be systematically screened, bringing only valuable and actionable information to the attention of operators. The automated system quickly performs the calculations that engineers and other technical staff previously had to complete manually over lengthy periods of time. An integrated remote operations center staffed with data scientists and operations-skilled digital translators now becomes conceivable.

The Curriculum Committee believes that the industry desired learning outcomes will evolve as the 'Field of the Future' comes into focus. There will always be the need to address safety, critical thinking and personal accountability. Training in the technology arena will need to be enhanced to include cloud base training, drones, sensors and management of big data. For example, drilling simulators are great tools to enable students to understand and respond to situations that they will be exposed to in their careers. The Committee suggests that an analogous production operations simulator may also be a tremendous asset to enable students to be exposed to what occurs in a control center and how personnel may respond to operations occurring at a well pad site.

Committee Recommendations

Key recommendations from the Curriculum Committee include:

1. ***Industry and community colleges across the state of Texas are strongly encouraged to formalize relationships through the establishment of new, or support of existing, industry advisory boards.*** These boards are essential to support ongoing communications concerning workforce needs. Advisory Board activities may include 1) ensuring that the staff and students at community colleges are kept informed of workforce needs, job opportunities and desired learning outcomes; 2) developing grant requests for development and testing of new training systems to address new areas (sensors, drones, management of big data, etc.); and 3) developing work-study programs to provide students with the opportunity to afford training.

2. ***Community Colleges and commercial training providers are urged to review the Gateway program and consider incorporating the program into training programs, courses and activities.*** The Gateway program is a great asset to help steer the development of drilling and production operations training.

3. ***The Energy Education & Workforce Development Committee is encouraged to establish a task force to develop a grant request to develop and test a production operations simulator that will enable students to experience a control center and how they may respond to operations occurring at a well pad site.*** This prototype training facility may be modular or trailer-designed to be portable, enabling the facility to travel to various locations and support programs at multiple community colleges and other locations.

Competencies and Learning Outcomes Matrix

Competency Area		Industry Desired Learning Outcome	Courses/Training Available to Meet Learning Outcomes			
			Community College		Industry Training Available	
#	Description		Midland College	Lone Star College	IADC	TopCorp
1.0	**Safety**	1. Demonstrate overall intent and proper safety procedures in a variety of different industry settings. 2. Understand basic safety concerns	OSHT 1301: Fundamentals of Safety & Health PTRT 1307: Recovery and Production Methods	Offers IADC RigPass	1. RigPass Certificate Program 2. Gateway Accreditation Program	Health and Safety
2.0	**Drilling and Completions 101**	1. Identify devices and tools used in the petroleum industry. 2. Understand the process of drilling and extracting petroleum. 3. Become familiar with oilfield terms and phrases.	PTRT 1301: Introduction to Petroleum Industry	PTRT 1303: Drilling	1. Introduction to Petroleum Industry 2. DIT Certificate Program 3. WellSharp Well Control Training a. Introductory Level b. Driller Level c. Supervisor Level 4. IADC KSA (Knowledge, Skill and Ability)	1. Basic Principles of Drilling Operations and Well Design 2. Completion and Workover Technologies
3.0	**Production Operations 101**	1. Identify surface equipment methods used to capture production 2. Describe natural reservoir drive mechanisms 3.Able to interpret tank gauge books and lact tickets 4. Understand basic RRC well status	PTRT 1307: Recovery and Production Methods	PTRT 1301: Introduction to Petroleum Industry	Introduction to Petroleum Industry DIT Production Focus Certificate Program	Production Facility Design and Operation
4.0	**Well Treatment**	1. Knows the purpose and objective of chemical treatments. 2. Can determine if a well has been chemically treated.				Well Stimulation Technologies
5.0	**Artificial Lift**	Describe artificial lift and recovery methods	PTRT 1307: Recovery and Production Methods			
6.0	**Salt Water Disposal**	1. Knows how to read and record meter readings 2. Understands standards and operational practices at a SWD Site				

Competency Area		Industry Desired Learning Outcome	Courses/Training Available to Meet Learning Outcomes			
			Community College		Industry Training Available	
#	Description		Midland College	Lone Star College	IADC	TopCorp
7.0	**Technology**	1. Ability to enter production data into systems and run reports 2. Ability to understand and analyze data from well monitoring systems.				
7.1	***Automation***	1. Identify methods of electromechanical control and classify as open or closed loop. 2. Discuss elements of automating a process, control factors, dependent operations, and unknowns. 3. Explore common instrument signal types and parameters. 4. Apply programmable logic controllers to multiple process scenarios. 5. Investigate trends in data acquisition currently used in industry. 6. Identify methods used to integrate automated devices into a system.	INMT 1317: Industrial Automation	INTC 1341: Principles of Automatic Control		
7.2	***Instrumentation***	Describe the oil field instrumentation; identify the basic instruments used with temperature, pressure, level, flow, and analytical field applications; and describe the basic components of a control loop.	PTRT 1324: Petroleum Instrumentation	PTRT 1424: Petroleum Instrumentation		
7.3	***Distributed Control and Programmable Logic***	Understand distributed control systems including configuration of programmable logic controllers, smart transmitters, and field communicators.	INTC 2336: Distributed Control and Programmable Logic	INTC 1341: Principles of Automatic Control		
7.4	***Corrosion Basics***	1. Distinguish between the causes of corrosion 2. State methods by which corrosion can be identified, monitored, and controlled 3. Describe potential field problems, and select the most reliable solutions.	PTRT 1309: Corrosion Basics	METL 1313: Introduction Corrosion		
7.5	***Pumps, Compressors & Drives***	Understand the theory and operations of various types of pumps and compressors	INMT 2303: Pumps, Comp. & EM. Drives	INMT 2303: Pumps, Comp. & Mch. Drives		
7.6	***Robotics***	Understand distributed control systems including configuration of programmable logic controllers, smart transmitters, and field communicators.	INTC 2336: Distributed Control and Programmable Logic	RBTC 1401: Programmable Controllers		
7.7	***SCADA***	Understands the concepts of remote monitoring				

Competency Area		Industry Desired Learning Outcome	Courses/Training Available to Meet Learning Outcomes			
			Community College		Industry Training Available	
#	Description		Midland College	Lone Star College	IADC	TopCorp
8.0	**Critical Thinking**	1. Gathers information as directed that is needed to solve problems. 2. Uses available tools and technology to troubleshoot and problem solve. 3. Can summarize and describe issues to aide in problem solving.				
8.1	***Data Aptitude***	Discuss steps and procedures used in critical thinking.	ELMT 2337: Electronic Troubleshooting, Service and Repair	PTRT 1491: Petroleum Technology Troubleshooting		
8.2	***Mechanical Aptitude***	1. Identify and be able to use tools and devices. 2. Test, calibrate and repair equipment using testing instruments. 3. Learn Ohm's Law and apply it to different projects. 4. Install and use both type motors in projects. 5. Time management, organizational skills and presentation.	ENER 1330: Basic Mechanical Skills			
8.3	***Electronic Aptitude***	1. Become familiar with different systems used in the energy field. 2. Use and understand test equipment necessary for trouble shooting problems in the field. 3. Identify symbols used in technical drawing and schematics. 4. Apply using test equipment and technical drawing to isolate and repair equipment.	ELMT 2337: Electronic Troubleshooting, Service and Repair	CETT 1409: DC-AC Circuits IEIR 1310: Motor Controls PTRT 1491: Petroleum Technology Troubleshooting		

Competency Area		Industry Desired Learning Outcome	Courses/Training Available to Meet Learning Outcomes			
			Community College		Industry Training Available	
#	Description		Midland College	Lone Star College	IADC	TopCorp
9.0	**Personal Development**	Time management, organizational skills and presentation.	ENER 1330: Basic Mechanical Skills		Facilitator Certificate Course (Train The Trainer)	
9.1	***Team Work***	Understand how to work collaboratively.			Introduction to Oil and Gas Training Program	Knowing Yourself and Social Strategies
9.2	***Personal accountability***	Understand the importance of ethics and life choices on employability.			1. Introduction to Oil and Gas Training Program 2. Competence Assurance Program	
9.3	***Communication***	1. Knowledge of individual and collaborative writing processes, including invention, organizing, drafting, revising, editing and publishing. 2. Able to apply small group communication skills, including problem solving, group roles, leadership styles, and cohesiveness. 3. Technical communication skills to explain data analysis and results	ENGL 1301: Composition I SPCH 1311: Introduction to Speech Communication ENGR 1201: Introduction to Engineering	SPCH 1311: Introduction to Communication		Knowing Yourself and Social Strategies